AGU™ CHAPMAN CONFERENCE

Granby, Colorado USA | 8-13 June 2013

Communicating Climate Science: A Historic Look to the Future

AGU Chapman Conference on Communicating Climate Science: A Historic Look to the Future

Granby, Colorado
8-13 June 2013

Conveners

Climate Science

Natalia Andronova
(Expertise: Climate sensitivity and feedbacks)
University of Michigan

Phil Rasch
(Expertise: Climate Modeling and research in Geoengineering)
Pacific Northwest National Laboratory

James Byrne
(Expertise: Global Environmental Change, Water Resources, Science Education and Communication)
University of Lethbridge

Climate Science History and Communication

John Perry
(Expertise: Climate Science History and Communication) – senior member
National Research Council (retired)

Naomi Oreskes
(Expertise: Science History, Climate Science Communication)
University of California San Diego

Program Committee

Climate Science

Ben Santer
(Expertise: Climate trends; data analysis)
Lawrence Livermore National Laboratory

Ken Caldeira
(Expertise: Climate, carbon, and energy)
Carnegie Institution of Washington

Myles Allen
(Expertise: Attribution climate change)
University of Oxford, UK

Gabi Hegerl
(Expertise: Climate variability)
The University of Edinburgh, UK

Alan Robock
(Expertise: Climate radiative forcing)
Rutgers University

Vladimir Kattsov
(Expertise: Arctic climate variability and trends)
Main Geophysical Observatory, Russia

Mike Mastrandrea
(Expertise: Integrated assessment modeling)
Stanford University

Social Science

Michael Oppenheimer
(Expertise: Environmental policy)
Princeton University

Paul Edwards
(Expertise: Information infrastructures; climate science)
University of Michigan

Steven Lloyd
(Expertise: Sustainability)
Syracuse University

Journalists/Communicators

Bud Ward
(Expertise: Climate change communication)
Yale University

Oliver Morton
(Expertise: Journalist, Energy and Environment Editor)
The Economist Magazine

Thank You to Our Sponsors

The AGU would like to take the time to thank our generous sponsor for their support of the 2013 Communicating Climate Science: A Historic Look to the Future, Chapman Conference.

nature climate change

Thank You to Our Partners

The conveners wish to acknowledge the generous support for this conference from our partners.

Robert Riecker Fund

AGU American Geophysical Union Atmospheric Science Section

AGU American Geophysical Union Global and Environmental Change Focus Group

Note: Attendees at the Chapman conference may be photographed by AGU for archival and marketing purposes. No photography will be permitted during scientific sessions.

AGU Chapman Conference on Communicating Climate Science: A Historic Look to the Future

Meeting At A Glance

Saturday, 8 June 2013

6:00 p.m. – 8:00 p.m.	Welcome Reception
6:00 p.m. – 6:45 p.m.	Icebreaker
6:45 p.m. – 7:00 p.m.	Opening Remarks, Logistics
7:00 p.m. – 8:00 p.m.	Entertainment by Lynda Williams
8:00 p.m. – 9:00 p.m.	Presentation by the American Geophysical Union – "Where Shall I Go; What Shall I Do?: How and Why to Communicate Climate Science to Many Different Audiences"

Sunday, 9 June 2013

8:00 a.m. – 9:15 a.m.	Session – Perspectives on Communication of the Climate Science from the Early Days I
9:15 a.m. – 9:30 a.m.	Q&A/Discussion
9:30 a.m. – 9:45 a.m.	Coffee Break
9:45 a.m. – 10:45 a.m.	Session – Perspectives on Communication of the Climate Science from the Early Days II
10:45 a.m. – 11:25 a.m.	Q&A/Discussion
11:30 a.m. – 1:00 p.m.	Lunch on Your Own
1:00 p.m. – 2:40 p.m.	Session – New and Bleeding Edge Topics in Climate Science I
2:40 p.m. – 3:00 p.m.	Q&A/Discussion 1.3
3:00 p.m. – 3:20 p.m.	Coffee Break
3:20 p.m. – 5:00 p.m.	Session – New and Bleeding Edge Topics in Climate Science II
5:00 p.m. – 5:30 p.m.	Q&A Discussion 1.4
5:30 p.m. – 7:00 p.m.	Dinner on Your Own
7:00 p.m. – 8:00 p.m.	Poster Session 1.3/1.4-1.P

Monday, 10 June 2013

8:00 a.m. – 9:45 a.m.	Session – Better Climate Communication
9:45 a.m. – 10:00 a.m.	Q&A/Discussion 2.1
10:00 a.m. – 10:15 a.m.	Coffee Break
10:15 a.m. – 11:30 a.m.	Session – Climate Communication with the Public I
11:30 a.m. – 1:00 p.m.	Lunch on Your Own
1:00 p.m. – 1:45 p.m.	Session – Climate Communication with the Public II
1:45 p.m. – 2:00 p.m.	Q&A/Discussion 2.2
2:00 p.m. – 2:15 p.m.	Coffee Break
2:15 p.m. – 4:15 p.m.	Session – New Media and New Thinking About Messages and Messengers: Innovative Ways Forward I
4:15 p.m. – 4:30 p.m.	Coffee Break
4:40 p.m. – 5:45 p.m.	Discussion Session 2.4 – New Media and New Thinking About Messages and Messengers
5:45 p.m. – 7:00 p.m.	Dinner on Your Own
7:00 p.m. – 8:00 p.m.	Poster Session 2.1/2.2
8:00 p.m. – 9:00 p.m.	Tutorial: Talking with the Media

Tuesday, 11 June 2013

8:00 a.m. – 9:30 a.m.	Session - Climate Change in the Classroom
9:30 a.m. – 9:45 a.m.	Q&A Discussion 3.1
9:45 a.m. – 10:00 a.m.	Coffee Break
10:00 a.m. – 11:30 a.m.	Session – Communicating with Policy Makers
11:30 a.m. – 11:40 a.m.	Q&A/Discussion 3.2
11:40 a.m. – 11:55 a.m.	Coffee Break
11:55 a.m. – 1:30 p.m.	Lunch on Your Own
1:30 p.m. – 5:30 p.m.	Field Trip to Rocky Mountain National Park
6:30 p.m. – 9:00 p.m.	Banquet Dinner

Wednesday, 12 June 2013

8:00 a.m. – 10:00 a.m.	Session – Toward an Integrated Approach to Climate Education, Communications and Outreach I
10:00 a.m. – 10:15 a.m.	Coffee Break
10:15 a.m. – 11:45 a.m.	Discussion Session 4.2 – An Integrated Approach to Climate Education, Communication and Outreach
11:45 a.m. – 1:00 p.m.	Lunch on Your Own
1:00 p.m. – 1:40 p.m.	Virtual Session: Psychological Determinants of Communicating Climate Change
1:40 p.m. – 2:00 p.m.	Q&A Discussion 4.2
2:00 p.m. – 3:30 p.m.	Session – Shifting the Paradigm in Climate Communication and Education I
3:30 p.m. – 3:45 p.m.	Coffee Break
3:45 p.m. – 5:30 p.m.	Session – Shifting the Paradigm in Climate Communication and Education II
5:30 p.m. – 7:00 p.m.	Dinner on Your Own
7:00 p.m. – 8:00 p.m.	Poster Session 4.3
8:00 p.m. – 9:00 p.m.	Tutorial: Communicating Climate Science to Policy Makers

Thursday, 13 June 2013

8:00 a.m. – 11:00 a.m.	Plenary and Breakouts
11:00 a.m. – 12:00 p.m.	Closing Remarks
12:00 p.m.	Lunch on Your Own

SCIENTIFIC PROGRAM

SATURDAY, 8 JUNE

6:00 p.m. – 8:00 p.m.	**Welcome Reception 6:00 p.m.-6:45 p.m. - Drinks/Icebreaker 6:45 p.m.-7:00 p.m. - Opening Remarks, Logistics 7:00 p.m.-8:00 p.m. - Entertainment, Lynda Williams**
	Presentation by American Geophysical Union Indian Peaks Conference Room
8:00 p.m. – 9:00 p.m.	**Joan Burhman** | Presentation - Where shall I go; What Shall I Do?: How and Why to Communicate Climate Science to Many Different Audiences *(INVITED)*

SUNDAY, 9 JUNE

	Perspectives on Communication of the Climate Science I Presiding: Natalia Andronova Indian Peaks Conference Room
8:00 a.m. – 8:25 a.m.	**Michael MacCracken** | A Retrospective on Early Climate Science From a Physical Scientists Point of View *(INVITED)*
8:25 a.m. – 8:50 a.m.	**Spencer R. Weart** | History of Relations Among Climate Scientists, Policy-makers and the Public in the 20th Century *(INVITED)*
8:50 a.m. – 9:15 a.m.	**Maxwell Boykoff** | The History of Climate Communication: A Journalist's Perspective *(INVITED)*
9:15 a.m. – 9:30 a.m.	Q&A/Discussion 1.1
9:30 a.m. – 9:45 a.m.	Coffee Break
	Perspectives on Communication of the Climate Science II Presiding: James Byrne Indian Peaks Conference Room
9:45 a.m. – 10:05 a.m.	**Paul N. Edwards** | The History and Future of Knowledge Infrastructures in the Earth System Sciences *(INVITED)*
10:05 a.m. – 10:25 a.m.	**Stephan Lewandowsky** | Scientific Uncertainty in Public Discourse: The Case for Leakage Into the Scientific Community *(INVITED)*
10:25 a.m. – 10:45 a.m.	**Michael E. Mann** | The Battle to Communicate Climate Change: Lessons from The Front Lines *(INVITED)*

10:45 a.m. – 11:25 a.m. Q & A Discussion

11:30 a.m. – 1:00 p.m. **Lunch on Your Own (Sunday)**

New and Bleeding Edge science Topics in Climate Science I
Presiding: Philip Rasch
Indian Peaks Conference Room

1:00 p.m. – 1:45 p.m. **Richard B. Alley** | State of the Climate System *(INVITED)*

1:45 p.m. – 2:05 p.m. **Alan Robock** | Trying to Tell the World about Nuclear Winter – Denial Ain't Just a River in Egypt *(INVITED)*

2:05 p.m. – 2:25 p.m. **Clara Deser** | Communication of the Role of Internal Variability in Climate Change Projections

2:25 p.m. – 3:00 p.m. Q&A/Discussion 1.3

3:00 p.m. – 3:20 p.m. Afternoon Coffee Break

New and Bleeding Edge Topics in Climate Science II
Presiding: Philip Rasch
Indian Peaks Conference Room

3:20 p.m. – 3:40 p.m. **Lori Bruhwiler** | Artic Permafrost and Carbon Climate Feedbacks

3:40 p.m. – 4:00 p.m. **Peter Gleick** | Grand Challenges at the Interface of Climate, Hydrology and Water Systems

4:00 p.m. – 4:20 p.m. **Phil Rasch** | Geoengineering: A Challenging Topic for Science, Communications, and Society

4:20 p.m. – 4:40 p.m. **Spencer R. Weart** | Nuclear and Climate Imagery in Historical Perspective

4:40 p.m. – 5:00 p.m. **Chris Green** | Recarbonization of the global energy system

5:00 p.m. – 5:30 p.m. Q&A/Discussion 1.4

5:30 p.m. – 7:00 p.m. **Dinner on Your Own (Sunday)**

7:00 p.m. – 8:00 p.m. **Poster Session 1.3/1.4 - 1.P**
Indian Peaks Conference Room

S-1 **William W. Hay** | The 'Experimenting With a Small Planet' Experiment

S-2 **Holly Buck** | Geoengineering as drama off Haida Gwaii: A case study of narrative spread

S-3 **Karen Raucher** | An Audience Segmentation Analysis – The Climate Change Water Nexus

S-4 **Laurna Kaatz** | Climate Change Communications for Water Utilities

S-5 **Jenna Jadin** | Communicating Climate Change in Agriculture: Challenges, Framing, and Research Needs

S-6 **P. Z. Klos** | Forest managers' response to climate change science: Toward understanding the cognitive impacts of boundary objects at the management-research interface

S-7 **Robert W. Pinder** | Energy system scenarios to simultaneously achieve air quality management and climate change mitigation goals

S-8 **Sahana Bose** | Water Resource Management in North Bengal (India): Need for dissipating climate science information for adaptation to Climate Change

S-9 **Russell Seitz** | In From The Cold

MONDAY, 10 JUNE

Better Climate Communication

Presiding: Alan Robock

Indian Peaks Conference Room

8:00 a.m. – 8:15 a.m. **Gavin A. Schmidt** | Finding a Role in Climate Communications *(INVITED)*

8:15 a.m. – 8:30 a.m. **M. Bryson Brown** | On the Differential Diagnosis of Denial and Skepticism

8:30 a.m. – 8:45 a.m. **Dominique Paquin** | Ouranos' Experience Part 1 - From Scratch to More Than 10 Years on Explaining Climate Modeling and Climate Change

8:45 a.m. – 9:00 a.m. **Karen Raucher** | Applying the Science of Risk Communication to Climate Change – An overview of the Why's and How's

9:00 a.m. – 9:15 a.m. **Benjamin Strauss** | A Scientific Research Agenda for Improving Climate Science Communication

9:15 a.m. – 9:30 a.m. **Adriana Raudzens Bailey** | How grammatical choice shapes media representations of climate (un)certainty

9:30 a.m. – 9:45 a.m. TBD

9:45 a.m. – 10:00 a.m. Q&A Discussion 2.1

10:00 a.m. – 10:15 a.m. Coffee Break

Climate Communication with the Public I

Indian Peaks Conference Room

10:15 a.m. – 10:30 a.m.	**Robert Ward** | Loss of Public Trust by UK Climate Researchers and Implications for Future Communication *(INVITED)*
10:30 a.m. – 10:45 a.m.	**Claudia Wunram** | Climate Services as a Climate Communication Channel *(INVITED)*
10:45 a.m. – 11:00 a.m.	**Kelly Klima** | Successful Communication of Adaptation, Geoengineering, and Other Climate-Related Work
11:00 a.m. – 11:30 a.m.	Q&A Discussion
11:30 a.m. – 1:00 p.m.	**Lunch on Your Own (Monday)**

Climate Communication with the Public II

Indian Peaks Conference Room

1:00 p.m. – 1:15 p.m.	**Nancy J. Selover** | Communicating Climate Science to Stakeholders in Plain Vanilla
1:15 p.m. – 1:30 p.m.	**Hilary Zarin** | Shifting Gears: Climate Regulation and Communication with the American Public
1:30 p.m. – 1:45 p.m.	TBD
1:45 p.m. – 2:00 p.m.	Q&A/Discussion 2.2 II
2:00 p.m. – 2:15 p.m.	Coffee Break

New Media And New Thinking About Messages And Messengers: Innovative Ways Forward I

Presiding: Geoff Haines-Stiles

Indian Peaks Conference Room

2:15 p.m. – 2:30 p.m.	**Geoffrey Haines-Stiles** | Preaching to the Choir And Empowering The Congregation: Using Facebook And Face Time To Counter Denial
2:30 p.m. – 2:45 p.m.	**Asher Minns** | How Do I Restore Trust in Climate Scientists to Tell the Truth About Climate Change? *(INVITED)*
2:45 p.m. – 3:00 p.m.	**Matt Hirschland** | Doping the Atmosphere, and Other Metaphors That Stick: Taking a Page from the Madison Avenue Playbook
3:00 p.m. – 3:15 p.m.	**Jeff Masters** | The Weather Underground experience
3:15 p.m. – 3:30 p.m.	**Peter Sinclair** | Bottled Lightning - Is there a Secret Sauce for Social Media?
3:30 p.m. – 3:45 p.m.	**Amanda C. Staudt** | How Can Scientists and Non-Governmental Organizations Better Collaborate to Improve Climate Science Communication?

3:45 p.m. – 4:00 p.m. **Laurel Whitney** | Dissecting the Joke: Using Humor to Communicate Climate Issues

4:00 p.m. – 4:15 p.m. **Lynda Williams** | A Survey on Theatrical, Musical and Film Takes on Climate Change and the Challenges These Genres Have with Scientific Exposition ***(INVITED)***

4:15 p.m. – 4:30 p.m. Coffee Break

4:30 p.m. – 5:45 p.m. **Discussion Session 2.4: New Media and New Thinking About Messages and Messengers**

5:45 p.m. – 7:00 p.m. **Dinner on Your Own (Monday)**

7:00 p.m. – 8:00 p.m. **Poster Session 2.1/2.2/2.3**
Indian Peaks Conference Room

M-1 **Bruce F. Molnia** | Communicating Climate Change Through the Use of Repeat Photography of Alaskan Glaciers and Landscapes

M-2 **Leigh A. Bernacchi** | By any other name: Perceptions of the difference between "weather" and "climate"

M-3 **Barbara M. Boustead** | Wilder Weather: Channeling the Narrative Voice of Laura Ingalls Wilder to Communicate Weather and Climate Concepts

M-4 **Momcilo Markus** | Flood frequency issues in a changing climate of Northern Illinois

M-5 **Saumitra Mukherjee** | Space Environment Viewing Network for Climate Change

M-6 **Sunita Verma** | Understanding Tropospheric Chemistry: An Interactive Global Climate Chemistry Modelling Approach

M-7 **Emily Powell** | Temperature and Precipitation Indicators of Climate Extremes across the Southeast United States: Observed Variability and Related Planning

M-8 **Drew F. Bush** | Does an Individual's Digital and Physical Geography Impact Perceptions of and Learning about Climate Change?

M-9 **Yekaterina Kontar** | New Trends in Climate Science Outreach and Engagement

M-10 **Michael Theusner** | Educating the public about climate change - the Klimahaus in Bremerhaven, Germany

M-11 **Liz R. Allen** | Evaluating A Process Model Advising Format For Stakeholder Engagement In A Regional Earth System Modeling Initiative

M-12 **Natalia Andronova** | Mapping Surface Temperature Variability and Trends – is it an Old or New Message?

M-13 **Michel S. Bourqui** | Communicating Climate Science to the Public: A Vulgarisation Peer-Reviewed Open Access Scientific Journal?

M-14 **P. Thompson Davis** | Climate Change Communication between TV Broadcast Meteorologists and Their Viewing Audience

M-15 **Alexandra Bass** | The relative roles of political identity and elite cues in American public opinion about climate change

M-16 **SueEllen Campbell** | Lessons from the Field: Climate Change for Citizens

M-17 **Yoshie Goto-Maeda** | Enhancing Communication between Journalists and Scientists on Climate Change in Japan

M-18 **Katharina Kaesehage** | Why Climate Change Interests Businesses That Do Not Want To Hear About It

M-19 **Stacy Rebich Hespanha** | Basic Human Values and Visual Representation of Science in News about Climate Change

M-20 **Scott Douglass** | Development of a Manual for Transportation Professionals on Climate Change and Extreme Coastal Events

Tutorial: Talking with the Media
Indian Peaks Conference Room

8:00 p.m. – 9:00 p.m. **Mary Catherine Adams** | Talking with the Media Tutorial

TUESDAY, 11 JUNE

Climate Change in the Classroom
Indian Peaks Conference Room

8:00 a.m. – 8:15 a.m. **Daniel P. Bedford** | What Do College Students Think (and Know) About Global Warming?: A Case Study

8:15 a.m. – 8:30 a.m. **Minda Berbeco** | Climate and Energy Literacy: A New Direction for Science Education in the 21st Century

8:30 a.m. – 8:45 a.m. **James A. Brey** | Raising Climate Literacy: AMS Education Program Efforts

8:45 a.m. – 9:00 a.m. **Cherilynn A. Morrow** | Insights into How College-Age Students at a Southeastern Research University Think About Climate Change Concepts

9:00 a.m. – 9:15 a.m. **Jennifer D. Small** | Climate Change Literacy Through Writing: Successes in an Undergraduate Writing Course

9:15 a.m. – 9:30 a.m.	**Kim L. Trenbath** | Climate Change Communication in the Classroom: How College Undergraduates' Ideas Change
9:30 a.m. – 9:45 a.m.	Q&A/Discussion 3.1
9:45 a.m. – 10:00 a.m.	Coffee Break

Communicating with Policy Makers
Indian Peaks Conference Room

10:00 a.m. – 10:15 a.m.	**Molly E. Brown** | Communicating the Needs of Climate Change Policy Makers to Scientists
10:15 a.m. – 10:30 a.m.	**Isabelle Charron** | Ouranos' experience part 2- A guide for decision-makers in climate change adaptation: lessons on how to communicate information through the understanding of user needs
10:30 a.m. – 10:45 a.m.	**Miguel Fortes** | Science-Policy Integration: The Missing Link in Effective Communication with stakeholders in Adaptive Coastal Management
10:45 a.m. – 11:00 a.m.	**Yoshie Goto-Maeda** | Stakeholders' Inputs through Dialogues to Summary Reports on Climate Change Risk Management Strategy
11:00 a.m. – 11:15 a.m.	**Steven F. Newton** | Addressing Climate Change Denial in the Age of "Academic Freedom" Bills
11:15 a.m. – 11:30 a.m.	**Kent A. Peacock** | A Sense of Urgency: Prediction and Its Influence on Policy-Making
11:30 a.m. – 12:00 p.m.	Q&A/Discussion 3.2
12:00 p.m. – 1:30 p.m.	**Lunch on Your Own (Tuesday)**
1:30 p.m. – 5:30 p.m.	**Optional Field to the Rocky Mountain National Park**
6:30 p.m. – 9:00 p.m.	**Banquet Dinner**

WEDNESDAY, 12 JUNE

Toward an Integrated Approach to Climate Education, Communications and Outreach
Presiding: Mark McCaffrey
Indian Peaks Conference Room

8:00 a.m. – 8:15 a.m.	**Mark McCaffrey** | The Climate ECO-system: Toward an Integrated Approach to Climate Education, Communications and Outreach-Roundtable Discussion and Workshop Proposal

8:15 a.m. – 8:30 a.m.	**Hunter Cutting** | Lessons from Trends in Public Opinion on Climate Change *(INVITED)*
8:30 a.m. – 8:45 a.m.	**Lisa-Anne D. Kelly** | Positive Affective Connections to Animals and Behaviors that Address Climate Change among Public Audiences
8:45 a.m. – 9:00 a.m.	**Eli S. Kintisch** | A Climate Journalist Explores Art: New Tools, New Partnerships and New Audiences
9:00 a.m. – 9:15 a.m.	**Sheryl Luzzadder-Beach** | Communicating Collapse, Climate, and Complex Society: the Case of the Ancient Maya
9:15 a.m. – 9:30 a.m.	**Joe H. Witte** | Science Visualization For System One Communication of Climate Science: Utilizing the Right Brain
9:30 a.m. – 9:45 a.m.	TBD
9:45 a.m. – 10:00 a.m.	TBD
10:00 a.m. – 10:15 a.m.	Coffee Break
10:15 a.m. – 11:45 a.m.	**Discussion Session 4.2: An Integrated Approach to Climate Education, Communication and Outreach**
11:45 a.m. – 1:00 p.m.	**Lunch on Your Own (Wednesday)**
	Virtual Session: Psychological Determinants of Communicating Climate Change Presiding: Stephen Lewandowsky Indian Peaks Conference Room
1:00 p.m. – 1:20 p.m.	**Adam Corner** | A New Conversation with Conservatives About Climate Change: Values Frames & Narratives
1:20 p.m. – 1:40 p.m.	**Stuart Capstick** | The Psychology of Climate Change Adaptation: Prevention is Better Than Cure?
1:40 p.m. – 2:00 p.m.	Q&A Discussion
	4.3 Shifting the Paradigm in Climate Communication and Education Presiding: James Byrne Indian Peaks Conference Room
2:00 p.m. – 2:15 p.m.	**John Cook** | The Importance of Consensus Information in Reducing the Biasing Influence of Worldview on Climate Change Attitudes *(INVITED)*
2:15 p.m. – 2:30 p.m.	**Simon D. Donner** | Why the Climate Makes Climate Change Communication So Difficult *(INVITED)*
2:30 p.m. – 2:45 p.m.	**John Calderazzo** | Stealing From the Storytellers: How Simple Narrative Techniques Can Help Scientists Communicate Better

2:45 p.m. – 3:00 p.m. **Sonja Klinsky** | "It's the Economy Stupid": Rethinking the Communication of Economic Model Insights about Climate Mitigation

3:00 p.m. – 3:15 p.m. **Michael MacCracken** | Might Being More Careful In Our Communications Help To Improve Public Understanding About Climate Change? *(INVITED)*

3:15 p.m. – 3:30 p.m. **Bruce A. Wielicki** | Can the Economic Value of Climate Science be Determined and Communicated?

