

Ethical Framework for Climate Intervention Research and Adaptability

Phase-One Ethical Framework Summit

A Global Hybrid Convening / Washington DC and Virtual

September 23, 2022

Session 1: Welcoming Remarks

Randy Fiser, AGU Executive Director/CEO
Susan Lozier, AGU President

Session 1: Discussion with the Climate Overshoot Commission

Jessie Reynolds, Executive Director, Climate Overshoot
Commission

Susan Lozier, AGU President

Session 2: Coordination with Others- Lessons Learned and Future Work

Moderators
Joel Cutcher-Gershenfeld
Billy Williams

(9:30 – 10:20 a.m.) Governance and General Guidance

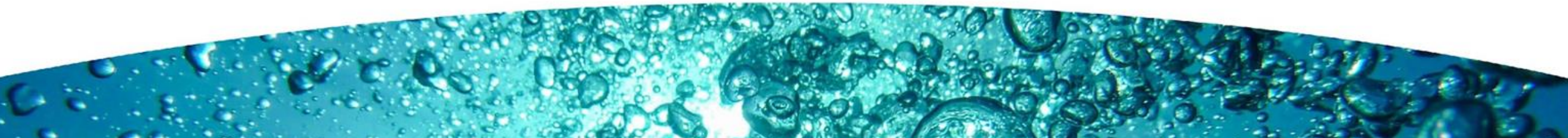
Phil Duffy, Climate Science Advisor, White House Office of Science and Technology Policy

Cynthia Scharf, Senior Strategy Director, Carnegie Climate Governance Initiative (C2G)

Amanda Staudt, Director, Board on Atmospheric Sciences and Climate, U.S. National Academies of Sciences, Engineering and Medicine

Michael Conathan, Senior Policy Fellow, Oceans and Climate - Aspen Institute

Q&A (10 min)



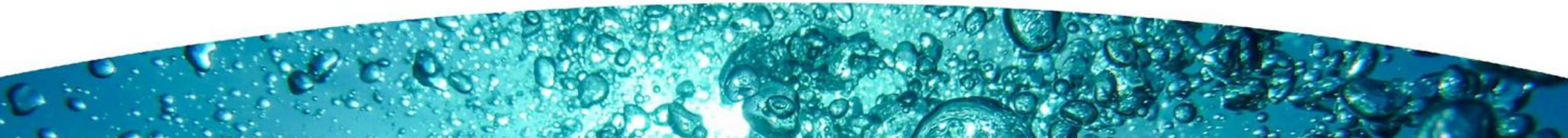
(10:20 – 11:00 a.m.) Perspectives on SRM-related Research and Modeling– issues and opportunities for Ethical Framework

Kelly Wanser, Executive Director, SilverLining

David Keith, Professor of Applied Physics, Harvard University Harvard University Solar Engineering Research Program

Pia Bausch, OHB SE, Coordinator Geoengineering Project, OHB SE / **Rolf Janovsky**, Director for Predevelopment, Space System Studies & Proposals

Q&A (10 min)





Break (11:00 – 11:15 a.m. ET)

(11:15 a.m. – 12:15 p.m.) Perspectives on CDR-Related Research and Scaling – issues and opportunities for Ethical Framework

Frances Wang, Program Manager, Carbon Dioxide Removal, ClimateWorks

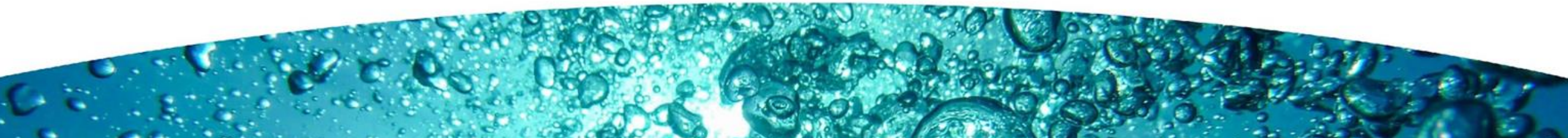
Lisa Suatoni, Deputy Director Oceans Division, NRDC

Sarah Cooley, Director of Climate Science, Ocean Conservancy

Tom Green, CEO, Vesta

Calli Obern, Director of Public Policy and Stakeholder Engagement, Capture6

Q&A (10 min)





Lunch (12:15 – 1:00 p.m. ET)

Session 3: Inclusion and Impact- Applying Climate Justice Principles to an Ethical Framework