3:30 p.m. – 3:45 p.m. **Melanie Fitzpatrick** | Visioning Climate Impacts: The Future is Now

3:45 p.m. – 5:30 p.m. **Shifting the Paradigm in Climate Communication and Education**

5:30 p.m. – 7:00 p.m. **Dinner on Your Own (Wednesday)**

7:00 p.m. – 8:00 p.m. **Poster Session 3.1/3.2/4.1/4.2/4.3**
Indian Peaks Conference Room

W-1 **Cindy D. Hauser** | Climate Change in the High School Enrichment Program, Undergraduate Classroom and CE Opportunity for Secondary School Teachers: What Should the Next Generation Know?

W-2 **Dominique M. Bachelet** | Build it but they might not come

W-3 **Amelia Greer** | The National Science Foundation's Support Mechanisms for Climate Science

W-4 **Mary Catherine Adams** | What AGU Can Do For You!

W-5 **Tapan Pathak** | Climate Masters of Nebraska: Innovative Action Based Approach on Climate Change Education

W-6 **Jane Beitler** | Shifting Gears in Climate Change Communications: From Facts to Actions?

W-7 **Cary Lynch** | A Case Study of Communicating Climate Projections for the Northeast US Via Webinar

W-8 **Jennifer Rood** | Communicating Scientific Uncertainty in the Realm of Ocean Acidification: Developing Understanding and Practical Solutions to Overcoming Communication Barriers

Tutorial: Communicating Climate Science to Policy Makers
Indian Peaks Conference Room

8:00 p.m. – 9:00 p.m. **Erik R. Hankin** | Tutorial: "Communicating Climate Science to Policy Makers"

THURSDAY, 13 JUNE

8:00 a.m. – 9:00 a.m.	**Keynote Address - James Hansen**
9:00 a.m. – 11:00 a.m.	**Breakout Session - The Way Forward**
11:00 a.m. – 12:00 p.m.	**Breakout Groups Reports to Plenary and Closing Remarks**

ABSTRACTS

listed by name of presenter

Adams, Mary Catherine

Talking with the Media Tutorial

Adams, Mary Catherine[1]; Ambrogio, Olivia[1]; Hankin, Erik[1]

1. Public Information, American Geophysical Union, Washington, D.C., DC, USA

This interactive tutorial will offer participants the chance to practice climate communication skills in mock interview scenarios. A panel will share insider perspectives on the world of news media – explaining why journalists do what they do – and advice on how to tackle tricky questions and avoid common pitfalls during media interviews. Participants will then have a chance to practice interview skills: First, they will come up with carefully-considered talking points to then share in role-playing interviews with workshop leaders or other participants. A discussion about talking points—why do we need them?—and lessons learned will follow.

Adams, Mary Catherine

What AGU Can Do For You!

Adams, Mary Catherine[1]; Hankin, Erik[1]; Ambrogio, Olivia[1]; Adamec, Bethany[1]

1. Strategic Communications and Outreach, American Geophysical Union, Washington, D.C., DC, USA

Talking about climate science to general audiences can be difficult, especially when there's a microphone in your face. To help Earth and space scientists tackle media interviews, classroom visits, and one-on-one meetings with legislators, AGU offers a range of resources and activities designed to improve your communications confidence and skills. This poster will acquaint you with what's available from AGU's Strategic Communications and Outreach department, including: presentations on climate-science related legal topics, communications workshops at AGU meetings, e-mail newsletters, and AGU's Expert Outreach Network (EON)—a network of scientists interested in reaching beyond the scientific community by writing op-eds, making videos, joining in the social media chatter, and more. In addition, AGU has recently launched a web portal (sharing science.agu.org) to bring all of the Union's online resources together in one place, and also to highlight related resources offered by others.

Allen, Liz R.

Evaluating A Process Model Advising Format For Stakeholder Engagement In A Regional Earth System Modeling Initiative

Allen, Liz R.[1]; Stephens, Jennie C.[1]; Kruger, Chad E.[1]

1. Washington State University, Pullman, WA, USA

As environmental science research is increasingly justified with a "solutions" orientation focused on societal relevance, integration of stakeholder engagement is becoming a critical component of many earth system modeling projects. In environmental modeling, model developers have potential to engage directly with stakeholders who may be able to use the model results to inform decision-making. Such engagement has potential to improve model accuracy and enhance model relevance for communities outside of academia. This work analyzes stakeholders' perspectives during the first year of engagement in a 5-year regional earth systems modeling project named "BioEarth". The BioEarth project aims to improve regional understanding of climatic and anthropogenic impacts on water availability, nitrogen and carbon cycling in the Pacific Northwest by integrating and modifying multiple existing models at different scales. The funded proposal for this large collaborative project (18 principal investigators are included) was designed to integrate input from natural resource managers in the agriculture and forestry sectors to ensure applicability of the model to industries and communities in the region. Individuals from government agencies (federal, state, local and tribal), farm and forestry advocacy organizations, conservation organizations, and industry are involved in defining their information needs and specifying possible future economic, environmental and policy scenarios to be addressed by the BioEarth model via a process model advising (PMA) structure. To assess stakeholders' perceptions of the PMA process within BioEarth, surveys were conducted with all 34 participating stakeholders before and after stakeholder advisory workshops and semi-structured interviews were conducted with a subset of participating stakeholders. Results from surveys and interviews with stakeholders are assessed in conjunction with earlier findings about researchers' perceptions of the value of stakeholder engagement in earth system modeling. Study of interactions and evolving perceptions among researchers and stakeholders provides insights into how to better develop stakeholder engagement plans that achieve the goal of facilitating communication between the scientific community and communities outside of academia who benefit from scientific information and providing relevant environmental modeling outputs that can be utilized by stakeholders.

Alley, Richard B.

State of the Climate System *(INVITED)*

Alley, Richard B.[1]

1. Dept Geosci & Earth Env. Syst., Pennsylvania State Univ, University Park, PA, USA

Warming has been reducing the Earth's ice in many ways, primarily affecting the more temperature-sensitive types and seasons including Arctic sea ice and coastal parts of Greenland and West Antarctica, but with less-consistent changes or even increases in especially cold places and times including Antarctic sea ice and interior ice-sheet regions. "Global warming" models have shown skill in projecting these that may not be understood by many members of the public. Projections of cryospheric response to additional warming generally show more and faster shrinkage. Of particular interest in this respect are changes in ice sheets, which are expected to contribute to sea-level rise, and which have at least a slight chance of contributing greatly and rapidly. The distribution of possible outcomes, a most-likely estimate that is at least somewhat costly to society, with the chance of costs being slightly less, slightly more, or much more, but without a corresponding chance of much less, is common to many issues of climate change, but also rather difficult to communicate and often not well-recognized in public.

Andronova, Natalia

Mapping Surface Temperature Variability and Trends – is it an Old or New Message?

Andronova, Natalia[1]; Jarrett, Michael[1]

1. University of Michigan, Ann Arbor, MI, USA

Changes in regional climate are dependent on various temporal and spatial scales of processes occurring in the climate system, which bring great uncertainties into the prediction of regional climate change. Surface temperature has the longest observational records in many places of the world, and is widely used for both estimating climate sensitivity and assessing climate feedbacks. We use observations (HadCRUT3 data), a model simulation (from AR4 GFDL), and reanalysis data (NCEP) to evaluate the differences between various temperature trends and between the decadal climate variability of twelve distinct regions, as outlined by the IPCC AR4 report. Based on our analysis of NCEP and HadCRUT3 data we have the following two main messages, which are not new: —Absence of long-term, continuous observations in a number of regions strongly limits our confidence regarding future climate predictions; namely, of the four regions with sufficient observational data, consistent oscillations were found in two: North Atlantic and Australia. —The GFDL AR4 general circulation model does not show the same oscillations as the observational and reanalysis data, which is somewhat discrediting.

Bachelet, Dominique M.

Build it but they might not come

Bachelet, Dominique M.[1]; Comendant, Tosha[1]; Sheehan, Timothy[1]

1. conservation biology institute, Corvallis, OR, USA

The Conservation Biology Institute created a science-based mapping and analysis platform that supports learning, research, and sustainable environmental stewardship. To facilitate access to climate change related information, the Data Basin Climate Center points to the most popular and recent climate change datasets that are available on databasin.org, and provides case studies stories, as well as current climate related news. However, while the site was created to bridge the gap between scientists, managers and decision makers and provide easy access to data, new users continue to come in large part from Academia rather than management agencies. The abundance of data and guidance documents describing climate change scenarios and impacts has become challenging to managers with limited time to digest all the available material. We are developing projects specifically with land managers to develop tools that query databasin.org database to answer their specific questions as they develop and implement federally required climate adaptation plans. The environmental evaluation modeling system based on fuzzy logic is one such tool that has been applied in a range of ecological evaluations such as siting wind turbines in the Tehachapis or determining vulnerability to habitat change for rapid ecological assessments.

http://climate.databasin.org/
http://consbio.org/products/tools/environmental-evaluation-modeling-system-eems

Bass, Alexandra

The relative roles of political identity and elite cues in American public opinion about climate change

Bass, Alexandra[1]

1. Political Science, University of Chicago, Chicago, IL, USA

In recent years a partisan gap in opinions about anthropogenic climate change (ACC) has grown in the American public, with Republicans and Democrats

disagreeing over its causes and consequences. Though social scientific research has long asserted that skepticism about ACC results from a lack of public scientific literacy, political psychology research now indicates that predispositions and values may be more important than scientific information in shaping climate change opinions. This paper investigates how political identity and values impact Americans' perceptions of climate change by examining both elite discourses about the issue as well as public opinion data. First, I examine the editorial content two national newspapers to evaluate how elite political discourses use cultural and political cues when discussing ACC. Second, I use large-scale survey data from the American National Election Studies to investigate whether political values predict lay citizens' opinions about climate change. By considering the relationship between elites' cues and the public's opinions about the scientific consensus on ACC, this paper broadens research on the relative influences of information, as opposed to pre-existing political identity and values, on public perceptions of scientific issues.

Bedford, Daniel P.

What Do College Students Think (and Know) About Global Warming?: A Case Study

Bedford, Daniel P.[1]

1. Geography, Weber State University, Ogden, UT, USA

College students constitute an important audience for climate science information. As mostly young people, they retain the freedom to engage in activism to bring about societal change, including at their own educational institutions (e.g. fossil-fuel divestment campaigns); as the people who will inherit the most serious consequences of global warming, their voices carry substantial moral authority; and, being enrolled in higher education, they can choose to be exposed to the most up-to-date science in the field. However, college students are not empty vessels waiting to be filled up with knowledge (e.g. Nathan, 2005). They are as prone as anyone else to biased assimilation and heuristic filtering when confronted with information that is discordant with their preconceptions. Politically contested fields of science, such as global warming, are especially vulnerable to these psychological defence mechanisms because individuals are likely to have formed an opinion based on factors unrelated to the science itself, such as the views of authority figures, their peer group, or heuristic 'gut feelings'. When inaccurate characterizations of the science, or outright misinformation, are a part of the public discourse, as they are with the science of global warming (e.g. Oreskes and Conway, 2010), students may be entering the classroom with thoroughly distorted perceptions of the underpinnings of the scientific consensus on climate change. Research on the psychology of misinformation suggests that such perceptions can be very difficult to correct (Lewandowsky et al., 2012). It is therefore valuable to know what students already think about global warming before they even enter a climate science classroom, and the extent to which misconceptions can be corrected by formal or informal instruction. While this is a problem that science educators have grappled with for decades, the urgent nature of the global warming case makes climate science communication in the classroom especially critical. This paper presents and analyses survey data on what college students think and know about global warming. The data were gathered on three occasions (2009, 2011 and 2013) at Weber State University (WSU), a medium-sized, open-enrollment public university in northern Utah, USA. WSU provides an interesting case study because, as a commuter campus situated in a politically conservative part of the country, its student body as a whole tends to be predisposed towards climate change skepticism. Examining what this student body thinks and knows about global warming therefore raises important questions about the effectiveness of formal (and informal) college-level instruction about global warming, and carries implications for other institutions of higher learning. References: Lewandowsky, S., U.K.H. Ecker, C.M. Seifert, N. Schwarz and J. Cook. 2012. Misinformation and its correction: continued influence and successful debiasing. Psychological Science in the Public Interest 13(3): 106-131. Nathan, R. 2005. My Freshman Year. Cornell University Press. Oreskes, N., and E. Conway. 2010. Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming. Bloomsbury Press.

Beitler, Jane

Shifting Gears in Climate Change Communications: From Facts to Actions?

Beitler, Jane[1]

1. National Snow and Ice Data Center, University of Colorado Boulder, Boulder, CO, USA

Dan Kahan with the Cultural Cognition Project at the Yale Law School recently posted some bits of advice on science communications: 1) "Information about climate change should be communicated to people in the setting that is most conducive to their open-minded and engaged assessment of it." 2) "Science communication should be evidence-based "all the way down." He talks at length about "the quality of the science communication environment" as the most important factor in whether people will seriously consider your arguments (http://www.culturalcognition.net/blog/2012/11/23/i-endorse-this-message-video-of-lecture-bits.html). What does this mean in practical terms? At the National Snow and Ice Data Center, we have been communicating about the changes we see in Earth's frozen regions, to a very broad public, for a number of years. We hear from ordinary citizens, scientists, meteorologists, skeptics, politicians, and just about everyone else you can think of. Here we examine some of our communications against Kahan's principles, to see how we rate and where we have room for improvement. We'll look at some "quality environments" as well as some "polluted" ones we've communicated in, and evaluate how evidence-based our communications are. Kahan goes on to say, "Don't either ignore or take as a given the current

political economy surrounding climate change; instead, engage people in ways that will improve it." How do you stick to "evidence based all the way down" while talking about policy matters? Now that we have people's attention, what next? Stop by and look at some interesting examples of interactions, and tell us how you think we rate. Do we validate Kahan's theories? What else should we, and other science organizations, be doing?

http://nsidc.org

Berbeco, Minda

Climate and Energy Literacy: A New Direction for Science Education in the 21st Century

Berbeco, Minda[1]; McCaffrey, Mark[1]

1. National Center for Science Education, Oakland, CA, USA

Currently, most American teens and adults do not understand climate and energy science basics. Moreover, with recent budget cuts and political transitions, many of the recent attempts at quality curriculum and programs are being cut back. Increased science literacy will require a commitment from the climate and energy communities to work collaboratively to ensure that students receive the information they need to be tomorrow's decision-makers. In December 2012, the National Center for Science Education held its first Climate and Energy Literacy Summit. The summit was attended by core leaders of the literacy community, including members from the federal, non-profit, and academic communities. They were charged with devising a path forward to substantially and measurably improve climate and energy literacy to provide the next generation with the scientific foundation to prepare for global changes. In this presentation, we will address the challenges laid out by the summit attendees, short-term goals for addressing literacy, plans for future collaborations, and how the climate community can chart a path forward to greater climate and energy literacy.

http://ncse.com

Bernacchi, Leigh A.

By any other name: Perceptions of the difference between "weather" and "climate"

Bernacchi, Leigh A.[1]; Kane, Stephanie L.[2]; Gabrielli, Augusto C.[3]; Wulfhorst, J. D.[1, 2]

1. Agricultural Economics and Rural Sociology, University of Idaho, Moscow, ID, USA
2. Social Science Research Unit, University of Idaho, Moscow, ID, USA
3. Environmental Science & Water Resources, University of Idaho, Moscow, ID, USA

One of the greatest challenges for climate change communication has been to meet the public's understanding of climate change concepts and terms. How different publics perceive of climate change, the risks and benefits locally and globally requires targeted communication strategies. This social science research presents findings on how Inland Pacific Northwest wheat producers and residents of Oregon, Idaho and Washington 1) perceive of climate change and 2) conceptualize the differences between climate and weather. In the fall of 2012, 1,300 urban and rural residents were surveyed by phone across the tri-state Pacific Northwest region. Similarly, from December 2012 thru February 2013, 2000 wheat producers were surveyed by mail. All data includes a spatial component. Most questions required specified answers, yielding quantitative results. We coded qualitative responses to fit quantitative structures around the research question: How do Pacific Northwest producers and publics define the difference between climate and weather? We conducted weighted cross-tabulation and multi-variate analyses of variables such as origins of climate change, risk perception, education on climate change, and relationships with science and technology. Significant findings show that the general public has observed changes in weather over their lifetime (83%) but approximately half of them attribute these changes to natural causes. One version of the coding of "weather vs. climate" showed 58% of the general public realize climate as larger than weather in terms of temporal and spatial scales; 10% saw no difference between the terms. Results for the wheat producers will be compared with the general public responses to create climate perception profiles. The implications of such findings inform not only how we discuss climate change with respect to agriculture but for audiences regionally.

www.reacchpna.org
http://web.cals.uidaho.edu/ruralsoc/

Bose, Sahana

Water Resource Management in North Bengal (India): Need for dissipating climate science information for adaptation to Climate Change

Bose, Sahana[1]

1. Test, Test, India

The Farakka barrage was built in 1975 in North Bengal of India across the upper stream of the River Ganga with the intension of inducing water into the Hugli River, a distributary of River Ganga to flush out the sediment load of Hugli estuary in the downstream, before falling into the Bay of Bengal. Climate change has increased the intensity of Ganga River erosion in its upper bank. This has caused several problems like loss of fertile agricultural lands, large scale population displacement, international border disputes, marginalization of the rural communities living by the river basin and led to the formation of char lands on its left bank due to the deposition of the sediments. This is mainly because the region lacks in common understanding of the climate science and its knowledge that is not properly disseminated among the policymakers, government and village dwellers. Objectives: This paper talks about the immediate need for proper way to communicate about climate science and to disseminate information for sustainable water resource management and to tackle the problem of river erosion in North Bengal. It talks about the future possibility of border disputes between India and

Bangladesh since demarcation of the international boundary between them is based on the course of the flow of Ganga, due to which illegal migration is taking place from both the countries. What are the social and political drawbacks which prevent the region from getting the correct information? What are the present government's plans for adaptation strategies to climate change? It also discusses the problem of rehabilitation and additional labour force in agriculture in North Bengal affecting the agrarian economy of the country as a whole. Methodology: Reports of both governments and non governmental organizations have been consulted and questionnaire survey was done for fifty households based on random sampling. Major Findings: People are unaware about the concept of climate change; they misuse the land resources without knowing the impact of climate change. The barrage has obstructed the natural oscillation of the river within its meandering belts and this has choked the riverbed and reduced its cross-sectional area. No less than 10,000 people every year are evicted from their homelands by erosion losing everything into the river. During the partition of India in 1947, Ganga was chosen as the international boundary in this stretch of land. Erosion has wiped away many boundary posts at many places created demarcation problems. The international boundary should not oscillate with the changes in deep water channel. This region lacks in decentralized planning and lack of fund from government side has made it more vulnerable to climate change. Conclusion: There exist very low level of technological adjustment and ill-directed planning from government's side which are not sufficient to combat this problem. There is need for the efficient basin management plan and this needs proper way of communicating climate science issues.

sahanadona_bose@yahoo.com

Bourqui, Michel S.

Communicating Climate Science to the Public: A Vulgarisation Peer-Reviewed Open Access Scientific Journal?

Bourqui, Michel S.[1]

1. Atmospheric and Oceanic Sciences, McGill University, Montreal, QC, Canada

This poster will candidly explore the need and feasibility of a peer-reviewed open access journal devoted to the vulgarisation of climate science and its mediation to the general public. Most past efforts to mediate climate science to society have aimed at informing policy-makers (e.g. the IPCC). In parallel, the emergence of climate skeptics has led scientists and governmental agencies to organise web sites, blogs and booklets aimed at correcting the public debate on climate change. Web sites intended to provide resources for schools have also been developed. However, a media aimed at providing, in an accessible language, and in a coherent manner on the long term, first-hand information about climate science to the general public seems to be lacking. Such a media could have two major impacts. The first is the better information of the public, which is necessary to the democratic process, and which would reinforce the efforts made in communicating with policy-makers. The second is the progressive development, in the climate science community, of both the know-how and the interest in communicating science to the general public. The use of an adapted peer-review process would be essential in order to help the communications clarify as much as possible the scientific consensus and distinguish it clearly from authors' individual opinions. Furthermore, by adding non-scientists to the reviewers committee, the peer-review process would also help tune the communications to be accessible to the general public. Finally, with the rigor of a peer-review process and the setup of an adequate impact factor for this journal, efforts made by scientists to vulgarise climate science could progressively become recognised as a significant element of the academic Curriculum Vitae, a recognition which is currently mostly lacking. The poster will discuss the current context and explore main ideas for developing such a journal. Propositions for collaborations and partnerships are welcome.

http://www.meteo.mcgill.ca/bourqui/

Boustead, Barbara M.