Elizabeth Cripps, Associate Director of CRITIQUE:
Center for Ethics and Thought

Raj Pandya, AGU VP for Community Science

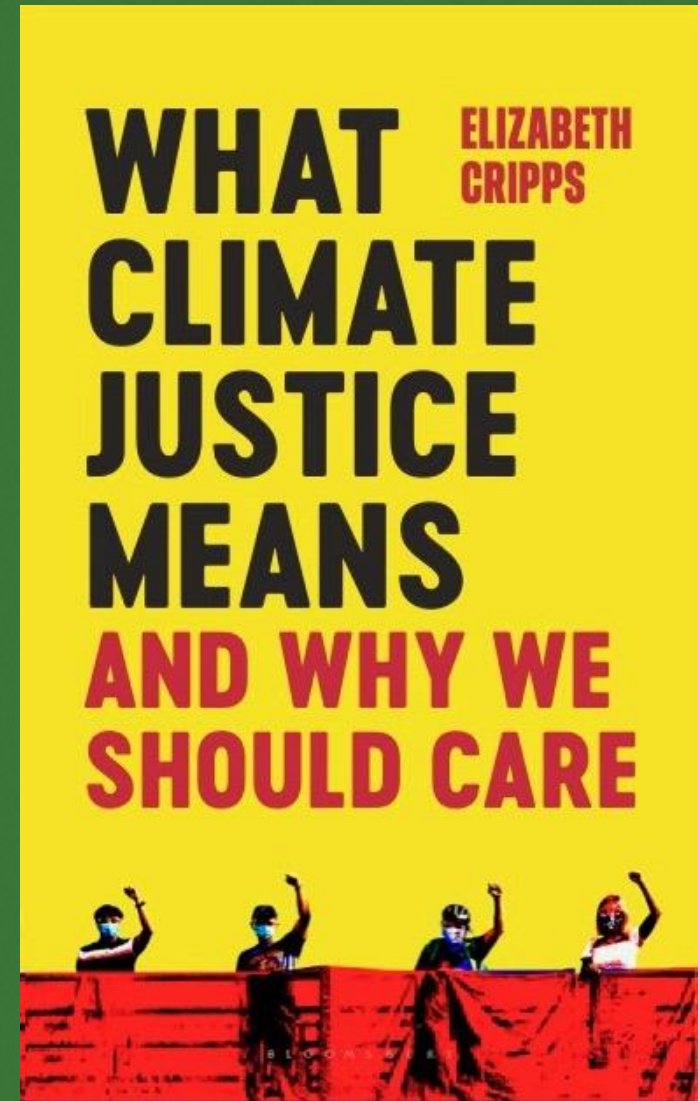
Inclusion and Impact: Applying Climate Justice Principles to an Ethical Framework

Dr Elizabeth Cripps

Senior Lecturer at the University of Edinburgh

elizabethcripps.weebly.com

@ebcripps



Climate change as fundamental injustice

- This is a *moral* emergency, not only a scientific, technical, economic or political challenge.
- Moral basics:
 - Don't do serious harm
 - Protect human rights
- Collectivize to fundamental principles of justice.
- But... not all in the same boat

'We are living in hell': Pakistan and India suffer extreme spring heatwaves

April temperatures at unprecedented levels have led to critical water and electricity shortages



📷 A man walks across a dried bed of the Yamuna River in New Delhi, India. Photograph: Manish Swarup/AP

Climate change, race, gender & intersectionality

- Anthropocene or (White m)Anthropocene?
- Marginalization and climate harms – across & within borders
- Intersectionality
- History & context...
 - Race & colonialism
 - Gendered social institutions
- Participatory injustice, misrecognition... and masculine thinking



'Devastating': more than 61,000 koalas among 3 billion animals affected by bushfire crisis

A new report says 143 million mammals were affected in the 2019-20 blazes, one of the 'worst wildlife disasters in modern history'

Humans, nature & climate injustice

- Climate change & species extinction
- Individual non-human suffering
- Matters in itself... & inseparable from human injustices



A firefighter carries a koala injured during the Kangaroo Island bushfires in January 2020
Photograph: David Mariuz/AAP



What would climate justice look like?

- Mitigation, adaptation, compensation
- Need for technology (*but* not all technology)
- Who pays? Polluters, beneficiaries, the rich
- Who decides? Participatory justice & recognition

global assembly in 2021 on the climate and ecological emergency
COP 26

global citizens' assembly that anyone on earth can join

ART

land's world-leading citizens' assembly. What worked? What did

ed on 27/06/2019, 1:17pm

ment: While the Irish assembly provoked a shift in government policy on climate change, there are important lessons to learn from this democratic experiment



Back in the real world...

- Paris is not enough
- Increase compliance
- Trade-offs to find the least unjust feasible option (*who* picks up the slack?)
- *But* some don't-cross lines
 - Basic rights
 - Historical context (recognition, not exacerbating vulnerability)
 - Genuine, informed participation

Cop26 legitimacy questioned as groups excluded from crucial talks

Communities and groups say being shut out of key negotiations will have dire consequences for millions



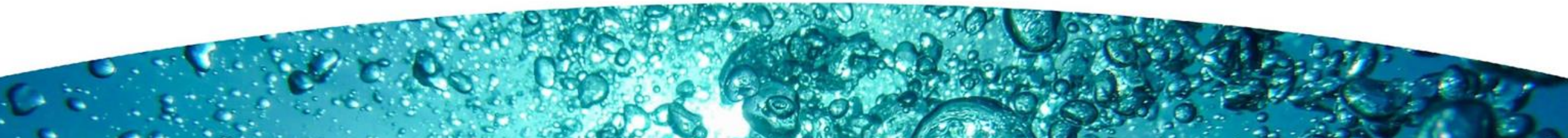
Members of indigenous groups from Brazil stand on the stage in George Square during the Cop26 summit in Glasgow. Photograph: Jane Barlow/PA

What about me?