Wilder Weather: Channeling the Narrative Voice of Laura Ingalls Wilder to Communicate Weather and Climate Concepts

Boustead, Barbara M.[1, 2]

1. National Weather Service, Valley, NE, USA
2. School of Natural Resources, University of Nebraska, Lincoln, NE, USA

Laura Ingalls Wilder and her "Little House" series of historical fiction books are woven into the fabric of American culture. Countless children grew up reading her books or watching the television series "Little House on the Prairie", which was based loosely on the book series. The nine books recount Laura's life from ages 3 to 22 as the Ingalls family pioneered across Wisconsin, Kansas, Minnesota, and South Dakota. While the books are historical fiction, they are rooted in the experiences of the Ingalls family, with many story elements that are verifiable with historical accuracy. The stories remain in the memories of their readers, though, because of the storytelling elements and Laura's narrative voice as much as their realism and history. Throughout the "Little House" books, Laura detailed a number of weather and climate events, including droughts, prairie fires, floods, extreme cold, blizzards, thunderstorms, tornadoes, and a notorious grasshopper plague. The accounts are often detailed, specific, and historically accurate, not to mention riveting and memorable. Many fans Laura and her books are eager to learn the "truth" behind her books, including the accuracy of events and the explanations of why they occurred. The natural curiosity of the audience allows engagement regarding weather and climate concepts that range from tornado safety to climate change, all in the context of the "Little House" books and through the trusted narrative voice of Laura Ingalls Wilder herself. The narrative about weather and climate concepts, including climate change, through the

voice of Laura Ingalls Wilder has allowed the author to gain trust and credibility with "Little House" audiences, opening opportunities for education and engagement. The veracity of the weather and climate stories in the book series, the translation of these stories to modern concepts like climate change, and the effectiveness of this narrative concept will be discussed in this presentation.

http://www.bousteadhill.net/wilder_weather/ and http://www.facebook.com/wilderweather

Boykoff, Maxwell

The History of Climate Communication: A Journalist's Perspective *(INVITED)*

Boykoff, Maxwell[1]

1. University of Colorado, Boulder, Boulder, CO, USA

Abstract text not available.

Brey, James A.

Raising Climate Literacy: AMS Education Program Efforts

Brey, James A.[1]; Geer, Ira W.[1]; Weinbeck, Robert S.[1]; Moran, Joseph M.[1]; Mills, Elizabeth W.[1]; Nugnes, Kira A.[1]

1. Education Program, American Meteorological Society, Washington, DC, USA

Accurate and engaging educational materials have been a trademark of the American Meteorological Society's (AMS) Education Program. For K-12 teachers or undergraduate students, the AMS has been striving to increase climate science literacy.The AMS in partnership with NOAA, NASA, and SUNY Brockport, offers a suite of pre-college teacher professional development courses, including DataStreme Earth's Climate System (ECS). The courses are delivered to small groups of K-12 teachers through Local Implementation Teams (LITs) positioned throughout the U.S. DataStreme ECS investigates natural and human forcings and feedbacks and examines mitigation and adaptation strategies. Participants also use the AMS Conceptual Energy Model to differentiate between climate variability and change. With NSF's support, a special group of five LITs was established in regions of the U.S. with high minority populations that are especially susceptible to climate change impacts. Each LIT engaged in local climate education outreach, broadening the impact of DataStreme ECS. AMS reviewed the AMS DataStreme Model and its effect on knowledge growth and pedagogical development for K-12 teacher participants and their mentors, with climate literacy of particular importance. Results were extremely favorable. The AMS has also developed scientifically authentic, introductory, undergraduate courses that engage students in the geosciences through the use of real-world environmental data. AMS Climate Studies takes an innovative approach to studying climate science by exploring the fundamental science of Earth's climate system while addressing the societal impacts. Information and data from respected organizations, such as the IPCC, the USGCRP, NASA, and NOAA are used throughout. Increasing students' climate literacy, especially those at Minority Serving Institutions (MSIs), is another goal. In a partnership with Second Nature, the AMS Climate Studies Diversity Project recruited 30 MSI faculty members for an inaugural workshop in May 2012. Participants were immersed in the course materials, received presentations from knowledgable speakers and were trained as change agents for their local institution. Afterwards, faculty worked within their MSI to introduce and enhance geoscience curricula and offer the AMS Climate Studies course. The next AMS Climate Studies Diversity Project will be held in May 2013 with subsequent workshops held throughout the next 3 years, targeting 100 MSIs. The AMS, James Madison University, and Los Angeles Valley College are working in collaboration with the Consortium for Ocean Leadership/Integrated Ocean Drilling Program's Deep Earth Academy to integrate investigations of ocean core data of paleoclimates into course curricula of MSIs. In June 2012, this team participated in a workshop to gain direct experience with ocean core investigations. The goal is to form a trained team to help guide the future, large-scale integration of scientific ocean drilling paleoclimate research into existing MSI geoscience courses, and to develop new courses. Through the work of the AMS Education Program, millions of students have become responsible, scientifically literate participants in the discussion of climate change.

Brown, M. Bryson

On the Differential Diagnosis of Denial and Skepticism

Brown, M. Bryson[1]

1. Philosophy, University of Lethbridge, Lethbridge, AB, Canada

Public discussion of a number of scientific issues has been characterized by an interesting social phenomenon widely labelled 'denialism'. Denialists characteristically reject a broad scholarly consensus in some area of study—three current examples are the benefits of vaccination and the low level of risk associated with vaccinations; the fact of evolution and the central role of natural selection in explaining adaptation, and the impact of greenhouse gas emissions on the earth's climate. Philosophers are all too aware that it's easy to challenge assertions, even when they are well-grounded by common sense and/or scientific standards. Skeptical reasoning has been explored by philosophers for thousands of years, in multiple cultures and traditions. The possibility of skeptical reasoning arises naturally from reflection on how we go about justifying assertions: When an assertion is challenged, attempts to justify it standardly take the form of making further claims from which the assertion can be inferred. Obviously enough, the further claims can be challenged in their turn, as can the inference from them to the initial assertion. Given this pattern, simple regress arguments for strong forms of skepticism are available: one can argue that no claim is ever justified, since every justification offered can be questioned by challenging a premise or by challenging the inference that

makes the premises support the conclusion, and it seems that no challenger is ever obliged to give up her challenges. Alternatively, simply inverting W.V.O. Quine's dictum that any claim can be defended 'come what may' by making adjustments elsewhere in the 'web of belief' suggests that one can persist in denying any claim one feels a need to reject by the same expedient. Superficially, the resulting situation is symmetrical: each side presents its evidence and arguments while rejecting those on the other side. The focus of the response we present here is on the question of how to distinguish healthy from unhealthy forms of skepticism. Further, what we're looking for should not be terribly subtle or philosophically intricate. For instance, it's not hard to recognize the irrationality of evolution denial: familiarize yourself with the literature, follow the give-and-take, consider the evidence offered and arguments made on each side, and examine the history of the debate over evolution since the publication of Origin, and the irrationality of the deniers, from the empty shell of intelligent design's natural theology to the unexamined literalism of fundamentalists, is obvious. Denialists have gone seriously wrong, and we should be able to say something straightforward about how. We argue that denialism is not a matter of holding different views about what's true, what the evidence supports or doesn't support, which sources are to be trusted and which are not, and so forth. While denialist views can be rationalized by carrying out a systematic reconstruction of commitments about these matters, they don't originate in such differences, and the differences (and ongoing adjustments) that are required for such a rationalization don't stand up to examination. A serious, epistemically engaged skeptic about climate change will be much more skeptical about climate change denial.

Brown, Molly E.

Communicating the Needs of Climate Change Policy Makers to Scientists

Brown, Molly E.[1]; Escobar, Vanessa M.[1]; Lovell, Heather[2]

1. Biospheric Sciences Laboratory, NASA GSFC, Greenbelt, MD, USA
2. University of Edinburgh, Edinburgh, United Kingdom

In the confusion of the national conversation on climate change issues, a clear and explicit narrative can help cut through the chatter. Science can provide information to improv societal outcomes by focusing debate and guiding policy in ways that are transformative. The science that is done to support climate change policy, however, must be focused and relevant. The purpose of this chapter is to suggest ways that policy and decision-maker needs can be communicated to scientists working to improve understanding of processes, relationships and products in climate change science. A partnership between science and policy must be forged at multiple levels and at many time scales in order to be effective. Many organizations are developing programs that seek to increase the relevance of its science and data products to decision makers grappling with science, influencing not only the scientific questions that are asked, but also the format, resolution and scale of the data output. It is only through two-way communication and relationship building can effective partnerships be built that will help policy makers have the scientific foundations they need.

Bruhwiler, Lori

Artic Permafrost and Carbon Climate Feedbacks

Bruhwiler, Lori[1]

1. NOAA/ESRL/GMD, Boulder, CO, USA

Abstract not available.

Buck, Holly

Geoengineering as drama off Haida Gwaii: A case study of narrative spread

Buck, Holly[1]

1. Development Sociology, Cornell University, Ithaca, NY, USA

In July 2012, a fishing boat put around 100 tons of iron sulphate into the Pacific ocean 300 kilometers west of Haida Gwaii, Canada, in order to stimulate a plankton bloom. There are many ways of relating this event. After The Guardian broke this story in October, the event was variously labeled rogue geoengineering, a non-scientific event, or ocean pasture restoration, depending on the story-teller. The story was then re-blogged and reported internationally, and stories about the story's reporting began to emerge. This paper tracks and maps the empirics of the story's spread throughout space and time, and its fade, serving as a case study of how one "geoengineering" incident was framed and how its framed evolved. The analysis of the story's spread looks at three elements of the story's climate: performance, new media, and entertainment. The paper is informed (though not dominated) by dramaturgical governance theory (Hajer, 2009). It suggests that the sudden appearance of an international audience in October turned the event into a performance for consumption, and suggests that looking at the story as performance helps us understand how the story was received. Two related phenomena will also be mentioned: geoengineering in an era of keywords, i.e. the fact that this story is among the top results of people searching for "geoengineering"; and the geoengineering-entertainment complex, the idea that a geoengineering story is produced not only to inform but to entertain. A text or image about geoengineering offers the consumer certain pleasures (the encounter with the sublime, the mixture of pleasure/terror at the idea that humans now have the power to modify nature on a large scale, etc.). Together, these elements of the media climate— the performativity of it, the siting in new media, and the geoengineering-entertainment complex— present challenges for scientists, journalists, and citizens in search of information. Hajer, Maarten (2009). Authoritative Governance, Policy Making in the Age of Mediatization. Oxford: Oxford UP. Lukacs, Martin (2012). World's biggest

geoengineering experiment 'violates' UN rules. The Guardian, 15 Oct.

Burhman, Joan

Presentation - Where shall I go; What Shall I Do?: How and Why to Communicate Climate Science to Many Different Audiences *(INVITED)*

Ambrogio, Olivia[1]; Burhman, Joan[1]; Adams, Mary Catherine[1]; Hankin, Erik[1]

1. American Geophysical Union, Washington, DC, USA

Speakers: An AGU representative, a member of the policy community, a journalist, and possibly others [TBD - I have not included other affiliations at this time] [Note: We envision this presentation working best as a plenary session or panel open to all attendees.] It's often difficult to know how to go about communicating science to other audiences—and whether it's worth it to try. Members of this panel will discuss the variety of roles scientists and climate communicators can and should have in explaining climate science and its importance to different communities, including: - The role of scientific societies in climate communication, the work AGU has done on its Climate Science Messaging Project, and what AGU does to support its members in communicating climate science. - How scientists and climate communicators can take their message to policy audiences and why it is important. - How scientists and climate communicators can share their message with journalists and the public in a way that informs and excites, and why that communication is important. Questions from and discussion with the attendees will follow.

Bush, Drew F.

Does an Individual's Digital and Physical Geography Impact Perceptions of and Learning about Climate Change?

Bush, Drew F.[1, 2]; Sieber, Renee[1, 2]; Chmura, Gail L.[1]; Seiler, Gale[3]

1. Department of Geography and Global Environmental and Climate Change Centre, McGill University, Montreal, QC, Canada
2. School of Environment, McGill University, Montreal, QC, Canada
3. Faculty of Education, McGill University, Montreal, QC, Canada

Research into perceptions of anthropogenic climate change demonstrates that providing the public with increasing amounts of scientific evidence has failed to significantly alter public opinion or knowledge of this complex issue due to differing views of the human relationship to the natural world and the work of climate scientists. Our research identifies the ways in which students' physical or digital communities influence their perspective on how humans relate to the environment and, consequently, learn Earth science. We define such learning as developing understanding of the scientific method, how the Earth functions as a system, and how climate scientists forecast anthropogenic climate change. We take as our independent variable the knowledge students gain in these three areas and their ability to apply it to analyze course materials and answer exam questions. We hypothesize that the characteristics of one's physical and digital communities (and the tension between them) influence how students learn about anthropogenic climate change as a subject uniquely linked to both individual physical communities and the global digital network. A student's physical community consists of multiple geographic places united by common practices and, in some cases, centered on the landscape where the student grew up. Digital communities, on the other hand, consist of a technological landscape where students need not be bound by geophysical location and can instead form social bonds, community networks and share or endorse information mediated by hardware and software. Many activities and people in these two communities overlap and, as the primary dependent variables, their relationship to each other and to the outcome of how well our students learn will be explored utilizing methods from the social science approach found in educational research. One of the things lacking in research into teaching anthropogenic climate change is the firmer integration of educational methodologies that utilize classrooms as case studies for answering ethnographic questions. We apply the constructivist and sociocultural perspectives of education to our curriculum, and their social science methods (including surveys, diagnostic tests, in-class electronic polling, digital course assignments and exit interviews) to determine the correlation between our variables and the effectiveness of the course. Working at McGill University gives us access to an international student body originating from more than 150 countries. Our first case study examines a large sample of academically and geographically diverse students in an introductory level course. The class consists of 209 students (aged ~17-21) who originate from the Middle East, South Pacific, Asia, and North America and are enrolled in major programs within the engineering, arts, education and physical sciences. We will present results on the relationship between the students' physical and digital communities and the evolution of their perceptions of anthropogenic climate change during the semester.

Calderazzo, John

Stealing From the Storytellers: How Simple Narrative Techniques Can Help Scientists Communicate Better

Calderazzo, John[1]

1. English, Colorado State University, Bellvue, CO, USA

Children everywhere plead, "Tell me a story!" They love a good tale. But this desire to hear a coherent story spun from the complicated and sometimes bewildering chaos of life doesn't end with childhood. Fairy tales, fables, plays, songs, novels, newspapers, movies, and water cooler conversations all tell stories. By helping us to understand and appreciate the world and our place in it, they fulfill a universal human

need. Old or new, stories also share some basic and easy-to-steal narrative techniques that can help scientists communicate to the public with increased clarity, power, and relevance. I propose to show how story structures and techniques such as character development, dramatic tension and scenes can help anyone reach a larger audience. With these methods, a researcher's quest for knowledge in the lab or the field can easily be told as a compelling journey from ignorance to knowledge, mystery to enlightenment. A quick example of a simple story telling technique is one that Rachel Carson used to introduce what could have been an intimidating tale of chemistry, biology, and ecology. She opens Silent Spring with "A Fable for Tomorrow" about a town where once upon a time "all life seemed to live in harmony with its surroundings" until one day "a strange blight crept over the area." These are the effects of DDT, of course. Carson goes on to explain plenty of hard science. But first she has grabbed the attention of the unscientific reader by telling a tale that parallels one of the most common story lines in human history: A stranger comes to town, and then important things begin to change. The same structure powers some of our earliest English literature (Beowulf), to popular movies like E.T. (benign stranger helps lonely boy) or Jaws and Alien (monsters need to be defeated). In small or large ways, the same structure can accurately be used to talk about climate change, a "stranger" that's come to the 21st century town we call Earth. Who would not pay attention? I've learned about these and many other storytelling techniques in two ways. First, for much of my career, I've written about science and nature in mainstream magazines such as Audubon and in two books on volcanoes, including one for kids. I've also written a how-to guide to freelance writing. As a teacher for the last 27 years, I've studied many kinds of nonfiction writing and helped students become book writers, editors and contributors to dozens of magazines and journals. Second, with my CSU English Department colleague SueEllen Campbell, I co-direct an interdisciplinary climate change education and outreach program in which we've recruited and coached professors and researchers from 28 academic departments to share their expertise with large campus and community audiences. We've also created a website, videos, and teaching materials with college-level content and primer-level clarity. Finally, at CSU and elsewhere, we've begun to train scientists who wish to better connect with the public, the media, and policy makers.

Campbell, SueEllen

Lessons from the Field: Climate Change for Citizens

Campbell, SueEllen[1]

1. English, Colorado State University, Bellvue, CO, USA

I propose to talk about key aspects of my experience as a climate change communication practitioner. I co-direct a multidisciplinary education and outreach program, Changing Climates @ Colorado State University, whose motto is climate change is everybody's business. Since 2007, we have focused on three main projects. (1) We run talks: more than 120 so far, given by some 115 speakers drawn from all our university's academic colleges, twenty-eight departments, and numerous other entities from our campus, city, region, and farther away. Our audiences of students, faculty, and community members have totaled over 6,000. We choose key topics, find knowledgeable and skilled speakers, and often help those speakers shape talks for broad audiences. These events have catalyzed the climate conversation on our campus (while costing very little money), and we also give talks about this project—and about the multidisciplinary nature of the climate problem—in hopes of inspiring others to do something similar. (2) With support from the NSF-funded Center for Multiscale Modeling of Atmospheric Processes (CMMAP), we run a website (http://changingclimates.colostate.edu) that offers an evolving selection of annotations and links to videos, articles, books, and other websites that consider the issue from many disciplinary perspectives, including climate science, biology, economics, political science, ethics, literature, art, and communication studies. We find, and sometimes create, materials with college-level content and primer-level clarity (a second motto), for a target audience of interested adult nonspecialists, college students, and teachers. We have begun creating short videos and concise handouts on such key topics as the life-span of today's carbon emissions, the shifting bell curve of temperature variability, and current debates among climate economists. (3) We offer training to specialists (especially, so far, scientists) who wish to better communicate about climate change with the general public, policy makers, and the media. In "courses" that last from one hour to one week, we focus on the basics: talk to the people in front of you; use ordinary English; keep it simple; make it vivid; make it matter; speak from your heart. Because both I and my co-director, John Calderazzo, are English professors and writers who have focused on writing about nature, the environment, and science, we bring to these activities our perspectives and skills as artists and humanists—and our position as citizens eager to learn about climate change without becoming scientists. Our six-year immersion in these projects has been challenging, enlivening, and extremely educational. At the Chapman meeting, I would like to share some of what we have learned about talking to the public about climate change; to distribute our concise guide to the literature on climate communication and our How to Talk to Everybody handout; and to show and talk about one of our new video/handout pairs as an example of how our experiences are informing our current work.

http://changingclimates.colostate.edu

Capstick, Stuart

The Psychology of Climate Change Adaptation: Prevention is Better Than Cure?

Capstick, Stuart[1]

1. Cardiff University, Cardiff, United Kingdom

Abstract text not available.

Charron, Isabelle

Ouranos' experience part 2- A guide for decision-makers in climate change adaptation: lessons on how to communicate information through the understanding of user needs

Charron, Isabelle[1]; Chaumont, Diane[1]

1. Ouranos, Montreal, QC, Canada

Planning and adapting to a changing climate requires credible information about the magnitude and rate of projected changes. Ouranos, a consortium on regional climatology and adaptation to climate change was launched in the Province of Québec, Canada, ten years ago, with the objective of developing and providing climate information in support of adaption. Ouranos differs from most other climate service centers by integrating climate modeling activities, climate analysis services, and impacts and adaptation expertise under one roof. This presentation will focus on the role of the Climate Scenarios and Services Group transferring climate information to end-users from different sectors. This group was not present at the onset of Ouranos but its need became apparent as impacts and adaptation users struggle to incorporate complex climate simulation information into adaptation strategies. This presentation will provide an overview of how Ouranos identifies, produces, and presents relevant climate scenarios and their associated uncertainties to different end-users. More specifically, it will outline the steps that are being taken to draft a decision maker's guide that will provide a road map to decision making in climate change adaptation while accounting for leading sources of uncertainty. The guide is meant to synthesise existing knowledge concerning decision-making frameworks for climate change. It is based upon previous work done through regional adaptation collaboration, on the experience of scientists at Ouranos and its numerous collaborators, and finally on first-hand accounts from decision-makers that will share the challenges they must face in order to develop adaptation strategies. Lessons learned about the key elements that must be in place in order to ensure proper communication will be addressed. As examples, specialists must develop a good relationship with their users, learn to guide users to clearly identify their climate information needs, and must ensure the transparency, traceability, and accountability of the climate information they share. At the heart of our communication strategy, lays the quality of the information provided, the confidence scientists have in the information, and the manner in which the information is presented. We focus more specifically on ways to communicate the necessity of using a large scenario ensemble, to understand the natural variability and the uncertainties associated with climate scenarios. Indeed, while climate science has now reached a certain level of maturity that makes it actionable, taking decisions based on climate information remains far from straightforward. Decision-makers are increasingly asked to address the large number of uncertainties and vulnerabilities related to the potential impacts of climate change. Uncertainty is too often considered a road block to adaptation but should, on the contrary, be seen as an additional piece of information that guards decision-makers against over-confidence and costly mistakes.

Cook, John

The Importance of Consensus Information in Reducing the Biasing Influence of Worldview on Climate Change Attitudes *(INVITED)*

Cook, John[1, 2]; Lewandowsky, Stephan[2]

1. Global Change Institute, University of Queensland, St Lucia, QLD, Australia
2. School of Psychology, University of Western Australia, Perth, WA, Australia

Political ideology has a strong influence on public opinion about climate change and how people update their beliefs in the light of new climate information. However, information about the scientific consensus on anthropogenic climate change has been shown to partially neutralise ideological bias. Also, a correct perception of consensus is a strong predictor of support for climate policy. While these are encouraging findings, there is a significant gap between perception of consensus and reality with less than half of the American public thinking climate scientists agree over the fundamental cause of global warming. This underscores the importance of incorporating consensus as an integral part of climate messaging. I will present two strands of research into the scientific consensus on climate change. Previous research has shown that consensus information effects the greatest change in climate belief among strong supporters for free market. Paradoxically, the group most influenced by consensus information also shows the greatest distrust of science. Experimental data will be presented that explores psychological mechanisms that may explain the effectiveness of consensus information. I'll also present results of the most comprehensive analysis to date of peer-reviewed climate research, covering 21 years of 'global climate change' or 'global warming' papers. We found 4014 abstracts stating a position on anthropogenic global warming. Of these, 97.1% abstracts endorsed the consensus. Among the 10,356 authors of these papers, 98.4% of scientists endorsed the consensus. This analysis of peer-reviewed research demonstrates a consensus of scientists and a consensus of evidence; a useful resource for those seeking to communicate the scientific consensus.

Corner, Adam

A New Conversation with Conservatives About Climate Change: Values Frames & Narratives

Corner, Adam[1]

1. School of Psychology, Cardiff University, Cardiff, United Kingdom

Abstract text not available.

Cutting, Hunter

Lessons from Trends in Public Opinion on Climate Change *(INVITED)*

Cutting, Hunter[1]

1. Climate Nexus, San Francisco, CA, USA

Numerous polls report a significant rebound in the recognition of global warming by Americans over the last three years, particularly among Republicans and the skeptical. Surveys also reflect growing public support for action by Congress and President to address climate change. This shift in public opinion has created space for renewed initiative, as evidenced by recent media coverage of climate change, that has both increased in volume and shifted in focus, and by renewed congressional activity. This sea change was driven largely by personal experience and media coverage of warmer temperatures, extreme weather, and the loss of iconic Arctic sea ice. Polling also indicates that climate scientists are highly trusted sources for information on a subject that is viewed by many as highly controversial, indicating that requests for media interviews are driven perhaps as much by a desire for trusted opinion on basic questions as by an appetite for expert opinion on complex questions. This analysis reviewed 21 public opinion surveys conducted by 14 different academic and commercial pollsters as well as 4 surveys on media coverage of climate change. Looking ahead to upcoming political and policy discussions, public opinion and attitudes on climate change now support the following big-picture talking points by advocates (not scientists) seeking to galvanize public will for climate protection: - Climate change is happening right here, right now. And it is hurting Americans. Superstorm Sandy, last year's historic wildfires, and recent record-breaking heat waves are examples of natural disasters made worse by climate change. - We need to take action now, to address the changes in our climate and to protect our communities and our resources. We must safeguard and prepare our communities. - How far we go in preparing for climate disruption depends upon how much climate change we prevent. We know an ounce of prevention is worth a pound of cure. And we need to act now to prevent climate disruption from becoming much worse. - Reducing carbon pollution and switching to clean energy is the way forward. We already have the technology, the ingenuity, and the solutions to modernize our energy system. - But big oil is blocking progress on tapping clean energy and cutting pollution. We need to break the political hammerlock of the fossil fuel industry. Climate scientists seeking to interact with the public on the question of climate change have to consider both why the media is seeking their perspective and how their offering interacts with the broader public dialogue on climate change as outlined above.

Davis, P. Thompson

Climate Change Communication between TV Broadcast Meteorologists and Their Viewing Audience

Davis, P. Thompson[1]; Oches, Rick[1]; Szymanski, David[1]; Meldrum, Helen[1]; Doner, Lisa[2]; McGarry, Mary Ann[2]; Avlles, Lourdes[1]; Miller, Sam[2]

1. Bentley University, Waltham, MA, USA
2. Plymouth State University, Plymouth, NH, USA

In response to the high level of public skepticism about climate change science, despite strong scientific consensus, we examine attitudes about global climate change among the public's primary climate information sources: broadcast meteorologists, and climate scientists. According to recent polls, a full 30% of TV broadcast meteorologists regard anthropogenic global warming (AGW) with skepticism, despite position statements from nearly every U.S. Earth and atmospheric sciences professional society acknowledging dominantly human responsibility for global warming in the past 50 years. TV broadcast meteorologists have the attention of a national audience and self-identify as the primary science correspondents for many local news stations. By seeking effective ways to reduce skepticism among TV/radio meteorologists and commercial daily weather forecast providers about AGW, and improving their awareness and acceptance of the quality and reliability of climate science, we believe this work has potential to be rapidly transformative on a national scale. Our NSF funded project (DRL-1222752) tests the following hypotheses: 1) A majority of U.S. meteorology degree programs fail to provide a sufficient number of courses specifically on climate change that address salient aspects of the mechanisms for change; 2) Meteorology students, who typically earn STEM-rigorous B.S. degrees, graduate with an inadequate level of climate literacy; 3) Meteorology instructors, with Ph.D.s in meteorology, are unlikely to have educational backgrounds in paleoclimatology, or the climatic aspects of geology or oceanography, and so tend not to cover those topics in depth while teaching content on climate change; 4) Meteorology professionals who work on short time scales, on the order of 5-10 days, and develop mesoscale forecasts on local to regional spatial scales, often lack experience with pre-instrumental records of climate change and synoptic-global scale climate behaviors that would inform them about climate change; 5) For meteorologists, differences in the type of quantitative training that meteorologists and climate scientists receive and use in their research affects the credibility of climate reports; and 6) Some TV broadcast meteorologists may have only degrees in broadcast journalism with limited backgrounds in meteorology or climate science. Our anticipated outcomes include a quantitative survey of the more than 120 U.S. undergraduate programs offering B.S. degrees in meteorology or related disciplines; 2) a random sample, detailed, qualitative survey of first-year students and those nearing graduation selected from the B.S. meteorology degree programs in the U.S.; 3) two closely assessed qualitative surveys of TV/radio

meteorologists and news directors in the greater Boston and the more rural northern New England areas to determine their basis for climate literacy, attitudes about AGW, and confidence in the scientific method; 4) two assessment-based workshops on climate science, one targeted at TV/radio meteorologists and news directors within the New England area; and 5) inter-disciplinary training for graduate and undergraduate students.

Deser, Clara

Communication of the Role of Internal Variability in Climate Change Projections

Deser, Clara[1]; Phillips, Adam S.[1]

1. Climate and Global Dynamics Division, NCAR, Boulder, CO, USA

Over the next several decades, Earth's climate trajectory will be influenced by both human-induced climate change and internally-generated climate variability. The latter contains a large unpredictable component and thus represents an irreducible source of uncertainty for climate projections. This talk will highlight the relative contributions of forced and internally-generated climate trends at local and regional scales over North America and Eurasia in the coming decades, based on large ensembles of integrations with two state-of-the-art coupled climate models.

This talk will draw on results from papers published on the author's website: /www.cgd.ucar.edu/cas/cdeser/

Donner, Simon D.

Why the Climate Makes Climate Change Communication So Difficult *(INVITED)*

Donner, Simon D.[1]

1. Department of Geography, University of British Columbia, Vancouver, BC, Canada

Public opinion in North America about human-caused climate change has varied over the past 20 years, despite an increasing consensus about the scientific community. Deep skepticism about the basic evidence for a human role in climate change persists among roughly one-fifth of the North American public. Furthermore, the fluctuation in opinion polls suggests that a significant fraction of the remaining public lacks conviction in their attitude about climate change. The persistent gap between expert and public thinking about climate change has been attributed to a number of factors including personal values, political ideology, the media environment and personal experience. In this presentation, I will describe recent evidence for relationships between climate variability and public opinion about climate change, review the possible mechanisms behind these relationship, and suggest communication strategies that can address the lack of conviction among many of the public about climate change. Our recent work found that the fraction of respondents to national polls who express "belief in" or "worry about" climate change was significantly correlated to U.S. mean temperature anomalies over the previous 3–12 months. In addition, the fraction of editorial and opinion articles which "agree" with the expert consensus on climate change was also significantly correlated to U.S. mean temperature anomalies at seasonal and annual scales. This variability in public opinion with climate may be driven by migration of climate "swing voters" – people with less defined attitudes about climate change – towards the extremes and back. The influence of climate variability on public opinion itself may be largely indirect, mediated by the effect that climate variability has on the media, as reflected in opinion article analysis. As a consequence, the dynamics of not just the media, but scientists' interaction with the media, could be inadvertently exacerbating the variability in the nature of news coverage and public attitudes about climate change. Instilling a deep appreciation for the causes and effects of climate change that will persist through the next anomaly, whether in the climate or the economy, requires adopting a broader perspective on the causes of skepticism and rethinking how scientists interact with the media.

Douglass, Scott

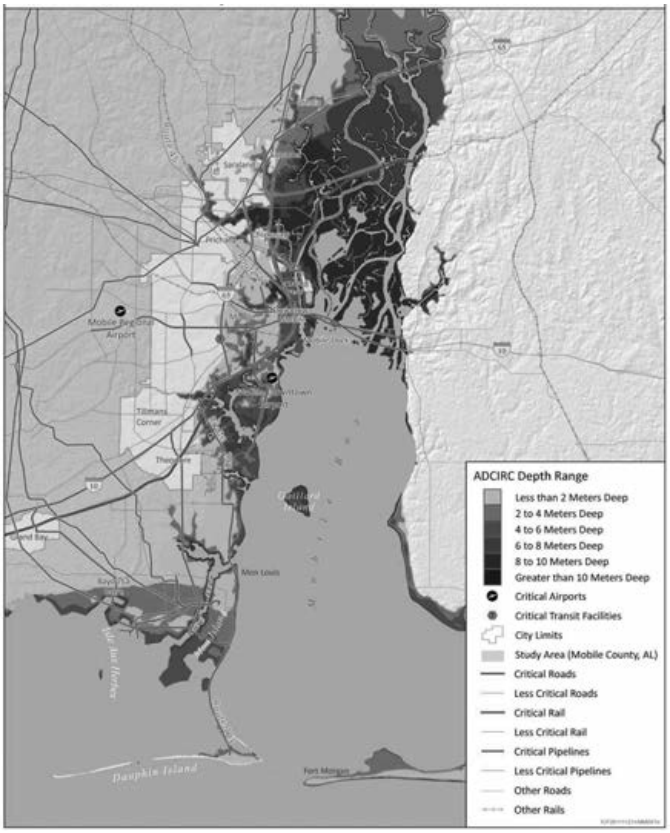
Development of a Manual for Transportation Professionals on Climate Change and Extreme Coastal Events

Douglass, Scott[1, 3]; Webb, Bret[1, 3]; Kilgore, Roger[2]

1. South Coast Engineers, LLC, Fairhope, AL, USA
2. Kilgore Management & Consulting, Inc., Denver, CO, USA
3. Civil Engineering, University of South Alabama, Mobile, AL, USA

In the wake of recent storms which have caused billions of dollars in damage to transportation infrastructure, the National Highway Institute of the Federal Highway Administration (FHWA) is developing a new reference manual for transportation professionals on assessing climate change and extreme events in a coastal environment. The manual is being developed by the authors of this abstract to be a supplement to both an existing FHWA manual (HEC-25 FHWA-NHI-07-096, Douglass and Krolak, 2008); which is the primary FHWA reference manual for coastal highway design issues such as waves, tides and sand transport; and a National Highway Institute professional development short-course on the same subject. The purpose of the new manual is to provide technical guidance and methodologies on how to incorporate climate change and extreme events considerations when addressing highway planning and design in the coastal environment, particularly focusing on issues related to sea level rise, storm surge, and wave action. A specific emphasis is that this document should be understood by non-engineers and engineers alike. It is anticipated that the reference manual will become a guidance document for the FHWA, state Departments of Transportation, the American Association of State Highway and Transportation Officials (AASHTO), consultants, and others. The manual will have a nationwide focus based on input from five regional peer exchanges to occur in April-

June 2013 which will assess regional coastal extreme events and processes. One of the coastal modeling approaches will likely draw from the recently posted DOT/FHWA HEP-12-053 document (Choate, et al 2012) which included detailed hurricane storm surge (ADCIRC) and wave (STWAVE) modeling under different sea level rise scenarios developed by the first two of the authors of this abstract. The attached figure shows maximum modeled depths in Mobile, Alabama under a scenario of 0.75 m of sea level rise and a hurricane with characteristics similar to those of Hurricane Katrina but with a different track.



Storm Surge Depth for the Hurricane Katrina-Shifted-Path Scenario with 0.75 m Sea Level Rise (from Choate, et al, 2012)

Edwards, Paul N.

The History and Future of Knowledge Infrastructures in the Earth System Sciences *(INVITED)*

Edwards, Paul N.[1]

1. Univ of MI-School of Info, Ann Arbor, MI, USA

Climate modeling developed in a series of distinct stages. In the 1950s and 1960s, the earliest computer models were built as a "craft" activity by individuals or small groups. By the 1970s, modeling had become a laboratory activity, with larger (but still co-located) groups and more specialized roles. In the 1980s, community modeling projects began, with some elements of work distributed across multiple sites and institutions (though many labs continued to work in the more traditional, local mode). By the end of the 1990s, new techniques such as modeling frameworks and improved network infrastructure had opened the door to even more highly distributed work processes. At the same time, however, the complexity of modeling activity and the important interface with IPCC reports began to pose difficult challenges for the Earth system science community. Major Earth system models currently exceed 1 million lines of computer code — so complex that no individual can now understand every element of such a model. Efforts to extend them to cover even more aspects of the environment, as well as human activity and economics, will make them even more complicated. In this context, organizing modeling work has become a major issue for the community. Meanwhile, the generalized movement toward transparency — under such headings as open access, open source, transparent governance, reproducible computational science, "climate audits," and so on — is opening up the once-private world of climate science to a large range of outsiders of highly variable competence (and often with political stakes). This situation raises issues of organization, governance, and trust. Work organization among modeling groups is changing to reflect the complexity of the models, but traditional modes of evaluation (peer review, reputation, trust) remain significant and are unlikely to be completely displaced. Yet it appears inevitable that increasing openness will lead to more communication with more stakeholders than ever before, and that these interactions will take place at all stages of the knowledge production process. The question for both scientists and communicators is whether increased communication can lead to greater public trust in climate — and if so, how. This talk outlines these issues and some recent efforts to address them, such as the NSF EarthCube and the Earth System Commodity Governance project. It closes with considerations about how a more public science can produce more effective, more trusted and trustworthy knowledge.

Fitzpatrick, Melanie

Visioning Climate Impacts: The Future is Now

Fitzpatrick, Melanie[1]

1. Union of Concerned Scientists, Berkeley, CA, USA

A unique aspect of our work at the Union of Concerned Scientists (UCS) is the melding of scientific research and a robust communications initiative to bring salient information to decision makers and the public. Over the years, we have tried many different strategies to convey complex scientific information in an effective and appealing way, from movie stars to hope psychology, from dire warnings to academic appeals. But now that we are seeing climate impacts locally and climate change is no longer a future reality, what new vision do we need to support ongoing action?

Fortes, Miguel

Science-Policy Integration: The Missing Link in Effective Communication with stakeholders in Adaptive Coastal Management

Fortes, Miguel[1]

1. University of the Philippines, Quezon City, Philippines

The history of the role of science in coastal management in Southeast Asia approximates a sigmoid curve, wherein the threshold could be characterized by an increased demand for equal if not more emphasis on the role of the social sciences and policy. The reason became obvious when only about 10% of the total number of marine protected areas failed to reach their objectives, brought about by the fact that these areas were managed largely by natural scientists, without the essential partnership with social scientists and decision makers. Currently, there is a change in paradigm wherein science-policy linkage is a focus of resources, the product of which is translated into a decision support system which facilitates communication of outcome of efforts to the stakeholders. Keywords: science, ICM, decision support, policy

Gleick, Peter

Grand Challenges at the Interface of Climate, Hydrology and Water Systems

Gleick, Peter[1]

1. Pacific Institute, Oakland, CA, USA

Abstract text not available

Goto-Maeda, Yoshie

Enhancing Communication between Journalists and Scientists on Climate Change in Japan

Goto-Maeda, Yoshie[1]; Emori, Seita[2]; Takahashi, Kiyoshi[2]; Aoyagi-Usui, Midori[2]; Tanaka, Yasuyoshi[3]; Fukuda, Hiroyuki[4]; Fukushi, Kensuke[1]; Kawamiya, Michio[5]

1. IR3S, the University of Tokyo, Tokyo, Japan
2. National Institute for Environmental Studies, Tsukuba, Japan
3. The Mainichi Newspapers, Tokyo, Japan
4. Hitotsubashi University, Tokyo, Japan
5. Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan

In the field of climate science, gaps between journalists and scientists on the recognition of reporting of scientific studies are often seen in the regard of expressions of uncertainty and accuracy. Since its start in 2009, Climate Change Media Forum has held five yearly events for the purpose of filling the gap and enhancing communication between journalists reporting climate change and scientists studying it. Every year, 50 to 70 professionals participate in the event to listen to the lectures and exchange comments on the reporting of the selected theme. The participants include journalists working for leading newspapers and a TV station in Japan and TV/radio meteorologists as well as leading researchers in the field of climate change science and communication. The basic structure of each event consists of lectures on the latest topics on climate change and a discussion session on the selected topics. Depending on the theme, different styles have been also applied, such as seating arrangement to separate journalists and scientists, a collaborated event with a press conference on another climate change research project. The themes were selected mainly from timely and complicated issues on climate change. Through the lectures and the discussion, participants are expected to learn about the latest topics of climate change and also viewpoints of the other side of the professionals. Originally, it was started by researchers in communication and climate change science as part of a climate change project funded by the Ministry of the Environment. In the second year, the planning team gained a few members from the journalist side to make the event more meaningful for both groups of participants. After the end of the original project, it is continued as part of a climate change project under the Ministry of Education, Culture, Sports, Science and Technology of Japan.

Goto-Maeda, Yoshie

Stakeholders' Inputs through Dialogues to Summary Reports on Climate Change Risk Management Strategy

Goto-Maeda, Yoshie[1]; Emori, Seita[2]; Takahashi, Kiyoshi[2]; Fukushi, Kensuke[1]

1. IR3S, the University of Tokyo, Tokyo, Japan
2. National Institute for Environmental Studies, Tsukuba, Japan

In formulating risk management strategies against climate change, scientific studies are the most important source to rely on. As represented by the IPCC reports, scientific studies on climate change are organized and summarized by scientists to place them into scientifically reliable reports for use by professionals from various fields. Many reports on climate change are being published focusing on various aspects with different purposes. However, narrowing the gap between scientists' viewpoints and user demands is a complicated problem, and is sometimes ignored. Under a comprehensive research project on climate change risk management starting in 2012, the Global Climate Risk Management Strategies, supported by a research fund by the Ministry of the Environment of Japan, we have been continuously conducting group interviews with potential readers of the climate change risk management strategy reports to make them reflect stakeholders' viewpoints as much as possible. The feedbacks from the interviews with different categories of professionals are considered to reflect in the newer report, and the new version becomes the next object for interviews. This process continues until the final version is published. The interviewees are also questioned about their background information, which can affect their decision-making process and information sources. Although group interviews are less effective in collecting enough data for statistical analysis,

their inputs may go beyond the questions prepared by interviewers. In the earlier stage, the interviews are conducted with the potential readers of the research project outputs, such as professionals participating in climate change conferences, to confirm the general direction of the reports. Later, the interviews are conducted with other stakeholders, who are less likely to be involved in the process of developing climate change risk management strategy, but are still likely to be affected by climate change impacts or the risk management strategies. In this presentation, the details of the interview process and the feedbacks from the interviewees are introduced.

Green, Chris

Recarbonization of the global energy system

Davis, Steven J.[1]; Caldeira, Ken[2]; Green, Chris[3]; Hoffert, Martin I.[4]

1. Earth System Science, University of California, Irvine, Irvine, CA, USA
2. Global Ecology, Carnegie Institution of Washington, Stanford, CA, USA
3. Economics, McGill University, Montreal, QC, Canada
4. Physics, New York University, New York, NY, USA

Stabilization of atmospheric CO2 at twice pre-industrial levels while sustaining economic growth and development will require replacing current fossil energy infrastructure with carbon-free energy technologies that can provide additional tens of terawatts of carbon-emission-free primary power as demand grows in the coming decades, even with substantial improvements in the efficiency of energy conversion and use. Here we report that, in the 25 years between 1985 and 2010, the global economy has decarbonized at an average rate of only 0.8% per year, significantly less than anticipated under business-as-usual but not quite as slowly as under the IPCC's new RCP8.5 pathway. However, between 2000 and 2010, the global economy has carbonized at an average rate of 0.6% per year. These rates illustrate the failure of recent efforts to stem the growth of global CO2 emissions. And, perhaps more importantly, they suggest that expected rates of decarbonization have been—and in the case of the RCPs may continue to be—overly optimistic. We have known for some time that in order to stabilize global climate, humanity must transition to a new generation of technologies that can change the way primary energy is produced and consumed. Judging by even our gloomiest expectations (e.g., RCP8.5), this transition is behind schedule. While population and the global economy are growing as anticipated, the carbon intensity of the world economy is moving in the wrong direction.

Greer, Amelia

The National Science Foundation's Support Mechanisms for Climate Science

Greer, Amelia[1]

1. The National Science Foundation, Arlington, VA, USA

As climate science continues to work its way into mainstream public discourse, the federal government is facing the need to engage the country in a meaningful, substantive dialogue about this politically and socially sensitive topic. Effective communication and education of those both in and out of science arenas are as integral to the process of understanding as the science itself. The National Science Foundation (NSF) plays a key role in this as one of the US government's foremost funding agencies for science, engineering, and technology research and education. In 2010, the NSF established the Science, Engineering and Education for Sustainability (SEES) portfolio of activities as one of the mechanisms to fund climate science research and outreach. SEES is an agency-wide NSF investment that inspired new and modified existing programs across all of the directorates and offices within the Foundation to refocus emphasis on sustainability-related fields. The SEES programs aim to reach a large variety of audiences from varying perspectives and employ a range of funding methods from large interdisciplinary competitions to small business support. This paper examines the SEES research activities at the NSF and outlines several of the programs that most directly support the communication of climate science.

Haines-Stiles, Geoffrey

Preaching to the Choir And Empowering The Congregation: Using Facebook And Face Time To Counter Denial

Haines-Stiles, Geoffrey[1]

1. Passport to Knowledge, GHSPi, Morristown, NJ, USA

"Earth: The Operators' Manual" (ETOM), supported by NSF, is an education and outreach initiative which uses stories, metaphors and innovative communications strategies to cut through misinformation about climate change and promote positive action on clean energy solutions. ETOM includes three PBS specials, a series of on-site presentations by scientists and military officers, a website functioning as portal to its video components, and a lively and growing Facebook community. External evaluation provides both quantitative and qualitative data on the success of this approach. This presentation will include short videos illustrating the strategy, and images from live nationwide events and Facebook posts. At outreach events at science centers such as the Science Museum of Minnesota, geoscientist Richard Alley, host of the TV programs, presented to large audiences with ample opportunities for follow-up Q&A. Audience surveys reported that Alley offered "the most clear explanation of linking carbon dioxide to climate change" and noted that his physical performance (such as nodding his head to show his

"North Pole" bald spot to illustrate precession) was memorable. "I'll have that vision in my mind forever." 91% said the information was new to them, and 96% said the performance encouraged them to discuss the issues with friends: "He gave us language that we can use to communicate to other people, and I think that's what we need more than more data." Surveys showed audiences wanting specific arguments to counter frequent denier comments. The producers added a set of rebuttals ("But My Brother-in-law Said...") to the next live performance, at OMSI's Science Pub in Portland OR, with positive responses. The live events relied on stories and metaphors that audiences found new and memorable. Emitting CO2 is analogous to how we used to dump filthy human waste out our windows, before the sanitation revolution. "You could have a good cocktail conversation with this information because he's giving you metaphors for it." While the ETOM website offers key background information, such as annotated scripts of all three programs with references for all facts and assertions, the project's Facebook page has evolved into a lively venue, publishing key climate and clean energy facts, illustrated by impactful images. "Great graphics, great videos, original stories that haven't been overexposed online already." "ETOM has stayed above the dirty by citing DATA." As expected, several deniers lurk on the page, repeating assertions such as "Climate is always changing", "It's the Sun", and maligning Al Gore. What ETOM had not anticipated, but certainly welcomes, is how often 3rd party posts (i.e. from other than ETOM staff) rebut that misinformation with solid science, often with web links to additional material, and sometimes with appealing wit and engaging bluntness. At AGU's 2013 Chapman Conference on Climate Change Communications we will present data showing that empowering those who may already think humans are changing Earth's climate with new arguments and approaches is a promising and productive way to counter denial. If the ETOM programs broadcast on PBS were a classic outreach strategy, ETOM's social media approach looks to the future of climate change communications.

http://earththeoperatorsmanual.com
https://www.facebook.com/EarthTheOperatorsManual.Page

Hankin, Erik R.