- Corporate/government culpability/primary responsibility, but...
- ... individuals can and should act (to help protect human rights & not to be complicit in harm)
- ‘Cooperative promotional duty’
 - Activism (broadly construed)
 - Also lifestyle changes
 - Most effective/efficient use of skills/influence/capacity...



Discussion/ Q&A



Session 4: Workshop 1-4 Feedback

Billy Williams
Christian Guillot
Joel Cutcher-Gershenfeld

Ethical Framework for Climate Intervention Research and Adaptability

Workshop Module Summaries

Phase-One Ethical Framework Summit
September 23, 2022

Workshop Goals

- Identify the core elements of an **ethical framework** to guide climate intervention research
- Anticipate the **implications of potential scaling** of climate intervention research
- Understand the **current scope and timeline** of this ethical framework Initiative
- Understand the **process for providing input** advancing the ethical framework
- **Review** the current eight draft **ethical framework modules**
- **Provide input** into each of the **eight ethical framework modules**
- Understand process for providing additional **input post-session**
- Anticipate **next steps for a planned September 23rd Summit** on this topic (a hybrid convening in Washington DC) and beyond 2022



Toward a Shared Vision



All climate intervention research and applications are guided by ethical principles that are **widely shared, effectively applied**, and **regularly updated** based on advances in the science, associated technologies, and community views.

A set of interoperable and extensible **climate intervention ethics modules** are useful to researchers in universities and government labs, industry leaders, students, policy makers, and other stakeholders – with **globally shared governance**.

Monitoring processes provide valuable feedback and learning to researchers and policy makers. **Catastrophic risks** are mitigated in demonstrable ways. **Parallel CO2 reduction efforts are undiminished** and complemented by the climate intervention advances.



AGU Engagement Principles:

We are committed to:

Ensuring that research about climate intervention strategies is **done in ways that are inclusive, representative and just.**



Ensuring that research about climate intervention strategies is **done in ways that do not make deployment inevitable.**



Ensuring that research about climate intervention strategies **does not undermine efforts to reduce carbon emissions.**



Assuring public participation and consultation in the development of decision-making mechanisms and processes.

Ethical Framework Development - Timeline

Phase 1 (June – Nov 2022)
feedback and preliminary framework input prior to COP 27

Phase 3 (June – Nov 2023) Broader partnership outreach at international gatherings and at COP 28

Phase 2 (Nov 2022 – June 2023) Refine the EF modules. Additional outreach and stakeholder convenings to address gaps

Post-COP28 Progress Status and Plans, Reevaluation with Advisory Board and AGU Governance

Module Summaries

Module 1: Guiding Principles

Module Vision of Success:

- Overall guiding principles for climate interventions are stated in way that is interoperable with exiting scientific ethical principles and other climate intervention principles. The format is extensible as the science, technology and community views evolve.

Key Module Recommendations:

- Existing climate intervention guidelines, principles, and related policy documents are readily available together and harmonized to the extent possible.
- Develop mechanisms that take into account the many diverse (and often conflicting) views on climate interventions and broader climate change issues.

Open Issues for Module:

- To what extent are guiding principles needed for modeling and lab studies?
- How different are the principles for small-scale and large-scale field application projects?
- To what degree does the statement of principles create a bias toward action?
- How to get beyond vague statements such as “promoting the collective benefit of humankind and the environment”?

Motivational Questions:

- In what ways do the Asilomar and Oxford principles apply (see principles listing under recommended resources)
- What other guiding principles might be relevant?
- What would success look like for guiding principles?
- What issue are not addressed but need guiding principles?



Module 2: Protecting Societal Interests, Public Participation and Representation

Module Vision of Success:

- Mechanisms are provided to ensure diverse, representative voices are involved in decision making (not just notified and educated), including first nations, developing economies, and others what are at risk from adverse effects of climate interventions and less likely to be consulted.

Key Module Recommendations:

- Ensure systematic orientation and education of diverse communities on the potential risks, benefits, and processes associated with climate intervention research and applications.
- Establish an array for forums for consultation and dialogue with diverse communities relevant for climate intervention initiatives.

Open Issues for Module:

- How to ensure robust representation of diverse voices (not just who shows up)?
- How to balance research, commercial, regulatory, first nations, and other community interests?
- How to assure input for locally impacted communities
- How to address protecting environmental ecosystem, not just human interest.

Motivational Questions:

- What the relevant public stakeholder groups?
- What are the current mechanisms and forums available for public participation?
- What would success look like in ensuring public interests are taken into account?
- What gaps need to be addressed?



Module 3: Environmental Justice

Module Vision of Success:

- Mechanisms for addressing environmental justice are integrated into research projects and field applications at initial design stages and throughout the projects' life cycles.