Tutorial: "Communicating Climate Science to Policy Makers"

Hankin, Erik R.[1]; Ambrogio, Olivia[1]; Adams, Mary Catherine[1]

1. Strategic Communications and Outreach, American Geophysical Union, Washington, DC, USA

This interactive tutorial will provide participants with the background and insight needed to effectively communicate their science with Members of Congress and their staff so as to build a positive relationship with a policy office. Topics will include: how to research and prepare for a meeting with a policy maker, how to frame your message and present your "ask", tips for a successful meeting, and how to build on the relationship with the policy office after a meeting. Attendees will then have the chance to practice communication skills by participating in small, mock meetings with legislative staff where they have to effectively communicate their message and science.

http://www.agu.org/sci_pol/

Hauser, Cindy D.

Climate Change in the High School Enrichment Program, Undergraduate Classroom and CE Opportunity for Secondary School Teachers: What Should the Next Generation Know?

Hauser, Cindy D.[1]

1. Chemistry and Environmental Studies, Davidson College, Davidson, NC, USA

Climate Change is one of the richest interdisciplinary global challenges facing society today. As such, it is a topic that presents fantastic opportunities in the classroom. In educating the next generation to understand and address this challenge, we are faced with the question of what information is most important and how best to convey that information. Each time we prepare to discuss climate change with a variety of audiences from the junior in high school, freshmen undergraduate and senior anthropology major to the high school art teacher, we are faced with a deluge of reading material and data in addition to a wide variety of pedagogical methods. Indeed, it is the challenge of making this material accessible to others that often drives us to offer these opportunities to our students. It is, however, also a most daunting task. Here, I will present how we have addressed this challenge in a variety of academic settings and the resulting student outcomes.

Hay, William W.

The 'Experimenting With a Small Planet' Experiment

Hay, William W.[1]

1. Geological Sciences, University of Colorado at Boulder, Estes Park, CO, USA

"Experimenting with a Small Planet" was started after the Arctic sea-ice meltback of 2007. It was written in response to what I perceived as a need for the general public to understand the basics of climate and climate change. I expected it would take 3 months to complete. It took four years. Having written annual updates on Geology for World Book Encyclopedia (aimed at high-school students) for over a decade, I thought I knew what I was doing. I had also had experience in dealing with educating the general public as Director of the University of Colorado Museum. There I had learned that the attention span for reading labels is short, and exhibition labels must be very simple and concise. Early drafts of the beginning chapter were given to neighbors, all non-scientists. From them I learned: the metric system is totally foreign and unintelligible - as in World Book, all metric measurements must also be given in US feet, pounds, Fahrenheit temperatures, etc. Accordingly, the book starts

out assuming the reader knows nothing except how to read. The 900 + pages have over 400 illustrations to break up the text into short self-contained segments. Through informal storytelling it builds up the background necessary to understand our sophisticated science. It introduces mathematics, Newtonian and quantum physics, chemistry, basic biology, then goes on to explain how the atmosphere, ocean and climate system work. The book's subtitle, 'A Scholarly Entertainment' derives from G. F. Handel's subtitle for 'The Messiah' as 'A Musical Entertainment' and is deliberately intended to suggest that the book is both informal and entertaining. It is also intended to cause the casual browser to look inside. Each of the chapters on science is followed by an 'Intermezzo' of personal stories from my life experiences, covering topics such as being present when the Berlin Wall went up, assisting in the defection of an important scientist from a communist country, becoming a close friend of Nikita Khrushchev's science advisor, and involvement in scientific ocean drilling from it inception. The intent is to make the general public aware that a life in academia is not the 'ivory tower' experience it is supposed to be.

Hirschland, Matt

Doping the Atmosphere, and Other Metaphors That Stick: Taking a Page from the Madison Avenue Playbook

Henson, Robert[1]; Hirschland, Matt[1]

1. University Corporation for Atmospheric Research, Boulder, CO, USA

Scientists and professional communicators have long sought compelling metaphors for the mechanisms behind climate change and the impacts associated with it. Among many other things, climate change has been likened to a "whodunit" mystery, to an angry beast being poked by sticks, and to progressive long-term illness, with Earth as the patient. Science is limited in its ability to attribute specific weather events to the increase in human-produced greenhouse gases. However, the change in the frequency and intensity of those events lends itself more readily to compelling comparisons and analogies that, when executed well, can move public hearts and minds. An oft-cited example is the "loaded dice" analogy popularized by Stephen Schneider, where climate change is changing the sequence on the dice so that particular rolls become more or less common. Over the last few years, several scientists have employed the "steroids" analogy to describe how enhanced greenhouse gases can be compared to the use of steroids by professional athletes. In both cases, the artificially boosted presence of a naturally occurring substance changes the frequency of certain outcomes—even if no single outcome can be directly or completely attributed to the enhancement. Our group has tested this by popularizing the steroids analogy in our own work, deliberately drawing upon essential tools used by Madison Avenue marketers while staying true to the relevant science. In the world of marketing, the most effective messages are "sticky," subscribing to six tenets recently popularized by author Dan Heath and organizational behavior professor Chip Heath. Because professional sports are highly popular among a broad cross section of the public, the steroids analogy has the potential to be sticky for many audiences. In conjunction with the debut of its AtmosNews website in early 2012, the NCAR & UCAR Office of Communications worked with NCAR scientist Gerald Meehl and the animation firm Parker Street to create a two-minute video. The work employed the six elements critical to sticky marketing, illustrating the steroids analogy and comparing the batting average of a steroids-using baseball player to the increasing U.S. prevalence of record highs vs. record lows across recent decades. The video, which accompanied a full package of articles on attribution science (http://www2.ucar.edu/atmosnews/attribution), has received more than 60,000 views on YouTube. It continues to be cited by major U.S. media outlets and was referenced in the 2011 State of the Climate supplement to the Bulletin of the American Meteorological Society. The widespread interest garnered by this video points to the impact and usefulness of communicating climate science using metaphors that are both apt and sticky. The public's ability to grasp the concept of probabilistic enhancement of weather events due to human-produced greenhouse gases will become increasingly important as society confronts the enhanced odds of various climatic outcomes. In this session, we will share lessons learned and how sticky-message creation, coupled with rich social and traditional media practices, can pay off in powerful ways.

Jadin, Jenna

Communicating Climate Change in Agriculture: Challenges, Framing, and Research Needs

Jadin, Jenna[1]

1. USDA, Washington, DC, USA

The constituency of the U.S. Department of Agriculture (USDA), America's farmers, foresters, and land managers, are one group in the U.S. that is going to be very severely impacted by the climate changes of the coming century, as their livelihoods are reliant upon knowing how and when to respond to changes in climate and weather. Because of this urgent need, the USDA is actively trying to find the best ways to communicate about climate to its stakeholders—but, it faces a wide array of challenges. For one, farmers, ranchers, and other rural populations who make up the audience base for USDA products, are thought to be socially conservative and skeptical of the subject of climate change. Finding ways to successfully talk about climate change to this audience, and convey the necessary information without losing their trust is a challenge for USDA and other agricultural communicators . Second, this audience is extremely diverse, socially, educationally, and geographically, and has a wide array of information needs, many of which we are only just beginning to understand. And finally, political pressures on USDA necessitate discretion when talking about climate change in this fiscally conservative environment. All

together, these issues pose major challenges for the USDA as it tries to develop better ways to communicate about climate change. However, balancing these challenges, USDA–funded researchers have some positive news to deliver— and that is, despite existing preconceptions, farmers, at least in the Midwest, are very concerned about climate change, are already working to adapt their lands to current and future climates, and are interested in hearing more information about ways they can prepare for severe weather and other predicted changes. And, extension officials across the US are beginning to talk about climate change to their stakeholders, some with very positive results. This new information should help guide USDA and other agricultural communicators as they determine what are the most useful messages and forums for delivery. In this talk, I will discuss some of these challenges facing USDA, the techniques we are using to frame and deliver the message, and what the new research shows. We will outline some of our climate communication research needs and look to the other participants at the conference to provide us with useful tools and techniques that can be used to enable the nations' farmers to continue to provide the world with food, whatever mid-century and beyond may bring.

Kaatz, Laurna

Climate Change Communications for Water Utilities

Raucher, Karen[2]; Kaatz, Laurna[1]

1. Denver Water, Denver, CO, USA
2. Stratus Consulting Inc, Boulder, CO, USA

Water utilities are on the front line of impacts from both long-term climate change and the climate change impacts on extreme weather events. In research conducted for the Water Research Foundation a series of communications were developed and tested by water utility internal staff and governing boards. This presentation will provide a review of the research results with an emphasis on how the findings can be used to develop science based communications about climate change that will resonate with stakeholders and build support for climate related actions. Lesson learned from these water examples are applicable across fields, and specific language and templates for building resonating communications will be shared.

Kaesehage, Katharina

Why Climate Change Interests Businesses That Do Not Want To Hear About It

Kaesehage, Katharina[1]; Caseldine, Chris[1]

1. College of Life and Environmental Sciences, University of Exeter, Penryn, United Kingdom

Although of great interest from a scientific perspective, the risks and opportunities of climate change have been little acknowledged from a business perspective making it difficult, especially for Small and Medium Enterprises (SMEs), to engage with climate change in a meaningful, profitable and sustainable way. Current research is not able to explain how this message is perceived by SMEs and why it only rarely makes businesses engage with climate change. In this paper we will show that there is actually no need for climate change science to be consistently communicated to businesses but instead they require appropriate information on business action. Business leaders tend to perceive climate change as negative and impracticable, therefore interpreting it with narratives like "low carbon" or "renewable energy" to offer an opportunity to present climate change related information in a form that is seen as more positive and potentially actionable. We examine critically a case study of 35 SMEs in Cornwall, UK who are engaging with climate change and 8 organizations communicating climate change knowledges. We explore how these businesses approach the knowledge gap between climate change science and business practice. The results show that (1) personal values of business leaders decide for or against the engagement with climate change; (2) SMEs actively create formal and informal knowledge networks to overcome the gap that exists between scientific knowledge on climate change and appropriate action by businesses. By this they unknowingly create a cluster in the field of climate change business practice innovating the low carbon economy because they struggle to engage with the risks and opportunities of climate change in a meaningful, profitable and sustainable way on their own. The results also illustrate that business leaders come together with various objectives and motivations primarily driven by a strong regional identity and financial benefit. Further it was found that funding efforts to get more businesses engaged with climate change and to develop a low carbon economy remain amongst "the same" actors and do not reach businesses not yet engaged with climate change. To enhance the number of businesses engaging with climate change, maximize the potential value of climate change for the economy and establish a low carbon economy, communication needs to target businesses outside the knowledge cluster through addressing personal values of business leaders, by communicating potential financial benefits, regional impacts and the potential "feel good factor" created by "doing business by doing good". This research contributes to debates not only on communication of climate change but also on business strategy more generally. The research demonstrates that understanding on climate change emerges around transient understandings where knowledge exchanges are of great value for SMEs to be able to innovate. The research also shows that current climate change communication concentrates on improving the quality of climate science knowledge rather than recognizing that end users do not really want yet more, often very similar, information.

Kelly, Lisa-Anne D.

Positive Affective Connections to Animals and Behaviors that Address Climate Change among Public Audiences

Kelly, Lisa-Anne D.[1]; Grajal, Alejandro[1]; Luebke, Jerry F.[1]; Clayton, Susan[2]; Saunders, Carol D.[3]; Matiasek, Jennifer[1]; Stanoss, Ricardo[1]; Goldman, Susan R.[4]; Mann, Michael E.[5]; Karazsia, Bryan T.[2]

1. Conservation, Education, & Training, Chicago Zoological Society / Brookfield Zoo, Brookfield, IL, USA
2. Department of Psychology, The College of Wooster, Wooster, OH, USA
3. Department of Environmental Studies, Antioch University New England, Keene, NH, USA
4. Learning Sciences Research Institute, University of Illinois at Chicago, Chicago, IL, USA
5. Earth System Science Center, Pennsylvania State University, University Park, PA, USA

Increased science knowledge alone is insufficient to increase concern about environmental issues and engagement in conservation behaviors [e.g., Sturgis & Allum, 2004]. Therefore, climate change education and communications approaches need to consider the social and psychological contexts of climate change perceptions. Recent findings regarding the general lack of effectiveness in the use of negative emotions in motivating behavioral engagement [e.g., O'Neill & Nicholson-Cole, 2009] suggest the need to investigate the role of positive affect in climate change communications. Here we report the results of a survey of U.S. zoo and aquarium visitors conducted to identify conceptualizations of the issue of climate change. Two independent surveys were administered at 15 zoos and aquariums: One primarily focused on attitudes (n=3,594), another on behaviors (n=3,558). With nearly 170 million annual visitors in the U.S., zoos and aquariums are conservation organizations with a considerable reach. These audiences are receptive to climate change communications. Survey results indicated that zoo and aquarium visitors tend to show higher levels of acceptance and concern about climate change than the general American public: 82% of visitors believe climate change is happening, which is substantially more than the 64% among the general American public [Leiserowitz et al., 2011]. We found that visitors' participation in behaviors that address climate change clustered around two categories: consumer and environmental support behaviors. We used two multiple mediation models [Baron & Kenny, 1986] to test the relationship between sense of connection with animals and (1) consumer behaviors or (2) environmental support behaviors. We hypothesized that the relationship between sense of connection with animals and engagement in climate change mitigation behaviors is mediated by indirect effects: certainty that climate change is occurring, individual concern about climate change, and perceived ability to have a mitigating effect on climate change. Both models were supported. We also hypothesized that reporting lack of knowledge about what actions would be effective to address climate change—a barrier to engagement in mitigation efforts—would moderate the pathway between the mediators and the outcome variables. This hypothesis received partial support. These results provide a foundation for the design of climate change education resources, particularly for receptive audiences. When possible, learning opportunities should support public audiences in overcoming perceived barriers to participating in climate change mitigation actions, and leverage affective sense of connection to animals to reinforce certainty about climate change, increase awareness of impacts of climate change, and emphasize the potential to personally address climate change.

Kintisch, Eli S.

A Climate Journalist Explores Art: New Tools, New Partnerships and New Audiences

Kintisch, Eli S.[1]

1. MIT, cambridge, MA, USA

Through a two-year fellowship at MIT, a longtime reporter at Science magazine has radically shifted his career through various partnerships with artists around climate change. This new avenue was motivated by the belief that traditional forms of climate journalism — books, articles, blogs — have proven inadequate to convince Americans or policymakers of key facts about climate change. In a talk to the conference I will discuss lessons from this adventure as they pertain to new partnerships in these areas, how to measure effectiveness/impact of such collaborations, and plans for the future in this regard. First, a series of monthly meetings called ClimateArtPizza began to catalyze connections between artists, journalists and scientists in Cambridge around public projects related to climate, the focus being reaching audiences that don't read scientific or environmental articles. An art exhibition at MIT in April 2012 (toextremesexhibition.org) was inspired by the 2011 IPCC SREX report, beginning a discussion around how to explore extreme events and climate through public art. The winner selected by the judges of that exhibition, noted British film artist Sam Jury, has become a collaborator with Kintisch in a project called Here After Now, a climate-data-responsive video art installation (hereafternow.wordpress.com) that will be sited in a public place in Boston for an extended period. The piece consists of a dreamy, 30-minute loop Jury will create with Kintisch to explore climate impacts in Boston in the future and adaptation efforts. Separate smaller films will explore various extremes like flooding or drought. An algorithm controlling the piece will connect to live data that monitors weather paramaters like rain, heat and wind, or other data related to climate, like heat-stroke related hospital admittances. That algorithm will determine the order of images that the piece includes. In this way, a rainy period will trigger the playback of the loop exploring flooding. The philosophy of the piece focuses on findings in psychology that suggest that making climate impacts part of an individual's sense of personal risk is crucial to them feeling connected to climate change. A class taught at RISD in Fall

2012 studied how the design of tablet-based apps could explore how climate change is affecting the Narragansett Bay. Work coming out of this class included new proposed apps to visualize food webs, interactive games for children around the topic, abstract digital art pieces, and a proposed children's book. Finally, work with RISD students inspired a proposed project by Kintisch to use digital imaging techniques to allow individuals to view climate impacts forecast for the future — or climate extremes of the past — with their phone or tablet, in situ, in real time. Led by Kintisch, a team of artists, scientists and designers are awaiting a decision on initial funding from the National Science Foundation for that project, called Looking Glass.

hereafternow.wordpress.com toextremesexhibition.org http://expspace.risd.edu/?research=the-bay-in-flux

Klima, Kelly

Successful Communication of Adaptation, Geoengineering, and Other Climate-Related Work

Klima, Kelly[1]

1. Carnegie Mellon University, Washington, DC, USA

As the annual costs of severe weather events in the US grow into the billions of dollars, companies, communities, and countries are examining how best to plan ahead to protect their assets and bolster their bottom line. John Holdren, presidential science advisor, frames three choices when it comes to climate change: mitigation, adaptation, and suffering. We can minimize suffering by taking robust action to reduce greenhouse gas emissions (greenhouse gas mitigation, even geoengineering) and enhancing our physical and economic resilience to the increasing impacts of climate change (adaptation). This presentation will highlight three communication techniques aimed at different types of audiences such as the general public, high-level leaders, and the nation's youth. First, communication to the general public must capture their interest through actions, images, and words. For instance, we have iconic symbols for greenhouse gas reduction: windmills, cyclists, curly light bulbs. However, when we talk about adaptation or geoengineering, we typically show disaster photos. Presenting problems without solutions can lead to despair or cause the listener to lose interest. Additionally laypersons respond differently to climate issues; reaching across the aisle requires using the right words, such as "clean" instead of "green". Second, high-level stakeholders must find their own self-interest if they are going to engage in a solution. For instance, in some cases stakeholders might find different solutions attractive, and may take unilateral action. A common method to address this is to identify stakeholders needed at the table, understand their motivations for being and staying at the table, and then hold off-the-record conversations emphasizing candid discussion. Such informal conversation helps stakeholders share their perspectives and identify solutions with multiple co-benefits such as cost savings, social benefits, climate resilience, and greenhouse gas reduction. Third, we find that we must begin instilling change through the nation's youth. As one business executive has said, he'll be tough in the office, but at home he'll do anything his little girl asks. Carnegie Mellon University's Summer Center for Climate, Energy, and Environmental Decision-Making (SUCCEED) is a 5-day program designed to complement what ninth-grade students have studied in school and provide them with opportunities to expand their understanding of energy, the environment, and how those relate to climate change. At the end of the program, they will be able to answer a variety of question on mitigation, adaptation, and dealing with unexpected impacts. This program has received great reviews from the students and parents, prompting changes in their everyday lifestyle such as increased use of energy star appliances.

Klinsky, Sonja

"It's the Economy Stupid": Rethinking the Communication of Economic Model Insights about Climate Mitigation

Klinsky, Sonja[1]; Hatfield-Dodds, Steve[2, 3]

1. School of Sustainability, Arizona State University, Tempe, AZ, USA
2. CSIRO Ecosystem Sciences, Black Mountain Laboratories, Canberra, ACT, Australia
3. Crawford School of Public Policy, Australian National University, Canberra, ACT, Australia

Efforts to craft and implement policies that aim to reduce greenhouse gas emissions are consistently faced with concerns about economic costs. Due to the centrality of these concerns in climate policy decision-making, substantial modelling has been conducted to explore the economic consequences of GHG reduction actions. However, as with climate science models, economic models are extremely complex and necessarily impose a range of communication challenges. In this paper we review modelling insights about the economic implications of emissions reductions; identify a crucial disjuncture between the insights about wealth and living standards emerging from these models and the way in which these results are communicated to decision-makers; and use lessons from communications research to propose an alternative strategy for presenting model results. We suggest that greater attention by both modellers and science communicators to the communication challenges of presenting economic modelling results would help ensure that their insights are not overlooked or misunderstood during policy-making processes.

Klos, P. Z.

Forest managers' response to climate change science: Toward understanding the cognitive impacts of boundary objects at the management-research interface

Klos, P. Z.[1]; Blades, Jarod[2]; Kemp, Kerry[1]; Hall, Troy[2]; Morgan, Penelope[1]; Force, Jo Ellen[1]; Link, Timothy[1]

1. College of Natural Resources, University of Idaho, Moscow, ID, USA
2. Department of Conservation Social Sciences, University of Idaho, Moscow, ID, USA

Rapid biophysical changes occurring in forests of the western U.S. have highlighted a need for understanding and adapting to climate change impacts. Land managers, policy makers, and community officials lack local-scale climate change science and are urgently calling for research to inform management decisions. Nevertheless, a substantial disconnect remains between emerging scientific information and its application in management decisions. Recently, boundary objects have been identified as useful tools for facilitating the transfer of knowledge between scientists, land managers and policy makers – translating science into management. We have focused on the development and exchange of current climate change research across research-management-policy boundaries. One goal of our research was to enhance the understanding of the cognitive processes by which boundary objects may operate, namely by impacting risk perceptions, credibility, and salience of climate change impacts related to forest management decisions. We conducted four climate change workshops in the U.S. northern Rockies in which we presented current science, integrated across disciplines and scales, through a variety of workshop activities that allowed 109 U.S. Forest Service personnel, scientists, and engaged stakeholders to participate in open and reasoned discussions. This presentation will discuss our boundary object theoretical approach, the mixed methods employed, and preliminary findings about attitude, beliefs, and behavioral change. Gathering pre- and post-workshop data allowed us to evaluate changes in participant thinking and behavior related to using climate change science in land management decisions. We collected 169 questionnaires (91 pre, 78 post) and 95 semi-structured interviews (60 pre, 35 post). Workshop participation significantly influenced risk perceptions associated with anticipated changes in temperature, precipitation, and wildland fire. Participants also reported a substantial increase in their perceptions of the effectiveness of management activities to adapt and mitigate the potential impacts of climate change, and were more willing to consider novel restoration objectives in response to predicted climate change effects on forest composition. Overall, participants demonstrated a significant increase in their perceptions of the credibility and usefulness of climate change science in land management, notably for local-scale actions. We will discuss how our research informs boundary object theory constructs and broader applications for future research.

Kontar, Yekaterina

New Trends in Climate Science Outreach and Engagement

Kontar, Yekaterina[1, 2]

1. ANDRILL Science Management Office, University of Nebraska - Lincoln, Lincoln, NE, USA
2. Earth and Atmospheric Sciences, University of Nebraska - Lincoln, Lincoln, NE, USA

Nowadays perhaps just as perplexing as the biggest issues at the core of Earth science is the nature of communicating about nature of Climate Science. During my presentation I will examine the processes of communication necessary in bridging the chasm between climate change and natural hazard knowledge and public opinion and policy. This contribution is based on the previous research conducted in the fields of science and society; and it will demonstrate some of the most proactive and prescriptive approaches to communicating with the public, the media, and policy makers about the importance of Climate Science in everyday life. The preliminary research emphasizes communication principles and practices within an up-to-the-minute context of new environmental issues, new technologies, and a new focus on resiliency. This presentation will benefit environmental professionals, researchers, and educators in the Climate Science.