Key Module Recommendations:

- Forge public-private partnerships concurrent with climate intervention projects so that issues of equity, fairness, and justice are considered concurrently with commercial interests.
- Identify stakeholders and interests associated with specific climate intervention research projects and field applications.
- Appreciate the interests of “rights holders” from first nations in comparison to “stakeholders.”

Open Issues for Module:

- How best to educate and involve representatives from developing economies, first nations, small islands, and other locations not historically in dialogue with climate intervention researchers?
- How to document and address adverse impacts of climate intervention research and applications?
- How to partner and develop trust for Ethical Framework process

Motivational Questions:

- How are environmental justice concerns advanced today when it comes to climate interventions?
- How can environmental justice be incorporated into project requirements?
- What would success look like in ensuring justice for underserved communities and other key stakeholders?
- What gaps need to be addressed?



Module 4: Data Principles, Data Sharing, Transparency

Module Vision of Success:

- This module provides guidance so that climate intervention data that can be openly shared is openly shared. Data that is proprietary or that would create unacceptable risks with sharing is at least registered with contact individuals identified.

Key Module Recommendations:

- Establish/identify appropriate data repositories for climate intervention data.
- Develop global scale models and data sets relevant to climate intervention research.

Open Issues for Module:

- How to advance data sharing when proprietary technologies are in use?
- Can a “pre-competitive” space be established for open sharing of data and research findings (comparable to the biomarkers consortium in pharmaceuticals)?
- How to address the tendency to suppress bad news on climate intervention research?

Motivational Questions:

- What data is relevant to climate interventions and what are current practices with data sharing and reuse?
- How can we ensure transparency with climate intervention data?
- What gaps need to be addressed?



Module 5: Guidance on Scaling

Module Vision of Success:

- Transitions from models and lab experiments to small-scale and large-scale field applications happen in an open and transparent way, with mechanisms to anticipate and mitigate known risks. Emergent risks are tracked, with response mechanisms in place.

Key Module Recommendations:

- Develop a classification system for scaling initiatives (e.g. levels 1, 2, and 3) for progressively greater scale and potential impacts.
- Develop protocols for public communication in advance of scaling applications.

Open Issues for Module:

- Historically, consensus on governing mechanisms for science and technology at scale is only reached after there is a disaster. How to avoid this approach?
- How is scaling different with ocean interventions compared to atmospheric and glacier interventions?
- How to advance ethical standards when proprietary technologies are in use?

Motivational Questions:

- What scaling guidance is needed in the lab and for modeling?
- What scaling guidance is needed in the natural environment (outside the lab)?
- What would successful review look like, prior to scaling?
- What gaps need to be addressed?



Module 6: Guidance on governance, Monitoring, and Compliance

Module Vision of Success:

- Ethical guidance, shared governance, monitoring and compliance are well matched to the diversity of climate intervention research and field applications. This module provides practical guidance to policy makers and other stakeholders/rights holders.

Key Module Recommendations:

- Global forums bringing together public and private stakeholders.
- Distinct ethical guidance along the spectrum from modeling, to lab experiments, to small-scale field applications to large-scale applications.
- Voluntary registration and facilitated public review/IRB-type processes relevant across the spectrum of research/applications.

Open Issues for Module:

- Monitoring mechanisms that are comparable to carbon sequestration in soil or nuclear test monitoring.
- Governance process for organizations and nations acting outside the ethical framework.
- Mechanisms for public education and policy maker expertise.

Motivational Questions:

- What governance of climate interventions happens now at local, regional, national and international levels?
- What mechanisms of monitoring and compliance would be needed to inform governance?
- What gaps need to be addressed?



Module 7: Carbon Dioxide Removal (CDR) Technology

Specific Guidelines

Module Vision of Success:

- Carbon Dioxide Removal (CDR) technologies have specific ethical standards that address the ways that CDR research and interventions are conducted.

Key Module Recommendations:

- Develop community accepted CDR impact measures.
- Develop CDR cost/benefit analysis tools and methods.
- Anticipate the reality that many CDR research questions can only be addressed with large-scale "experimental" interventions in the ocean.

Open Issues for Module:

- It is a "noisy system" making monitoring hard.
- How to address rapidly accelerating commercial CDR initiatives?
- The ocean does not respect territorial boundaries
- How to integrate CDR technology specific concerns

Motivational Questions:

- What is the current state for CDR technologies?
- What would success look like with CDR technologies?
- What gaps need to be addressed?



Module 8: Solar Radiation Management (SRM) Technology

Specific Guidelines

Module Vision of Success:

- Solar radiation management (SRM) technologies have specific ethical standards that address the ways that SRM research and interventions are conducted.

Key Module Recommendations:

- Develop community accepted SRM impact measures.
- Develop SRM cost/benefit analysis tools and methods.
- Anticipate the reality that many SRM research questions can only be addressed with small-scale pilot testing beyond laboratory modeling

Open Issues for Module:

- It is a “noisy system” making monitoring hard.
- How to address rapidly accelerating commercial SRM initiatives?
- How to address the historical focus, bias and expertise centered on SRM technologies?
- How to integrate technology specific concerns

Motivational Questions:

- What is the current state for SMR technologies?
- What would success look like with SMR technologies?
- What gaps need to be addressed?