Lewandowsky, Stephan

Scientific Uncertainty in Public Discourse: The Case for Leakage Into the Scientific Community *(INVITED)*

Lewandowsky, Stephan[1, 2]; Oreskes, Naomi[3]; Risbey, James S.[6]; Newell, Ben R.[4]; Smithson, Michael[5]

1. Psychology, University of Western Australia, Crawley, WA, Australia
2. Psychology, University of Bristol, Bristol, United Kingdom
3. University of California, San Diego, San Diego, CA, USA
4. University of New South Wales, Sydney, NSW, Australia
5. Australian National University, Canberra, ACT, Australia
6. CSIRO, Hobart, TAS, Australia

Uncertainty is an unavoidable part of science. In the case of climate science, any uncertainty should give particular cause for concern because greater uncertainty usually implies greater risk. However, appeals to uncertainty have been used in public debate to forestall mitigative action. Uncertainty has been highlighted in many situations during the last 50 years in which vested interests and political groups sought to forestall action on problems long after the scientific case had become robust. We suggest that the prolonged appeal to uncertainty in the public arena has "leaked" into the scientific community and has distorted scientists' characterization and self-perception of their own work. Although scientists are well trained in dealing with uncertainty and in understanding it, we argue that the scientific community has become unduly focused on

uncertainty, at the expense of downplaying solid knowledge about the climate system. We review some of the historical and empirical evidence for the notion of "leakage", and we identify the psychological and cognitive factors that could support this intrusion of ill-informed public discourse into the scientific community. To illustrate with an example, the well-known "third-person effect" refers to the fact that people generally think that others (i.e., third persons) are affected more by a persuasive message than they are themselves, even though this is not necessarily the case. Scientists may therefore think that they are impervious to "skeptic" messages in the media, but in fact they are likely to be affected by the constant drumbeat of propaganda. We review possible solutions to the undue leakage of biased public discourse into the scientific arena.

Luzzadder-Beach, Sheryl

Communicating Collapse, Climate, and Complex Society: the Case of the Ancient Maya

Luzzadder-Beach, Sheryl[1]; Beach, Timothy[2]; Dunning, Nicholas[3]; Scarborough, Vernon[4]; Heckbert, Scott[5]

1. Geography and Geoinformation Science, George Mason University, Fairfax, VA, USA
2. Science, Technology, and International Affairs, Georgetown University, Washington, DC, USA
3. Geography, University of Cincinnati, Cincinnati, OH, USA
4. Anthropology, University of Cincinnati, Cincinnati, OH, USA
5. Alberta Innovates Technology Futures, Edmonton, AB, Canada

Since Classical times, scholars have studied and written about the relationship between humans and the environment, for much of the time getting it wrong by oversimplifying complicated lines of evidence. We focus on efforts to understand the florescence and decline of the ancient Maya Civilization of Mesoamerica, and the complicated relationship the Maya had with not only climate and the environment, but with one another. Since Ellsworth Huntington and others laid a miasma of determinism over the study of human, climate, and environmental relationships, scholars have had to dig long and hard to rise above the dangerously misguided and simple causal relationships alluded to in early twentieth century science, in favor of more complex, multi-variable and multi-directional relationships uncovered by interdisciplinary teamwork. A further task was to dispel old notions of linear cause-and-effect relationships and successfully communicate convincing alternative hypotheses which frame issues in a complex systems perspective. This sea change in thinking and communicating has depended upon the use of multiple working hypotheses and new techniques both in the field and the lab, to understand and reconstruct climate from difficult-to-obtain proxies of the past. This communication revolution is supported by visualization, particularly spatial visualization and complex systems computer modeling. This paper synthesizes the history of understanding and communication about the ancient Maya and climate, collapse, and complex human-environment systems, bringing us to present day spatial modeling efforts. The ultimate goal of our historical, geographical, and archaeological efforts, beyond understanding and modeling the fascinating interactive histories of the Ancient Maya and the environment, is to use these lessons and models to understand our modern society from a complex systems perspective and understand our own vulnerabilities in light of future environmental trajectories.

Lynch, Cary

A Case Study of Communicating Climate Projections for the Northeast US Via Webinar

Lynch, Cary[1]; Seth, Anji[1]; Thibeault, Jeanne[1]

1. Geography, University of Connecticut, Storrs, CT, USA

We will be presenting a test case for communicating Northeast Regional climate change projections via a webinar to stakeholders in Connecticut. An understanding of climate change science is crucial when addressing regional climate change and the necessary societal response. Communication of causation and the effects of climate change must be aimed at policy makers and the public. Effective communication can nurture the social demand for regulation while overcoming barriers to public engagement with climate change mitigation and adaptation policies. Towards this goal, the April 2013 webinar targets a diverse group of people that range from non-profit organizations, government officials, museum administration, and educators at various levels. The intent is to increase public understanding of the regional effects of climate change and to increase the public's participation in creating policy for the state of Connecticut using publicly accessible data tools. We will share our methods of climate change communication as well as discuss feedback obtained after the webinar exchange. We believe that this webinar will facilitate a constructive dialogue between policy makers and the public.

MacCracken, Michael

A Retrospective on Early Climate Science From a Physical Scientists Point of View *(INVITED)*

MacCracken, Michael[1]

1. Climate Institute, Washington, DC, USA

Abstract text not included

MacCracken, Michael

Might Being More Careful In Our Communications Help To Improve Public Understanding About Climate Change? *(INVITED)*

MacCracken, Michael[1]

1. Climate Institute, Washington, DC, USA

In seeking to sample and summarize the views of the public (and even sometimes the views of the scientific

community), might the terminology being used be creating an impediment to public understanding of the science and significance of global warming? Might greater care in choosing our words be helpful in improving understanding of the scientific process and in finding out where the impediments are to public movement in dealing with climate change? While recent polls suggest that public concern is finally growing regarding the potential significance of climate change, there remains a sometimes sharp divide between those who are considered to be for and against taking action that is often expressed as a difference between those who "believe" in anthropogenic global warming and those who do not. This phrasing, however, seems completely reversed to how the two sides are coming to their conclusions. The scientific process is based on the development of the most internally consistent and plausible explanation for the available set of observations, field experiments, and numerical representations of the fundamental laws of conservation of mass, momentum, energy, and other quantities; scientific training calls for suppression of belief and findings that are not supported by objective measures, yet the intellectual result of this endeavor is said to be resulting in the "belief" that humans are primarily responsible for recent global warming. On the other hand, the critics of the hypothesis of anthropogenic climate change are said to be non-believers, when in fact, despite the increasing array of observational and theoretical evidence to the contrary and the lack of an alternative explanation, their view seems to be dominated by the belief that "there is no way that puny little man can affect God's great Earth." The bizarre paradox that seems to prevail is that the believers are those that draw their views from what is happening in the real world, and the non-believers seem incapable of accepting any evidence that goes against their tightly held beliefs in human insignificance and reverential powers. Given this mixed-up situation regarding believers and non-believers, coupled with the different perspectives on uncertainties and the level of confidence needed before proceeding to policy action, should we be surprised that scientific attempts at communication have seemed inefficient, public discussion and consideration have seemed contentious, and building a consensus for action has been difficult. A key question would seem to be whether our community can better frame our communications regarding climate change and how are views and findings are developed in order to bridge the current public and political divide on this issue.

Mann, Michael E.

The Battle to Communicate Climate Change: Lessons from The Front Lines *(INVITED)*

Mann, Michael E.[1]

1. Dept of Meteorology, Penn State University, University Park, PA, USA

I will discuss the continuing challenges and potential pitfalls climate scientists confront in efforts to communicate the science of climate change, its likely impacts, and solutions. Scientists, first of all, must contend with a well-funded and organized disinformation effort that aims to confuse the public about the nature of our scientific understanding and attack the science and the scientists themselves. In the face of these attacks, we must strive to communicate the science and its implications in plainspoken language that neither (a) insults the intelligence of our audience, (b) loses them in jargon and science-speak, nor (c) misrepresents the current state of our scientific understanding, including the uncertainties that remain. I will share insights that I have accumulated in my own communications and outreach efforts.

Markus, Momcilo

Flood frequency issues in a changing climate of Northern Illinois

Markus, Momcilo[1]

1. Illinois State Water Survey, Prairie Research Institute/University of Illinois, Champaign, IL, USA

To explain the changing flood frequency in the greater Chicago region, this study uses a suite of tools ranging from statistical flood frequency analysis to land-surface hydrologic modeling. It also uses the past observed data, as well as climate model generated future data generated by commonly assumed future climate scenarios. The main issues are illustrated through examples, including the Chicago metropolitan area, where the increasing intensity and frequency of heavy storm events along with rapid urbanization have caused a significant increase in flood-related economic and environmental damages; the Pecatonica River, which exhibited a decreasing trend in annual peak flows as a result of decreasing snow accumulation in the watershed; and the Rock River with ice-jam flooding and other issues.

Masters, Jeff

The Weather Underground experience

Masters, Jeff[1]

1. The Weather Underground, Ann Arbor, MI, USA

Originally an educational project at the University of Michigan in the early 1990s, the Weather Underground transformed into the highly successful commercial Internet weather web site, wunderground.com, in 1995. I give an overview of the science communication experiences learned during my 22-year experience with the Weather Underground. Some lessons learned: Find your own unique voice. Be entertaining; don't be such a scientist. Tell stories. Earn people's trust. Use colorful graphs, images that show people, historical events, or scenes of local interest to illustrate your message. Be careful with criticism. Allow your audience to participate. Enrich people's experience by turning them on to other groups that offer unique and interesting information. Collaborate with other communicators with the goal of providing the public with simple, clear messages, repeated by a variety of trusted sources.

http://www.wunderground.com/blog/JeffMasters/article.html

McCaffrey, Mark

The Climate ECO-system: Toward an Integrated Approach to Climate Education, Communications and Outreach- Roundtable Discussion and Workshop Proposal

McCaffrey, Mark[1]

1. National Center for Science Education, Oakland, CA, USA

Education, communications and outreach (ECO) around sciences in general and climate science in particular have for many years taken place in distinct silos that occasionally overlap but often involve competing goals and differing theories of change. There are now a number of converging factors at play that offer an opportunity to foster a more integrated, comprehensive approach to connect the three domains in more of an ecosystem-like framework. Beginning with a half day intensive that will begin with a roundtable discussion with short presentations from experts in each of these realms, participants will then work in one of three working groups—one focused on education and literacy around climate science and related social sciences, another on communication through a range of media mediums, and the third on fostering excellence in outreach by scientists and institutions. A concluding open plenary session will summarize the current challenges and potential opportunities for improved collaboration and cooperation among these realms by more clearly defining boundary conditions, niches, and potential conflicts and synergies. Discussants for the roundtable and facilitators of the working groups will be identified from amongst the participants of the conference.

Minns, Asher

How Do I Restore Trust in Climate Scientists to Tell the Truth About Climate Change? *(INVITED)*

Minns, Asher[1]

1. University of East Anglia, Norwich, United Kingdom

Science communication – based on principles of dialogue and engagement - and studies of climate change communication - should be able to help address any wavering mistrust of European or US publics for climate change scientists to tell the truth about climate change. How can we be proactive in re-building trust in climate scientists? How do we do openness and transparency, and public discourse, and also be clear about where we have higher and lower levels of confidence, but at the same time not suggest that climate scientists know less or are more uncertain? The purpose of this session is to draw together speakers and discussants to see what practical lessons climate change communicators and institutions can learn ahead of the launch of the Intergovernmental Panel of Climate Change's Fifth Assessment (IPCC AR5). Lessons learned will then be diffused to a European network of climate change communicators. Increased mistrust in climate change scientists may have been brought by the 'Climategate' media storm of 2009 and 'IPCC Glaciergate' 2010, and other controversies since. Though they are methodologically not comparable, it can be inferred from survey reports in the UK, Eurobarometer, and the US that trust has lowered for climate scientists to speak the truth about climate change. A UK poll in December 2009 immediately after Climategate showed that 41% of the public agreed that they trust climate scientists to tell the truth (YouGov 2009), focus groups in 2011 showed that 38% of the public have trust (Shuckbugh 2011 fig.1), a poll in 2012 showed 66% trust scientists the most when giving views on climate change (Ipsos-Mori 2012). Since 2006, repeat surveys by the UK'S Department for Transport show that public trust has declined in all Institutions and Professions who speak about climate change (Shuckburgh 2011 fig.2). Public support for the science of climate change in the UK has declined from 84% in 2006 to 70% in 2011 (DfT 2011). In the US, it has declined from 50% in 2008 to 40% in 2012 (Leiserowitz 2012). In Australia, 77% of people think that climate change is happening but they are evenly split to whether humans play a role, or not (Leviston 2011). The fallout of Climategate, however, can only be characterised as English speaking, white, anglo-saxon. In 2011 compared to 2009, combined European publics are more concerned about climate change (Eurobarometer 2011). It can be argued that this wavering public support in climate scientists to tell the truth about climate change transmits to national politicians who feel that policies addressing climate change do not have the support of the public. With this background I will attempt to learn lessons for how to begin to develop an international climate change research community with a strong sense of identity so that it communicates better, and how it could communicate better. In this session I am looking for contributors who have practical and applicable lessons ahead of the launch of IPCC AR5 (2012 and 2013) to inform European (and US and Australian) climate science communication.

http://tyndall.ac.uk/people/Asher-Minns

Molnia, Bruce F.

Communicating Climate Change Through the Use of Repeat Photography of Alaskan Glaciers and Landscapes

Molnia, Bruce F.[1]

1. CLU / LRS / CAC, US Geological Survey, Reston, VA, USA

Since the late 1990s, I have attempted to use repeat photography of Alaskan glaciers and landscapes to inform fellow scientists, policymakers, the media, and society that significant changes were occurring throughout Alaska in response to post-Little Ice Age climate change. I began this pursuit after being challenged by then Deputy Secretary of the Interior David Hayes, who requested unequivocal examples that climate change was real and underway. After considering several options as to how best respond to his challenge, I decided that if a picture is worth a thousand

words, then pairs of photographs of the same field of view, spanning a century or more, would speak volumes to documenting that dynamic climate change was occurring over a very broad region. To me, understating the obvious with photo pairs was the best mechanism to present irrefutable, unambiguous, nonjudgmental, as well as unequivocal visual documentation that climate change was both underway and real. Repeat photography is a technique in which a historical photograph and a modern photograph, both having the same field of view, are compared and contrasted to quantitatively and qualitatively determine their similarities and differences. I have used this technique from both ground-based photo stations and airborne platforms at nearly 200 Alaskan locations in Kenai Fjords National Park, Glacier Bay National Park and Preserve, Wrangell-St. Elias National Park and Preserve, Denali National Park and Preserve, the northern and northwestern Prince William Sound area of the Chugach National Forest, and the Mendenhall Glacier area of the Tongass National Forest, to document and determine changing glaciers and landscapes as a result of changing climate. The use of repeat photography to document temporal change is not new. It originated as a glacier-monitoring technique in the Alps about 150 years ago. What is unique in this Alaskan application of repeat photography is the systematic approach being used to obtain photographic documentation of glacier and landscape change for every glacier-hosting fiord in the southcentral Alaska, as well as at many Alaskan valley glacier sites. What is also unique is the development of an annotated website which presents nearly 100 pairs of these photographs as well as ancillary materials to help convey the basics of climate change. The website, Glacier and Landscape Change in Response to Changing Climate, was awarded the 2010 USGS Shoemaker External Communications Award.

http://www.usgs.gov/climate_landuse/glaciers/

Morrow, Cherilynn A.

Insights into How College-Age Students at a Southeastern Research University Think About Climate Change Concepts

Morrow, Cherilynn A.[1]; Afolabi, Comfort Y.[2]; Katzenberger, John[1]; Monsaas, Judith[3]; Somerville, Richard C.[4]; Elliott, W. C.[5]

1. Science Education, Aspen Global Change Institute, Atlanta, GA, USA
2. College of Education, Georgia State University, Atlanta, GA, USA
3. Assessment & Evaluation, University System of Georgia, Atlanta, GA, USA
4. Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA, USA
5. Department of Geosciences, Georgia State University, Atlanta, GA, USA

Undergraduate education is a key access point for climate science communication – a time when colleges are trying to foster the transformation from minds that accept dogma to minds that inquire and critically evaluate the source of information they encounter. Since the summer of 2011, we have been gaining insights into how a large and diverse population of undergraduate students at a southeastern research university think and reason about climate change. These insights are emerging as part of a research-based process to develop a climate change concept inventory (i.e., a carefully designed, multiple-choice "test" for assessing student learning about climate change concepts). This presentation will summarize the development process of the Concept Inventory, but the primary emphasis will be on reporting our findings and their implications for success and failure in communicating climate science. Our research is conducted with students taking a 4-credit-hour, introductory undergraduate course on weather and climate. Over 1000 students take the course each year to fulfill a core academic requirement. The course is taught at seven other institutions in the state; and similar courses are taught around the nation. . Our primary research methods are student group interviews about the questions and answer choices on the Concept Inventory, and statistical analyses of student performance on the pre- and post-course administrations of evolving drafts of the Concept Inventory. The emergent contributions to climate communication include: 1) knowledge about the sorts of words and expressions that students consider to be unfamiliar or confusing; 2) perspective on what young adults know and do not know about basic climate concepts (such as those listed in the Climate Literacy Handbook, the AAAS Atlas for Weather & Climate, and the IPCC FAQ); 3) information about the influences of self-reported sources of prior knowledge about climate change; and 4) insights about how students are thinking and reasoning with fundamental concepts (e.g. in physical science or mathematics) in ways that enhance or prevent clear construction of conceptual ideas about climate. In addition, the relatively low percentage of students responding correctly on certain well-developed concept inventory questions at the end of the course has led us to begin creating a derivative resource to support course instructors and teaching assistants. This resource will alert instructors to the insights about student misunderstandings that our research has detected and provide links to strategies for improving student understanding. A draft of our resource for instructors will be available at the conference for review, and we envision that both it and the Concept Inventory will be useful to colleagues engaged in climate communication beyond our state. Our work is being conducted in partial fulfillment of NASA NNX09AL69G.

Mukherjee, Saumitra

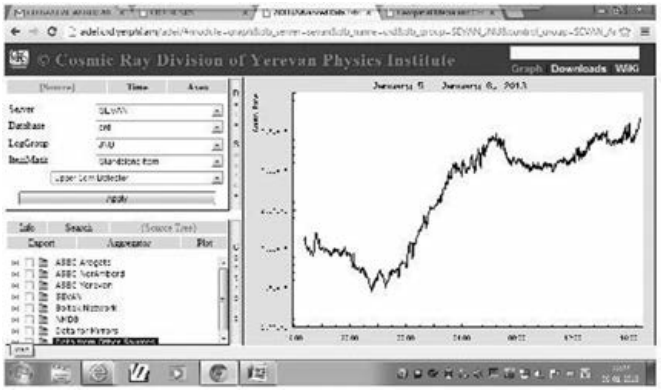
Space Environment Viewing Network for Climate Change

Mukherjee, Saumitra[1]

1. School of Environmental sciences, Jawaharlal Nehru University, New Delhi, India

Space Environment Viewing and Analysis Network (SEVAN) has the potential to infer the changes in the climate. The network has global coverage in different latitude and altitude which are showing potential information to infer global climate change. The instrument can differentiate the cosmic rays coming from extragalactic source, from distant Star/Nebular explosion or from the Sun. SEVAN detector data are being recorded in the Remote sensing applications laboratory in Jawaharlal Nehru University, New Delhi, India has shown that during low or no Sunspot days the extragalactic cosmic rays are coming to the earth at higher rate. Further the change in the cosmic ray rate from extragalactic source has been correlated with the climate change including influence on atmospheric temperature, sudden rainfall and adverse weather outbreak.

http://www.jnu.ac.in/Faculty/smukherjee
http://crdlx5.yerphi.am/press_releases/SEVAN_Network_expanding_to_India_Jawaharlal_Nehru_University



Geospatial correlation of Cosmic Ray rise with lowering in Atmospheric Temperature

Newton, Steven F.

Addressing Climate Change Denial in the Age of "Academic Freedom" Bills

Newton, Steven F.[1, 2]; Berbeco, Minda[1]; McCaffrey, Mark[1]

1. National Center for Science Education, Oakland, CA, USA
2. Life & Earth Sciences, College of Marin, Kentfield, CA, USA

"Academic Freedom" bills introduced at the state level are part of an organized campaign to undermine science education and challenge curriculum involving politically controversial topics, such as climate change and evolution. Under the guise of promoting critical thinking, "Academic Freedom" bills give legal cover for teachers to disseminate misinformation and have their students judge the "strengths and weaknesses" of well-established science. Under these laws, students may also protest low grades for scientifically-incorrect answers so long as they hold a "certain position on scientific theories." The National Center for Science Education uses its 30 years of experience defending evolution to counter climate change denialism, identifying and countering "Academic Freedom" legislation across the United States, including the recently-introduced bills in Colorado, Oklahoma, Missouri, Indiana, and Montana. As climate change science becomes increasingly integrated into public education, a strong network of advocates for accurate science education must debunk myths and provide quality educational materials. This paper addresses past and pending "Academic Freedom" bills across the country, and suggests ways the climate community can support quality science education.

Paquin, Dominique

Ouranos' Experience Part 1 - From Scratch to More Than 10 Years on Explaining Climate Modeling and Climate Change

Paquin, Dominique[1]

1. Ouranos, Montreal, QC, Canada

The Ouranos consortium on regional climatology and adaptation to climate change was created in 2001. It is composed of 19 regular and affiliated members and brings together up to 400 scientists and professionals from different disciplines, with only 30 regular employees. Members include Quebec government departments, universities, hydropower societies, and the Canadian meteorological office. Ouranos` main mission is to acquire and develop knowledge on climate change, its impact and related socioeconomic and environmental vulnerabilities, in order to inform decision makers about probable climate trends and advise them on identifying, assessing, promoting and implementing local and regional adaptation strategies. To do so, starting from scratch at the consortium's creation, we have developed a few strategies over the years and will expose some of them as examples in this first part. The second part will focus on the lessons learned and ways in which we are moving forward with providing climate information. The first strategy adopted during the first years of Ouranos was the creation of a Climate Scenarios group to discharge people in Simulations group from dealing directly with all the increasing number of users and their specific needs, allowing the specialists of the Simulation group to concentrate on the production of data for the users and on model analysis. Now the two groups are doing joint but distinct efforts to provide not only data and products but also expertise in climate change. For all members that express the need, the Simulations and Analysis group offers a short course on climate models. The course is adapted to the needs and to the level of the applicant, is provided at the applicant's choice of location and is offered in French or English. The aim of the course is to ensure that users not familiar with climate data develop a general understanding of the kind of tool that climate models are and are familiar with the concept of uncertainties. In fact, it would be

beneficial to schedule such a course at the onset of every impact and adaptation project, to ensure that basic knowledge on the subject is acquired and that the use of climate data will be appropriate. However, the large number of projects, limited resources and sometimes lack of good will make this impossible. The different impacts and adaptation projects at Ouranos can be separated in two categories: with or without contributed personnel from users in situ at the Ouranos offices. In order to carry out analyses for their particular field of study, some members found that it beneficial to have contributed personnel in-situ at Ouranos. For example many projects with Québec's provincial hydropower society (Hydro-Québec) involve mixing personnel from Ouranos' Climate Simulation and Scenarios groups and from Hydro-Québec. For projects involving users with their personnel remaining in their own organization, the Climate Scenarios and Services group adapts to the preferences of the users and presents the climate information in a way that is familiar and convenient to the end-user. The choices are made based on discussions between the users and Ouranos in order to avoid lost work or demands that would be impossible to meet within the timeframe and the human and financial resources available for the project.