Draft Modules Next Steps

- Provide draft module language based on the above Phase One workshop 8 module summaries - reflecting respective module vision, recommendations and issues to be resolved (Sept - Nov 2022)
- Seek additional public and expert feedback on draft language in Phase Two. Further refine and test module language with broad input (Nov 2022 - June 2023)



CDR and SRM Illustrative Cases

Climate projections scenarios



Heat waves



Drought



Wildfires



Sea-level rise



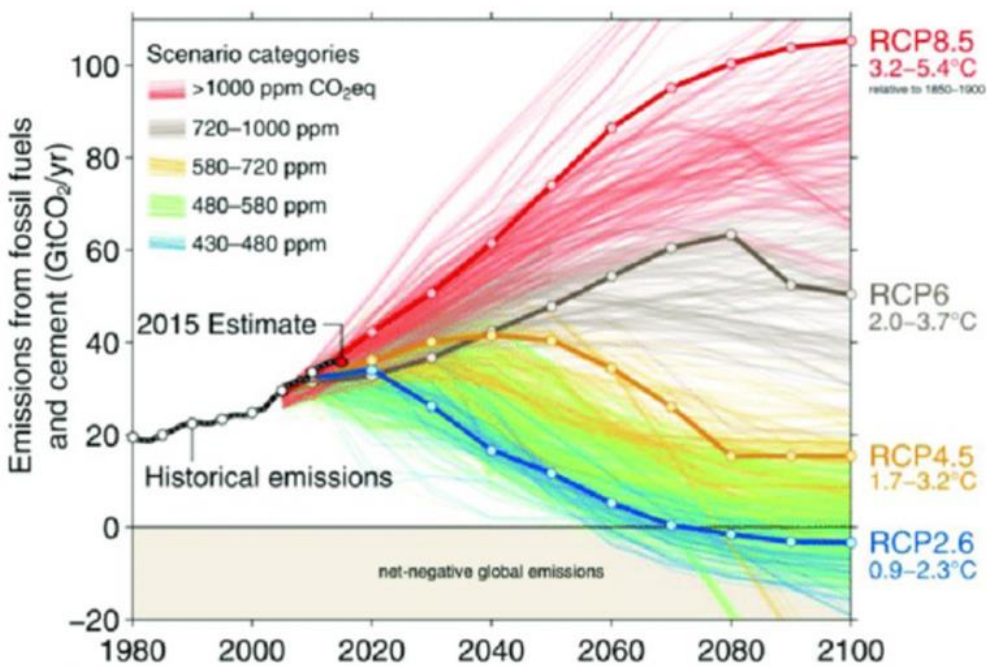
Extreme precipitation events



Climate projections

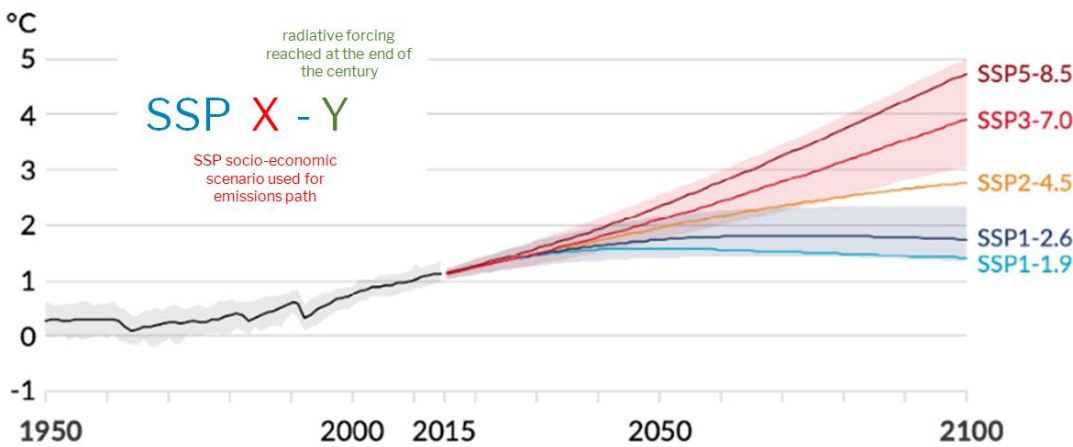
IPCC AR5

Representative Concentration Pathways (RCP)



IPCC AR6

Shared Socio-economic Pathways (SSP)



Climate Intervention scenarios

Normative scenarios

What **should** happen?



Predictive scenarios

What **will** happen?

complex system



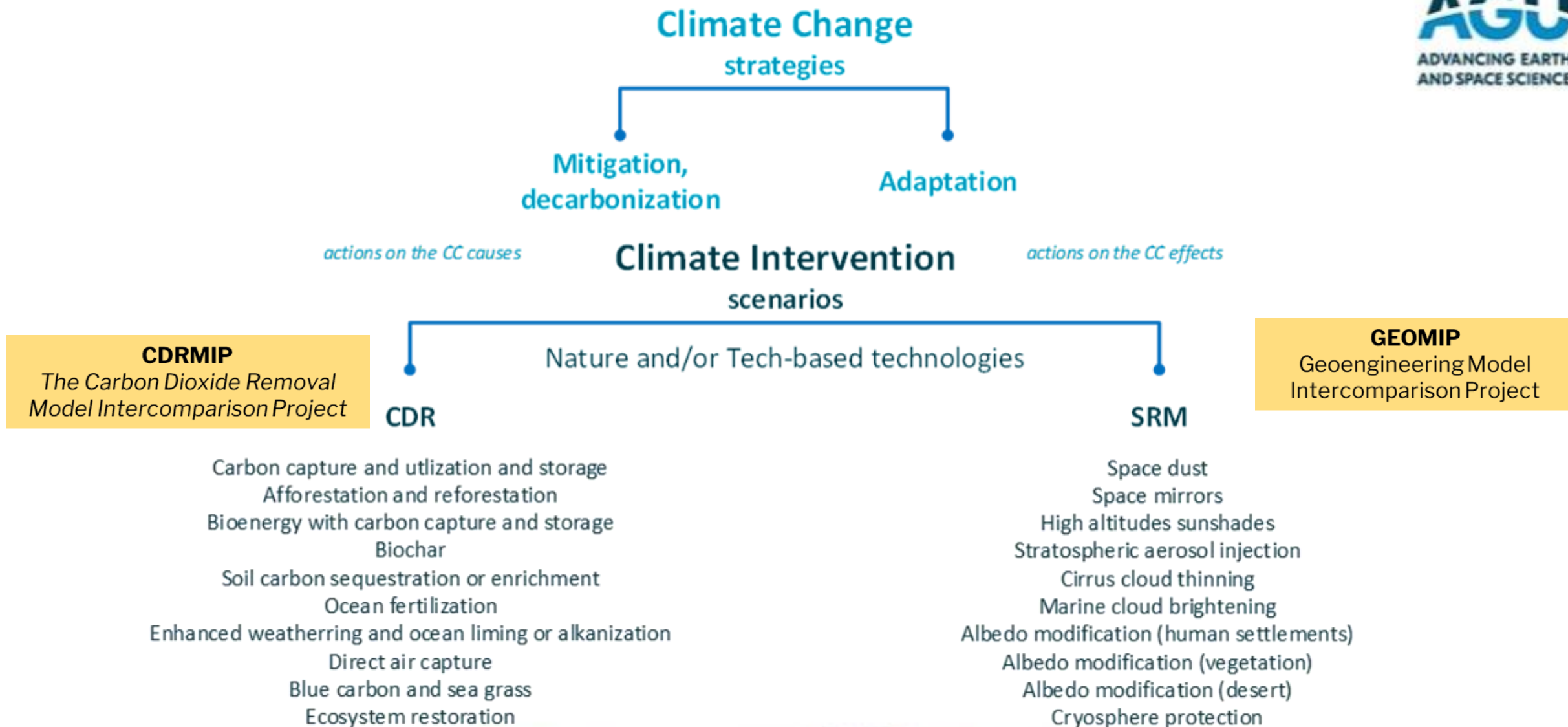
Exploratory scenarios

What **could** happen?

complicate system



Classification of the CI technologies



CDR illustrative technologies (non-exhaustive, speculative)

Tech-based CDR engineered

Direct Air Capture



Bioenergy with carbon
capture and storage



Ocean fertilization



Nature-based CDR biological

Blue carbon



Biochar



Enhanced weathering

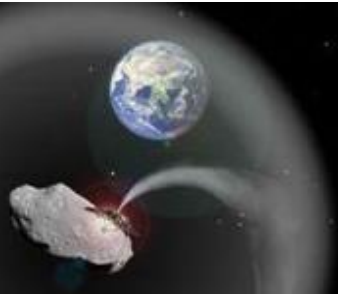


Afforestation / Reforestation

SRM illustrative technologies (non-exhaustive, speculative)

Space-based

Space dust



Stratospheric aerosol injection



Marine cloud brightening

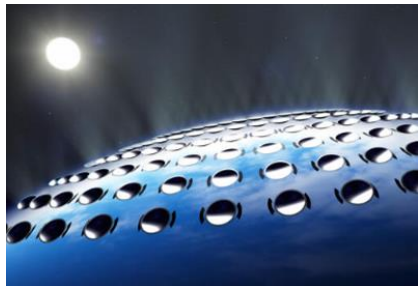
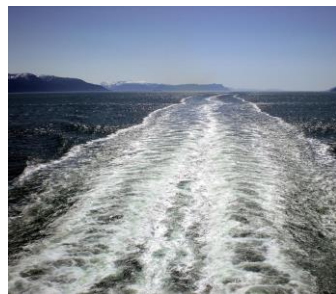


Surface-based

Vegetation b.