Pathak, Tapan

Climate Masters of Nebraska: Innovative Action Based Approach on Climate Change Education

Pathak, Tapan[1]; Bernadt, Tonya[2]; Umphlett, Natalie[3]

1. School of Natural Resources, University of Nebraska-Lincoln, Lincoln, NE, USA
2. National Drought Mitigation Center, University of Nebraska-Lincoln, Lincoln, NE, USA
3. High Plains Regional Climate Center, University of Nebraska-Lincoln, Lincoln, NE, USA

Given the lack of educational programs available to help guide the community about what practical actions they can take to effectively reduce GHG emissions, local motivation to do so remains modest at best. There was a clear need for a community-based educational project focused on training people to take individual action in response to climate change in their daily life and to motivate others to do the same. UNL-Extension Climate Masters of Nebraska is one such unique educational program that strategically trained community volunteers about climate change science and corresponding ways to reduce greenhouse gas emissions through those educational phases, with the idea that they become motivated to train others within their personal and professional networks – in turn achieving a significant multiplier effect. During the 10 sessions, participants were introduced to 10 topics: Climate Change, Home Energy, Transportation, Green Building, Renewable, Yards, Consumption and Waste, Food, Home Water Conservation, Preparing for Climate Change, Consultations and Outreach. Each of 10 sessions included a guest lecture, classroom activities that motivated critical thinking and problem solving, and volunteer work discussions. Class was organized with an emphasis on action based approach to mitigate climate change. 19 participants finished the course and 88 percent of reported that the course led them to make informed changes in their lives to reduce greenhouse gas emissions. More than 300 hours of volunteer work has been reported by participants in spreading the knowledge about climate change and ways to reduce greenhouse gases. Examples of volunteer work reported by participants include: assistance to city of Lincoln's Cleaner Greener Lincoln Initiative, home consultation focused on energy conservation, formation of Nebraska Citizen's Climate Lobby, and setting up climate masters booths at various educational events to educate public about greenhouse gas reduction and about the Climate Masters class.

Peacock, Kent A.

A Sense of Urgency: Prediction and Its Influence on Policy-Making

Peacock, Kent A.[1]

1. Philosophy, University of Lethbridge, Lethbridge, AB, Canada

"...when a man knows he is to be hanged in a fortnight, it concentrates his mind wonderfully." (S. Johnson) Any investigation of how to communicate climate science more effectively must include a discussion of what is to be communicated. Using the important example of catastrophic ice sheet collapse, I will argue that the more specific and quantitative a scientific prediction can be, the better chance it will have of being taken seriously by policy makers and the public. As the famous aphorism from Johnson suggests, a warning is far more likely to be taken seriously if it comes attached to a deadline and a probability, than if it is about something, no matter how serious, that may occur at some indefinite time in the future. The possible effects of AGW can be divided into two classes, gradual and catastrophic. It is now possible to make reasonably confident predictions of the gradual sea level rise we can expect by 2050 or 2100. However, paleoclimate studies (e.g., Hansen et al. 2007) point to the existence of mechanisms that can amplify the effect of modest thermal forcing such that ice sheet mass loss could occur not only at a continuous (though increasing) rate but also in occasional catastrophic bursts, leading to abrupt sea level rises on the order of metres. Such episodes of abrupt sea level rise would have disastrous and long-lasting global effects against which the Asian tsunami of 2004 would pale in comparison. As Hansen (2007) has emphasized, the melting of an ice sheet is a highly nonlinear process that is difficult to model or predict with precision, even if it is highly likely that more than one such collapse will occur over, say, a century. It might be said that there is little point in trying to predict a catastrophic ice sheet collapse. However, the issue is so important that the possibility of making such predictions should not be dismissed. Such predictions could never be anything other than probabilistic. They would take the following form: there is a probability of at least x that in the next (say) twenty years Greenland or WAIS will suffer a

collapse leading to metre-scale sea level rise. But even if x were a small number (such as .1) it would remove an element of speculation and make concrete action more likely. One barrier to crafting the predictions that humanity needs is funding. However, another barrier to be overcome is the understandable reluctance of scientists to make dramatic predictions when so many scientific uncertainties still exist. Given the seriousness and immediacy of the climate crisis, it is arguable that scientists must accept a higher risk of error. Every effort should be made to eschew the reticence spoken of by Hansen (2007) and make predictions of the likely effects of AGW, both catastrophic and gradual, as precise and specific as the science will allow. If scientists hope to influence the decisions of policy makers and the public, then they must, more than ever, make specific prediction, even of catastrophic events, a scientific goal. References Hansen, J. (2007): "Scientific Reticence and Sea Level Rise," Environ Res Lett 2 024002. Hansen, J., M. Sato, P. Kharecha, G. Russell, D. W. Lea, M. Siddall (2007): "Climate change and trace gases," Phil Trans Royal Soc A 365, 1925–54.

Pinder, Robert W.

Energy system scenarios to simultaneously achieve air quality management and climate change mitigation goals

Pinder, Robert W.[1]; Akhtar, Farhan[1]; Loughlin, Dan[2]; Henze, Daven[3]

1. Atmospheric Modeling Division, US Environmental Protection Agency, Research Triangle Park, NC, USA
2. National Risk Management Research Laboratory, US Environmental Protection Agency, Research Triangle Park, NC, USA
3. University of Colorado, Boulder, CO, USA

Poor air quality, ecosystem damages, and climate change are caused by the same emission sources, yet environmental management often addresses each of these challenges separately. This can lead to sub-optimal strategies and unintended consequences. Here we present GLIMPSE – a decision support tool for simultaneously achieving our air quality and climate change mitigation goals. GLIMPSE comprises of two types of models, (i) the adjoint of the GEOS-Chem chemical transport model, to calculate the relationship between emissions and impacts at high spatial resolution, and (ii) the MARKAL energy system model, to calculate the relationship between energy technologies and emissions. This presentation will demonstrate how this approach can find scenarios to better achieve both improved air quality and mitigate climate change. Furthermore, we will explore how to communicate mitigation options that achieve multiple goals and their trade-offs to decision-makers, realizing that decision-makers at local, state, and national levels all have different needs.

http://glimpse-project.appspot.com/

Powell, Emily

Temperature and Precipitation Indicators of Climate Extremes across the Southeast United States: Observed Variability and Related Planning

Powell, Emily[1]; Keim, Barry[2]

1. Geography & Anthropology, Louisiana State University, Baton Rouge, LA, USA
2. Geography and Anthropology, Louisiana State University, Baton Rouge, LA, USA

Changes in climate extremes and disasters are among the most serious challenges in coping with climate change (CCSP 2008). The southern United States experiences more weather extremes than any other region in the country (NWS 2012). This research examines spatial and temporal variability of extremes in temperature and precipitation for the Southeast U.S. using a suite of indicators developed by working groups headed by the World Meteorological Organization and the Climate Variability and Predictability program. Data are from the U.S. Historical Climate Network for the period 1910-2012. The calculation of indicators and trend analyses are examined using regression techniques in R and SPSS. Indicators reflecting the greatest change for the region include warm days and nights, summer days, diurnal temperature range, and maximum 1-day precipitation. Based on temporal trends in these extreme temperature and precipitation indicators, a climate extreme typology was created to group stations according to extreme event variability, i.e. increasing, decreasing, and no change in variability. For stations in each typology, time series of temperature and precipitation extremes are compared to climate-related policy and planning to understand how response to extremes differs across typologies and whether the level and type of response have traditionally been adequate to address changes in extremes. Results suggest that planning and policy approaches to extreme events may depend largely on local impacts from events, and actions taken by states and local municipalities remain largely reactive and short term rather than proactive and sustained over time. However, behavior differs widely across the region possibly as a result of local-level capacity and receptivity to climate change. This research is expected to increase knowledge about how past occurrence of extreme events does or does not shape related planning and policy behaviors. Grouping locales into typologies enables a local-level analysis of related planning and policy to better determine whether response to extreme events has been sufficient to increase resilience given the nature of how extremes are changing. Results can help government, planners, decision makers, and communicators make more informed decisions regarding future approaches to climate adaptation and hazard mitigation. Furthermore, this research can help identify better approaches to communicating climate data to relevant sectors particularly sensitive to changes in climate extremes.

Rasch, Phil

Geoengineering: A Challenging Topic for Science, Communications, and Society

Rasch, Phil[1]

1. Pacific Northwest National Laboratory, Richmond, WA, USA

Abstract text not available.

Raucher, Karen

An Audience Segmentation Analysis – The Climate Change Water Nexus

Raucher, Karen[1]

1. Stratus Consulting Inc, Boulder, CO, USA

In this presentation we share the results of a national survey, conducted for the Water Research Foundation, that identifies the primary audience segments for the climate change/water nexus. The research uses a survey design and approach similar to that used by the Yale and George Mason Climate Communication Project to identify the Six America audience segments for climate change. The survey results provide insights into: the range of America's views on the nexus of water and climate change, the percentage of people nationally in each segment, the regional distinctions, the audience attributes that drive the segmentation as well as simple water/climate messages that resonate or do not resonate with the various audience segments. A comparison of the audience segments for climate change alone, as identified by the Six-Americas research, is compared with the segments identified for the climate/water nexus to illustrate how including impacts of climate change on water increases support for climate change adaptation actions.

Raucher, Karen

Applying the Science of Risk Communication to Climate Change – An overview of the Why's and How's

Raucher, Karen[1]

1. Stratus Consulting Inc, Boulder, CO, USA

Climate change can be defined as a 'wicked' problem: a problem with a complex scientific component, a large group of stakeholders, and no one solution that is optimal for a majority of stakeholders. Communicating about wicked problems presents a number of barriers to how people receive and process information and form opinions. It also makes people uncomfortable. We provide a brief overview of the role that heuristics, frames and cultural cognition play in leaving people 'uncomfortable' and 'unwilling to engage' when discussing climate change. The science-based field of risk based communication and how it can be applied to keep communications out of the emotional response center of the brain and in the frontal lobe– the rational processing center is reviewed. Finally, examples of climate communication strategies that have proven successful using a risk-based format will be shared. In addition, templates will be provided that enable the user to design climate related communications, based on risk communication science, that encourages reasoned discourse and decreases emotional responses – in both the speaker and the listener.

Raudzens Bailey, Adriana

How grammatical choice shapes media representations of climate (un)certainty

Raudzens Bailey, Adriana[1]; Rivas, Javier[2]

1. Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, Boulder, CO, USA
2. Department of Spanish and Portuguese, University of Colorado Boulder, Boulder, CO, USA

Mass media are a primary avenue by which scientific information reaches the general public. As a result, news stories help influence public perception of (un)certainty around key scientific issues like climate change. This study examines how grammatical and word choices modify the certainty of newspaper statements about climate science (e.g. through the use of modal verbs, conditional clauses, and hedging). Four national newspapers from two countries are analyzed in order to determine how ideological differences influence reporting of climate science news: the New York Times and Wall Street Journal from the United States and El País and El Mundo from Spain. While the U.S. has shown considerable reluctance in embracing international policy on climate change, Spain has ratified the Kyoto Protocol and committed to national climate policies. We expect climate science reporting from these countries to reflect their contrasting political views on the topic. In the first part of the study, we examine the epistemic value of approximately 40,000 words, or 60 articles, from 2007—the year the Intergovernmental Panel on Climate Change (IPCC) released its 4th Assessment Report (AR4). We mark as "epistemic" any word or construction that indicates "room for doubt," either about the science discussed by the Working Group I of the IPCC or about the credibility or consensus of the IPCC authors. Nine-hundred eighty-three epistemic markers are identified. We find 1) there is little difference in the distribution of epistemic markers across grammatical categories amongst the four papers, however 41% of the total markers are found in the New York Times; 2) news articles contain significantly more epistemic markers than opinion pieces; 3) nouns and verbs frequently describe the IPCC process as a "debate," thereby shifting climate science from scientific to political discourse; 4) newspapers have adopted the Working Group I "likely"-scale to varying degrees; and 5) about 8% of epistemic markers pertain to differences in data and/or projections between AR4 and previous assessment reports. In the second part of the study, differences in epistemic expression are analyzed as a function of time. We compare the distribution and semantic strength of epistemic markers across word classes/parts of speech from articles covering the 3rd and 4th Assessment Reports (2001 and 2007, respectively). In addition, we examine which aspects of the science tend to be marked as uncertain and whether the

goal of reducing certainty around the science serves to encourage or discourage political action in various temporal and spatial contexts.

Rebich Hespanha, Stacy

Basic Human Values and Visual Representation of Science in News about Climate Change

Rebich Hespanha, Stacy[1, 3]; Hampton, Stephanie E.[1]; Rice, Ronald E.[2, 3]

1. National Center for Ecological Analysis and Synthesis (NCEAS), University of California Santa Barbara, Santa Barbara, CA, USA
2. Department of Communication, University of California Santa Barbara, Santa Barbara, CA, USA
3. Carsey-Wolf Center, University of California Santa Barbara, Santa Barbara, CA, USA

Imagery is a powerful form of communication about climate change, but there has been relatively little systematic study of what is represented in climate change news imagery or how people interpret this information. We present results from a content analysis of the 350 images in 200 randomly selected news stories about climate change that appeared in U.S. print news media between 1983 and 2009. After a brief overview of broad themes and image types, we focus in depth on how science is represented in this imagery. We explore how the issue is visually framed as certain aspects or fields of science are emphasized (e.g., atmospheric science, climate modeling, economics of energy production and consumption) while others are minimized or invisible (e.g., behavioral science related to consumption, social science related to security and dynamics of power). We then relate the thematic content of these images to established theory of basic human values and emphasize the danger of conceptualizing climate communication as a conflict between 'science' and 'values'. Values theory posits that all people possess the same set of basic human values, but differ in the importance or weight that they ascribe to each of these values. Here, we explore the notion that people's willingness to attend to scientific evidence (in this case, images) may depend to a large degree upon whether or not that evidence is relevant to, consonant with, or opposed to, their most important values. In light of values theory, it is quite plausible that those who 'accept' scientific evidence related to climate change do so because it provides information relevant to and in accord with their values, while those who ignore or 'deny' simply find the scientific evidence (but not necessarily any proposed policy changes) irrelevant, or opposed, to their important values. Climate science-themed news imagery very often presents evidence of threats to self-transcendent values such as harmony with nature or equality and justice. While there has been much discussion of 'anti-science' rejection of the evidence for anthropogenic climate change, we suggest that the unconvinced or unconcerned may be rejecting the importance of the values represented as under threat, or even the evidence as a threat to their strongly held values, rather than rejecting science itself. Our question then is, can we, as a scientific community, produce scientific evidence related to climate change that is pertinent to a broader set of basic human values? We argue that a more productive dialog will emerge if natural scientists collaborate with social scientists to produce such evidence, including using appropriate images, and advocate for evidence-based decision-making that encompasses this broader spectrum of basic human values.

www.nceas.ucsb.edu/~hespanha

Robock, Alan

Trying to Tell the World about Nuclear Winter – Denial Ain't Just a River in Egypt *(INVITED)*

Robock, Alan[1]

1. Dept Environmental Sciences, Rutgers University, New Brunswick, NJ, USA

As difficult as it is to communicate to the world about global warming, I have found it even harder to communicate about the climatic consequences of nuclear war. It is not that there is an active disinformation campaign against our work. It is rather that it is just ignored. New research by myself, Brian Toon, Mike Mills, and colleagues over the past six years has found that a nuclear war between any two countries, such as India and Pakistan, using 50 Hiroshima-sized atom bombs each could produce climate change unprecedented in recorded human history. This is less than 0.05% of the explosive power of the current global arsenal. We also found that a nuclear war between the United States and Russia today, or even after reductions planned for 2017 under the New START treaty, could produce nuclear winter, with temperatures plunging below freezing in the summer in major agricultural regions, threatening the food supply for most of the planet. The clear policy implication is that we need to rid the world of nuclear weapons much faster than is now happening. Despite peer-reviewed publications in major journals, including Science, Nature, PNAS, JGR, ACP, Climatic Change, and the Bulletin of Atomic Scientists, and articles in encyclopedias, Scientific American, and Physics Today, there so far have been no policy responses from nuclear nations. There has been a webpage for several years with all the information on our work at http://envsci.rutgers.edu/nuclear, and I give many talks on the subject and have even begun using Twitter. We gave a briefing in Congress a couple years ago, and wrote to the President's Science Advisor. But there has been no response or even acknowledgment of the work. The subject is difficult to deal with for many, and it feels better to just ignore it and hope it goes away. Numerous attempts to write op-eds in major newspapers have failed, and policy journals will not consider articles. Any suggestions as to how to proceed will be most welcome.

http://envsci.rutgers.edu/nuclear

Rood, Jennifer

Communicating Scientific Uncertainty in the Realm of Ocean Acidification: Developing Understanding and Practical Solutions to Overcoming Communication Barriers

Rood, Jennifer[1]

1. Graduate Certificate in Science, Technology and Policy, MIT, Cambridge, MA, USA

Scientific uncertainty can make science-dependent public policy decisions difficult to craft and even more difficult to implement. Despite this, policymakers must consider action in the face of uncertainty when the costs of inaction are potentially huge. In order to examine ways in which public policy can incorporate and manage inherent scientific uncertainty, I have chosen to study the interplay of policy and uncertainty in the arena of ocean acidification. Creating policy in spite of scientific uncertainty is of critical importance in the realm of ocean acidification, as many of the adaptation and mitigation strategies suggested to combat other aspects of climate change will have zero or negative impact on ocean acidification. In this work, I first characterize the perceptions of scientific uncertainty concerning ocean acidification among scientists, skeptics, the media, and policymakers. This examination of the understanding of uncertainty suggests that one source of policy inaction might be a conflicting comprehension of the most critical scientific uncertainties regarding ocean acidification. Following this analysis, I explore how current and proposed policy programs incorporate these varying perceptions of uncertainty, with a particular focus on policies which include adaptive strategies and/or public engagement on the issue of ocean acidification. By using ocean acidification policy as a case study, I hope to provide insight into both methods for scientists to communicate uncertainty to the public and policymakers, and ways to integrate scientific uncertainty into policy design.

Schmidt, Gavin A.

Finding a Role in Climate Communications *(INVITED)*

Schmidt, Gavin A.[1]

1. NASA/GISS, New York, NY, USA

Communications about climate science, policy or their interactions are complex and multi-faceted. There are multiple messages that can be conveyed, and multiple audiences to interact with. Rather than a single 'climate message', individual scientists must find their own role and comfort level and should be encouraged to do so. Clarity in what any scientist is publicly advocating for (whether it is science literacy, funding, emissions policies, interest in their own research etc.) is essential. Given that any voice will be heard across many audiences (even if they are not the intended one), familiarity with the landscape of the public discourse is very helpful. I will suggest tips for avoiding miscommunications - such by being explicit about what is meant and what is not - and ways of dealing with interactions, from genuine but skeptical questions to politically motivated personal attacks, that make communication more of a pleasure than a chore.

Seitz, Russell

In From The Cold

Seitz, Russell[1]

1. Russell Seitz, Harvard university, Cambridge, MA, USA

Five decades have passed since McLuhan observed that: "With the advent of television, advertising has become more important than products." As with advertising, the popularization of science often entail the deliberate creation of a double standard, with one set of facts for public discussion and another for internal scientific discourse Nowhere is this more evident than in the hermeneutics of climate science communication, a discipline created in McLuhan's heyday which continues to cultivate factoids in the service of social engineering. While many present practitioners are in denial as to the objectively political nature of this agenda, it did not escape detection when first employed in the initial fluorescence of environmental concern in the late 1960's. This paper will review some of the instrumentalities of climate communication first created by the public relations industry of that time and explore their evolution and continuity though such illustrative episodes as the publicity attending the " nuclear winter " hypothesis and the subsequent rise of climate modeling as both a scientific and policy tool and an expression of popular political culture .

Selover, Nancy J.

Communicating Climate Science to Stakeholders in Plain Vanilla

Selover, Nancy J.[1]; Chhetri, Nalini[2]; McClintock, Scott[3]

1. Global Institute of Sustainability, Arizona State University, Tempe, AZ, USA
2. Global Institute of Sustainability, Arizona State University, Tempe, AZ, USA
3. Global Institute of Sustainability, Arizona State University, Tempe, AZ, USA

In the past decade, the topic of climate change has waxed and waned as a significant issue in the United States, while maintaining a high profile in the rest of the world. This has not diminished the attention the topic has received in the scientific and academic communities. However, the mountain of climate studies remain relatively unknown to both the general public and the decision-makers, as the research continues to be inaccessible. While publishing in a peer-reviewed journal may satisfy the scientific community and academia, it does not advance knowledge until the science is widely disseminated to the non-scientists who make our policy decisions and our citizens who make daily choices that influence climate and society. The importance of climate research is not simply about the physical science outcomes, but its impacts on society. Effective policy cannot

simply be a top down process. To be robust, there must be input and buy-in from the bottom up. Decision makers at the local level are at the front lines of climate impacts, so they need to understand those impacts and what collateral effects their actions and policies may have. Effective communication of science requires plain language, without jargon or acronyms, and a level of trust between the communicating parties. For the past year, through the Center for Integrated Solutions to Climate Challenge (CISCC), Arizona State University (ASU) has been operationalizing a portfolio of climate services that focuses on effective communication with stakeholders. The CISCC has taken a specific approach to communicating climate science such that policy makers will be empowered to implement climate adaptation actions. We start by focusing on climate change issues that have wide acceptance to achieve buy-in by the stakeholders. Then we educate the stakeholders on the issue using the published climate research, explained by the researchers themselves, using an integrated media platform. The implications of adaptation strategies, and their cross-sector impacts are presented along with references and research details. In presenting ourselves as a resource for unbiased knowledge, we are developing relationships and gaining mutual trust. As we learn what our stakeholders do, they learn about our capacity to co-produce knowledge to solve problems, providing the stakeholders with the information they need to make decisions backed up by good science. This approach utilizes communication tools that emphasize a move away from scientific jargon in information sharing in its climate science communication. The process does not involve presenting a position or policy to the stakeholders, but requires educating them, so they can do critical analyses of the science and potential impacts, and reach their own conclusions.

Sinclair, Peter

Bottled Lightning - Is there a Secret Sauce for Social Media?

Sinclair, Peter[1]

1. Climate Denial Crock of the Week, Midland, MI, USA

Abstract text pending.