Water surface b.



Space / high altitude mirrors



Cirrus cloud thinning



Land and surface b.

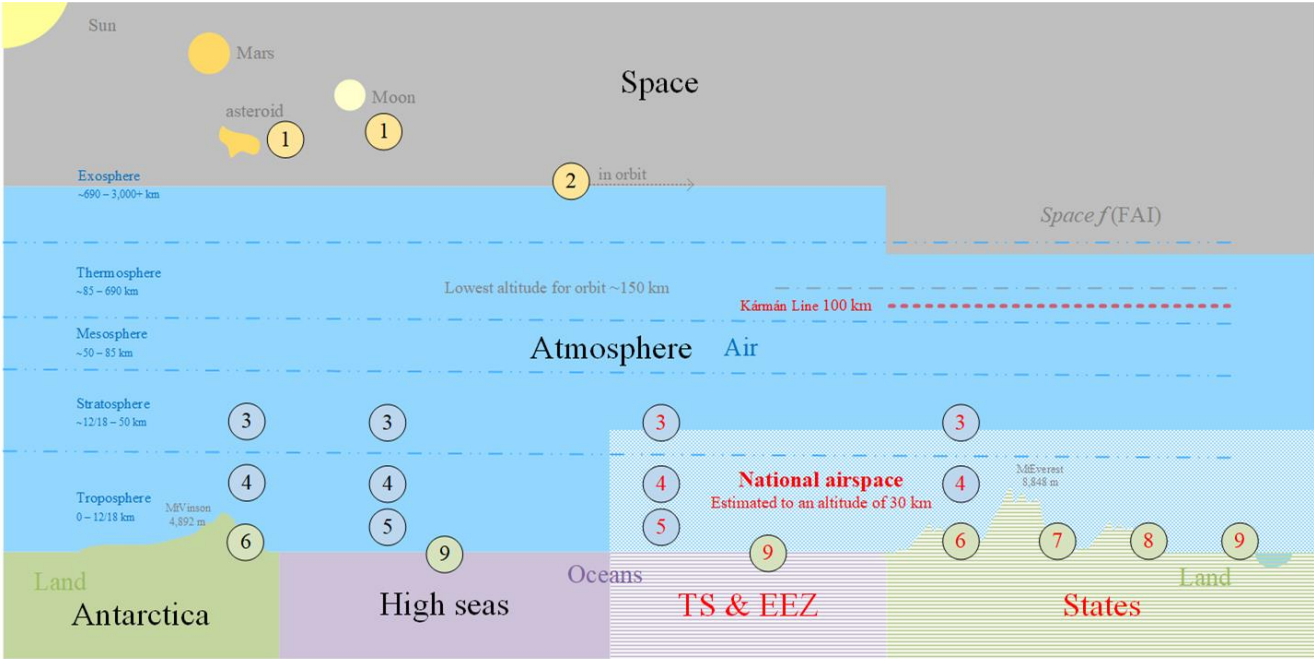
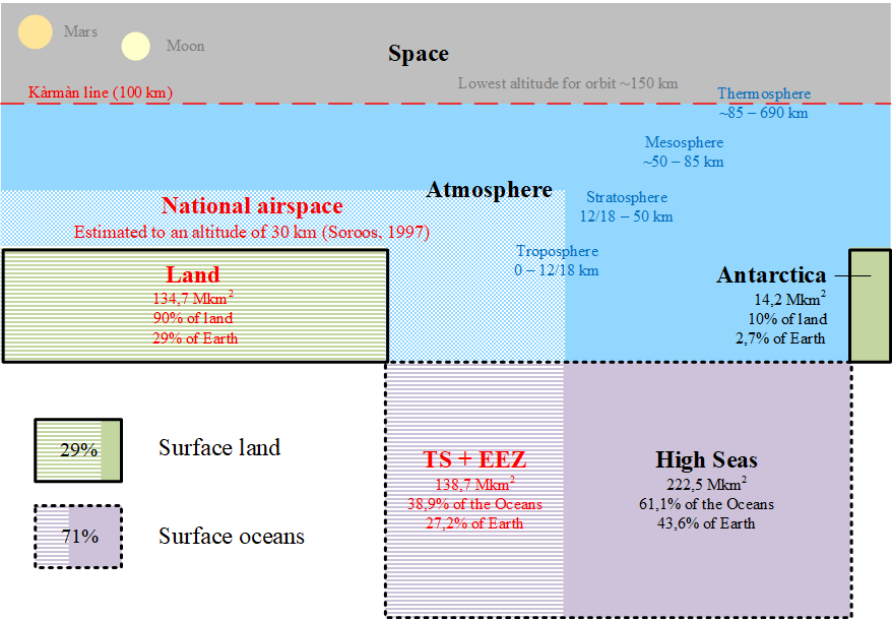


Human infrastructure b.