Small, Jennifer D.

Climate Change Literacy Through Writing: Successes in an Undergraduate Writing Course

Small, Jennifer D.[1]

1. Department of Meteorology, University of Hawaii at Manoa, Honolulu, HI, USA

Basic science literacy, especially with regards to climate change science, is often lacking in traditional K-12 and undergraduate education. This leads to broad misconceptions of scientific ideas based on distorted presentations of science in the media and colloquial understanding. Current educational research suggests that the teaching and learning of science can happen in many ways, whether it is through lectures, labs, research, inquiry or informal learning activities. This study was motivated by the desire to investigate the ability to teach climate change science content in the non-traditional mode of an undergraduate composition and writing course. This technique offers educators another option for integration of climate change material into their curriculum. The study incorporates the assessment and evaluation of student writing, in-class participation and student self-evaluations from "Writing about Change: Global Environmental Change and Society" a writing course that fulfilled a requirement to graduate from the University of California – Santa Cruz. The course was taught Winter Quarter 2007 with a total of 28 days of instruction and the participation of 20 undergraduate students. The overarching goals of this study can be broadly classified as attitudinal, skills development and content retention. This study was designed to address three broad questions related to the above broad goals: i) Did students leave the class more comfortable and confident with climate change issues and content? ii) Did students develop skills that are useful for reading and writing about scientific material related to climate change? iii) What did students learn (retain): more general concepts or specific facts regarding climate change? Analysis and coding of student work clearly show that students were successful in developing skills for understanding and utilizing scientific information via writing and making thoughtful judgments regarding the reliability of climate change science in various media. Additional analysis of student work and responses are necessary in order to fully evaluate the depth and breadth of student understanding and retention of scientific content and concepts.

Staudt, Amanda C.

How Can Scientists and Non-Governmental Organizations Better Collaborate to Improve Climate Science Communication?

Staudt, Amanda C.[1]

1. National Wildlife Federation, Reston, VA, USA

Non-governmental organizations (NGOs) play an important role in interpreting and communicating climate science. With access to grassroots networks, staff focused on issues relevant to decision makers ranging from local to federal scales, and high credibility with their respective constituencies, NGOs can be effective messengers. Furthermore, NGOs typically devote considerable resources to communication, from developing innovative and targeted materials to cultivating relationships with the media, community leaders, and elected officials. However, for the most part, climate scientists are only involved in these NGO-led communication efforts in an ad hoc manner. This creates the potential for missed opportunities, inaccuracies, and reduced credibility of communication efforts. This poster will examine the challenges and opportunities for collaborations among scientists and NGOs to more effectively communicate scientific findings. A handful of organizations were recently created to advance climate science communication and have made some notable

progress in bridging this divide. Meanwhile, several environmental and conservation organizations have developed new strategies for more effectively engaging climate scientists in their activities. In addition, the National Climate Assessment created a network of more than 60 partner organizations (NCAnet) intended to engage producers and users of climate information in the assessment efforts. The vast majority of NCAnet partners are NGOs representing a wide range of interest groups, indicating significant demand for climate science information. Despite these advances, much room for improvement remains and new challenges are emerging that would benefit from improved collaboration among scientists and NGOs. In particular, climate science communication is increasingly focused on informing adaptation and mitigation decisions at a more local level. Climate scientists cannot reasonably be expected to meet the needs of all these potential decision makers. In some situations, trusted leaders from targeted communities may be more effective sources of information anyhow. The poster will also present examples of how NGOs are already advancing locally-oriented communication efforts intended to support climate-related decision making and examine the role of climate science communication in those contexts.

Strauss, Benjamin

A Scientific Research Agenda for Improving Climate Science Communication

Strauss, Benjamin[1]

1. Climate Central, Princeton, NJ, USA

A large and widely noted gap exists between the urgent threats indicated by climate science, and the general lack of priority being assigned to climate change in U.S. culture and politics. This gap has motivated many climate scientists to try to engage more with lay audiences. One pathway for doing so is to speak or write directly for these audiences — for example, via community speaking events, books, or blogs. To succeed, however, this route generally demands development of entirely new and deceptively difficult skill sets, navigation of pitfalls, and a significant time investment outside of expected professional activities. A second pathway instead builds on scientists' traditional strength in research: orienting and extending research to increase to increase its interest and accessibility for wider audiences. A trivially simple but relevant example is disseminating results in English, not just metric units, even when this requires doing separate analysis (e.g. running an impacts model with a 2F input instead of 1C). More fundamentally, scientists can (and increasingly do) resolve research results to the finest spatial and temporal scales possible, in order to deliver information that is local and of immediate interest. But to increase effectiveness, research products must go beyond, for example, color scale maps — whatever their resolution — to summarizing and communicating findings for the geographic and administrative units that people care about, such as individual states, counties, or cities, whenever this is a scientifically legitimate and feasible exercise. Making the translation to simple impacts of common concern is also critical. In this talk, I will develop these and related themes, and draw heavily on my experience and lessons learned from Climate Central's Surging Seas project, a conceptually integrated research and communications program on sea level rise that has stimulated over 800 news stories, from small-town independent reporting to major national coverage, since its launch in March 2012.

Theusner, Michael

Educating the public about climate change - the Klimahaus in Bremerhaven, Germany

Theusner, Michael[1]; Nawrath, Susanne[1]; Tanneberg, Jens[1]; Tietjen, Nadja[1]

1. Klimahaus Betriebs-GmbH, Bremerhaven, Germany

The Klimahaus® Bremerhaven 8° Ost ("climate house Bremerhaven 8° east", hereafter abbreviated KH) is a science center at Germany's North Sea coast with the aim to educate the public on weather, climate and climate change, its scientific understanding, implications and what the individual can do about it. The main focus of the KH's educational work is sustainable knowledge transfer via interaction and experiencing different climate zones on an emotional basis, as well as raising awareness of the topics climate and climate protection. The KH encourages individual decision-making to act in an environmentally friendly manner and to take responsibility. A multitude of approaches to knowledge transfer including sensory stations, interactive exhibits, artifacts and original items, live plants and animals, multimedia installations, documentaries and room stagings support self-determined and exploratory learning. The KH's exhibition consists of four main sections: "The Voyage" where visitors can experience different climates along Bremerhaven's great circle longitude as well as the impact of those climates and climate change on everyday life of the local inhabitants. For each location protagonists are used to achieve an emotional connection between the visitors and those protagonists. This avoids threatening people directly with the effects of a changing climate. The "Perspectives" provide the scientific background on (anthropogenic) climate change in an easily understandable and playful manner. The "Opportunities" provide the solutions already available today to the individual (in Germany) to reduce his or her carbon footprint. The "Weather Studio" finally provides information on current weather events. Besides the exhibition the KH is involved in a wide range of educational programs especially for kindergartens and schools. Focusing on the young allows transforming society from the bottom up. Knowledge of climate change and a sustainable way of living is conveyed to those who will feel the impacts of climate change much more than the adults of today. The KH also is an official measure in the German action plan of UNESCO's Education for Sustainable Development program.

http://www.klimahaus-bremerhaven.de

Trenbath, Kim L.

Climate Change Communication in the Classroom: How College Undergraduates' Ideas Change

Trenbath, Kim L.[1]

1. Center for Research in STEM Education, University of Maine, Orono, ME, USA

This presentation investigates the ways that students' climate change understanding evolves during climate change courses. Knowing students' ideas and where they come from helps climate change communicators see how students incorporate current scientific content into their preexisting ideas. Stakeholders can tailor communication to addresses knowledge gaps identified by this research. This research incorporates a conceptual change perspective that people construct knowledge based on prior ideas, which can develop from experiences starting at a young age. Influences include everyday experience with the world, and information gathered from parents, friends, the media, and at school. A person's ideas can evolve throughout their lifetime, including college. This research examines climate change ideas through eight case studies of students enrolled in climate change courses; five non-science majors from a large western university and three Earth Science majors from a mid-sized northeastern university. Both groups had alternative ideas about climate change. Throughout the semester, some students struggled to understand that climate change can be both naturally- and anthropogenically-caused. Some students thought that the ozone hole causes global warming, while others thought the Earth is headed towards another ice age as a result of humans "accelerating" natural climate change. Throughout the semester, students' ideas changed, but their ideas were not always consistent with that taught by their professors. For example, three students developed definitions of "climate change" that were different than scientific definitions. Two students had definitions of "climate change" that involved only natural climate change, reserving the anthropogenic component for the term "global warming." One student conflated the definition of climate change with other environmental issues. Understanding these inconsistencies will allow the scientific community to address differences and improve student and public perception of the meaning of "climate change." These findings suggest that stakeholders should develop and communicate consistent definitions of the terms "climate change" and "global warming." Stakeholders should also expect conceptual change to take place gradually as people struggle with new ideas and incorporate them into their prior conceptions. Finally, "misconceptions" can be viewed as a starting point from which people construct knowledge with the intention of eventually reaching expert-like thinking.

Verma, Sunita

Understanding Tropospheric Chemistry: An Interactive Global Climate Chemistry Modelling Approach

Verma, Sunita[1]

1. Centre for Excellence in Climatology, Birla Institute of Technology Mesra, Jaipur, India

Atmospheric chemistry plays a crucial role in climate by controlling the abundance and distribution of natural and anthropogenic agents such as greenhouse gases, aerosols, and clouds, which influence incoming and/or outgoing radiation, temperature and precipitation. The study of such a complex system requires the use of numerical/global models. The coupled chemistry-atmosphere models have proved as important tools of climate research (Lawrence et al. 1999, Rasch et al. 2000, Boucher et al. 2002) in order to simulate sulfur compounds and their variations as well as the phenomena such as direct and indirect radiative forcing (where clouds-aerosol interaction plays an important role), still there exist large areas of uncertainties. To reasonably represent the tropospheric chemistry in the global models require a throughput consideration of multi-phase processes such as sulfate aerosols formation, the incorporation of a heterogeneous reaction system of aerosols (both gas phase and aqueous phase, predominating in cloud water), their subsequent transformation, dispersion and the mechanism for their eventual removal from the atmosphere. The current atmospheric chemistry models usually do not resolve the chemical species within the model domain and therefore neglect the effects associated with evolution of short-lived chemical species concentration with the evolving meteorology. .This study in above perspective is a focused effort to incorporate tropospheric sulfate chemistry with internally resolved short-lived species in a three dimensional global circulation model LMDZ. The model provides a size-segregated, two-moment distribution of aerosols which undergo processes like nucleation, condensation, coagulation and interaction with clouds. The present study highlights the importance of chemistry-driven atmospheric transport models and discusses important results of online chemistry module, its subsequent incorporation and coupling with LMD-GCM. References [1] M. G. Lawrence, P. J. Crutzen, P. J. Rasch, B. E. Eaton, and M., A. Mahowald, 1999, J. Geophys. Res., 104, 26,245-26,277. [2] O. Boucher, M. Pham and C. Venkataraman, 2002, Note scientifique de l'IPSL, 23, 32pp. [3] P. J. Rasch, M. C. Barth et al., 2000, J. Geophys. Res., 105(D1), 1367-1385.

Ward, Robert

Loss of Public Trust by UK Climate Researchers and Implications for Future Communication *(INVITED)*

Ward, Robert[1]

1. Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science, London, United Kingdom

There is strong evidence that climate researchers in the UK have experienced a significant and collective loss of public trust as a result of controversies surrounding the Climatic Research Unit at the University of East Anglia and the Intergovernmental Panel on Climate Change in late 2009 and early 2010. A public opinion survey carried out in March 2011 (Shuckburgh et al., 2012) found that only 38% of the UK public tended to agree or strongly agreed with the statement: "We can trust climate scientists to tell us the truth about climate change". By comparison, opinion polls continue to find that scientists are trusted to tell the truth in general by more than two-thirds of the UK public. Polls also show that the controversies in 2009-10 have made only a small sustained impact on public opinion about the existence and causes of climate change. Most of the damage to public trust appears to have been inflicted by prominent national media coverage over several months that raised doubts about the integrity, motives and conduct of UK climate researchers. Accusations of a lack of transparency, which were largely upheld by independent inquiries, appear to have been the most harmful. These controversies have led to a measurable and marked shift in the way in which many media have subsequently covered climate research. They have also been successfully exploited by climate change 'sceptics', particularly the Global Warming Policy Foundation, a lobby group that was launched three days after the e-mails hacked from the Climatic Research Unit were posted on the web. In order to re-build public confidence and trust, UK climate researchers will need to take account of the experience of other professions, as well as companies and organisations, that have suffered severe reputational damage. A successful strategy for climate researchers is likely to require proactive efforts across the profession that are sustained for many years, with the following broad objectives (Ward (2013): * engage the public more effectively through direct and indirect methods; * learn more about the information needs of the public (ie through two-way communication); * improve the explanation and presentation to public audiences of difficult issues such as risk and uncertainty; * implement measures for improving the reputation of the climate research profession for trustworthiness, particularly in terms of transparency; * increase efforts to influence the narratives on climate change that are being promoted by the media; * deal more effectively with criticisms of, and attacks on, mainstream climate research; and * engage policy-makers at international, national and local levels more effectively through direct and indirect methods. References: Shuckburgh, E., Robison, R. and Pidgeon, N. 2012. Climate Science, the Public and the News Media. Living With Environmental Change, London, UK. 54p. Ward, R. 2013. Communicating on climate change. Weather, v.68, no.1, p.16-17.

http://www.lse.ac.uk/grantham

Weart, Spencer R.

History of Relations Among Climate Scientists, Policy-makers and the Public in the 20th Century *(INVITED)*

Weart, Spencer R.[1]

1. American Inst. Physics, Hastings On Hudson, NY, USA

Abstract text not available.

Weart, Spencer R.

Nuclear and Climate Imagery in Historical Perspective

Weart, Spencer R.[1]

1. American Inst. Physics, College Park, MD, USA

The prospect of nuclear war, the testing of nuclear weapons, and to a lesser extent nuclear power, posed severe perceived environmental problems in the period 1945-1990. Public opposition was quite effective in promoting treaties to ban open-air bomb tests, to limit strategic armaments, and to halt the spread of nuclear reactors. This opposition drew much of its strength from images of disaster with a rich science-fiction history, and a related imagery that drew upon distrust of technological authorities. Opposition to emission of greenhouse gases, by contrast, has not gained much traction from images of disaster (which tend to be prosaic, and can even lead to resignation rather than activism). Moreover, distrust of authorities, in contrast to the nuclear experience, has promoted denial that there is a problem at all. This presentation will compare and contrast the two experiences. For example, a major difference is the difficulty, in the climate case, of presenting a convincing image of near-future harm to an average developed-world family. In conclusion I will offer remarks on the uses of historical presentations to reinforce trust in climate science, as exemplified by user responses to my website on the Discovery of Global Warming (http://www.aip.org/history/climate).

Whitney, Laurel

Dissecting the Joke: Using Humor to Communicate Climate Issues

Whitney, Laurel[1, 2]

1. Environmental Studies, Pace University, New York, NY, USA
2. Contributing Writer, DeSmogBlog, New York, NY, USA

Generally, if you have to explain a joke to someone, then it probably isn't funny. But in this case, we'll make an exception in order to dive into the nexus between science and humor. A well-placed metaphor or funny anecdote can cast a powerful spell over an audience while allowing people to retain information better and longer, even with technical

subjects like climate science. Humor can also make an audience more receptive to issues that are often depressing and even terrifying. Yet for the untrained, this device can fail spectacularly. Other times, delivering the perfect punchline can also mean sacrificing accuracy in information. Using exhibits from online cartoons, news articles, cable broadcasts, NGO campaigns, and media pranks, we can analyze how effective humor, satire, and parody is at informing general audiences about issues pertaining to climate science. Examples will be taken across the board from venues such as Gawker, The Daily Show/Colbert Report, XKCD, The Yes Men, and other mediums to showcase which devices work, which fail, and why.

Wielicki, Bruce A.

Can the Economic Value of Climate Science be Determined and Communicated?

Wielicki, Bruce A.[1]; Cooke, Roger[2]; Young, David[1]; Mlynczak, Martin[1]

1. NASA Langley Research Ctr, Hampton, VA, USA
2. Resources for the Future, Washington, DC, USA

There are many aspects of climate science communication. This paper proposes to address an aspect that has received little attention to date. The origin of this communication issue can be found in the following conundrum. While we have entered the "Anthropocene" and humans are now both consciously and unconsciously geo-engineering the Earth's climate, we have not developed or even planned for a rigorous climate observing system similar to the way we handle an integrated international weather observing system. Instead, we do the best we can with observations designed for other purposes: some from weather observations, some from scientific research observations, some from environmental regulation observations. But almost none of these have been designed or implemented to observe long term climate change. Climate monitoring typically requires 10 times the accuracy of weather observations. This continuing challenge clearly indicates that there is a fundamental failure to communicate either the need, or perhaps the value of a rigorous and complete (e.g. 50 GCOS ECVs) climate observing system. When faced with communication challenges as politically charged as climate change, one method that can be more productive and less emotional is to convert the discussion into the terms of economic value to society. In this paper, we have developed an innovative interdisciplinary approach that allows conversion of scientific advances in climate observing systems into economic metrics based on the social cost of carbon. The basic concept is that more accurate observations can advance the time for societal decisions, and is based on recent climate research of the time to detect climate trends as a function of observational uncertainties (Wielicki et al., 2013), particularly in the context of reducing uncertainty in climate sensitivity. The economic value of the resulting averted damages are based on the U.S. interagency Memo on the Social Cost of Carbon (2010), and on using current Integrated Assessment Models (IAMs), in this case DICE 2007. The Net Present Value (worldwide) of an advanced climate observing system implemented in 2020 is shown to be between $3 Trillion and $20 Trillion U.S. dollars, with a nominal value of $12 Trillion. This value depends on the discount rate, and the years in which the damages occur. We consider sensitivity to varying emissions scenarios, decision contexts, confidence levels, and starting date of improved observations. We include the current uncertainty of climate sensitivity, which has a large effect on future economic impacts. Each year of delay in advanced climate observations reduces value by ~ $350 Billion. Using the nominal discount rate of 3%, the return is roughly $50 of economic value for every $1 invested in a rigorous climate observing system. Higher accuracy climate observations can lead to clearer science communication, and to more accurate and efficient societal decisions that can be accelerated in time relative to those with less accurate climate observations. It is hoped that this new perspective will allow a more objective discussion of the need for future improved climate observations and of the value of improved societal decision making relative to climate science investments.

Williams, Lynda

A Survey on Theatrical, Musical and Film Takes on Climate Change and the Challenges These Genres Have with Scientific Exposition *(INVITED)*

Williams, Lynda[1]

1. Santa Rosa Junior College, Santa Rosa, CA, USA

No abstract submitted.

Witte, Joe H.

Science Visualization For System One Communication of Climate Science: Utilizing the Right Brain

Witte, Joe H.[1]

1. Center for Climate Change Comm, George Mason University, Arlington, VA, USA

"I often say climate is like a die." Stephen Schneider Stephen Schneider's visual metaphor leverages the familiar mental schema of rolling dice into an experiential meaning of climate change. Daniel Kahneman, 2012 winner of the National Academies' Communication Award for his book, Thinking Fast and Slow, posits that this type of "associative memory" helps people construct meaning of the world around them in a manner that is often automatic. This ease of retrieval from memory is what Kahneman calls "System I" thinking and is responsible for much of a person's thoughts and actions. Scientific visualizations can help create useful Kahneman-System I mental models, or schema. While there has been a great deal attention given to the verbal language used in climate change communication the power of visual has been largely neglected. Numerous theories of learning (dual-coding, cognitive, etc.) and neuroscience theories have validated the power of the visual in learning and memory. R. Mayer's cognitive multimedia learning theory provides some useful guidelines for designing visuals. Visuals are becoming

mandatory tools to reach the younger generations, who are reading less and spending more time on their iPads, iPhones, and laptops. Theirs is a visual world. Pew finds 95% of teens use the Internet and 77% use social media that often include video. Even textbook publishers are acting on this important media shift. Wiley now publishes a dozen different college freshman titles, such as Visualizing Weather, Visualizing Geography, Visualizing Environmental Science, each with over 1,000 images as well as online animations. Just as words can make a difference in science communication so can visualizations. Examples of effective and non-effective visualizations will be shown. "Tell me and I'll forget; show me and I may remember; involve me and I'll understand." Chinese Proverbs quote

www.climatechangecommunication.org

Wunram, Claudia

Climate Services as a Climate Communication Channel *(INVITED)*

Brasseur, Guy P.[1]; Wunram, Claudia[1]

1. Climate Service Center, Hamburg, Germany

Throughout the world, climate services are being established to address urgent needs for climate-informed decision-making, policy and planning. Their role is to develop "communication bridges" between the scientific community and a variety of stakeholders from public services and from the corporate world. The major focus of climate services is increasingly on issues related to society's vulnerability, resilience and adaptation with respect to climate change impacts. Climate services focus therefore on (1) encouraging and sustaining connections between climate information providers, users, donors, and researchers, (2) gathering, synthesizing and disseminating current knowledge on climate change impacts, (3) generating new knowledge on critical climate-related topics in response to stakeholder's needs and demands. The paper will discuss the attributes that are important for developing successful climate services. It will summarize lessons learned from establishing the national Climate Service Center in Germany. Typical communication products will be presented and the challenges associated with the development of effective networks with the scientific community and with users in different economic sectors will be discussed.

Zarin, Hilary

Shifting Gears: Climate Regulation and Communication with the American Public

Zarin, Hilary[1, 2]

1. American Association for the Advancement of Science (AAAS), Washington, DC, USA
2. U.S. EPA, Washington, DC, USA

This presentation examines climate communications and public outreach strategies and products developed as part of the United States Environmental Protection Agency's broad mission to protect human health and the environment. Primary focus will be on the transportation sector, in which the United States has made significant advances in climate change by implementing new requirements on fuel efficiency and greenhouse gas emissions in the passenger vehicle fleet. Passenger vehicles are responsible for 60% of U.S. transportation-related petroleum use and greenhouse gas emissions. Recent regulations approved by the U.S. EPA and the Department of Transportation, with broad support from the auto industry, climate scientists, and the Obama administration, reduce greenhouse gas emissions and increase fuel economy in passenger vehicles for model years 2017-2025 (163 grams CO2/mile and 54.5 mpg). Issuance of these regulations was preceded by extensive research and interagency collaboration, including development of communications tools such as the new fuel economy label. This experience is illustrative of opportunities available to U.S. government agencies to communicate climate science to the public and advance policies that reduce greenhouse gas emissions. The presenter is a Science & Technology Policy Fellow with the American Association for the Advancement of Science (AAAS), hosted at the United States Environmental Protection Agency (EPA), Office of Transportation and Air Quality (OTAQ), Climate Analysis and Strategies Center. One of her key roles is to assist the team with a progressive communications strategy that engages a diverse, and often misunderstood, consumer public on the topic of climate change and transportation. Dr. Zarin is a social scientist with expertise in environmental anthropology, the role of culture in human behavior, and bridging the gap between science, policy, and the public.