Beyond the CI effects the question of its deployment

National jurisdiction vs Global commons

- ~ 90% emerged land belongs to national jurisdictions
- ~ 60% of the oceans = high seas
- Atmosphere, stratosphere
- Outer space



- Deployment in space
 - Deployment in the atmosphere
 - Deployment on the Earth surface
- 1 Spatial aerosol projection SAP
 - 2 Solar orbiting reflectors SOR
 - 3 Stratospheric aerosol injection SAI
 - 4 Tropospheric cirrus cloud thinning CCT
 - 5 Tropospheric marine cloud brightening MCB
 - 6 Land surface brightening LSB
 - 7 Vegetation brightening VEB
 - 8 Human infrastructure brightening HIB
 - 9 Water surface brightening WSB

Numerous SRM / CDR scenarios simulation



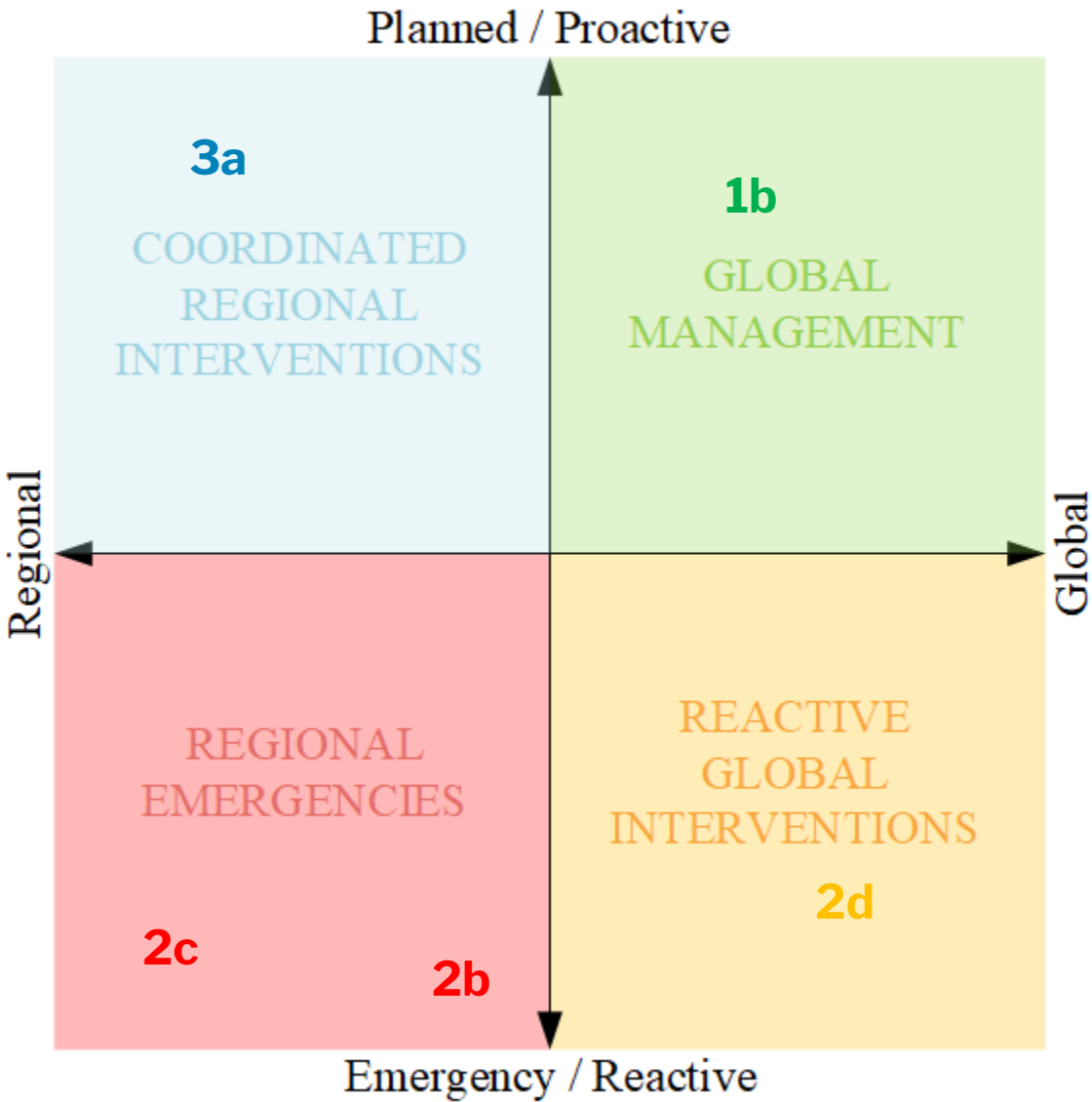
Multi-dimensional scenarios

- Example on politically relevant SRM scenarios

Source: Lockley, A. et al. (2021). 18 politically relevant solar geoengineering scenarios

Table 1: Summary of proposed scenarios. References to the literature on similar scenario(s) are provided where possible.

Scenario	Description	Global/ Regional	Planned/ Reactive
1a) Napkin Diagram	Combined mitigation with temporary phase-in of SRM, using CDR to ramp down deployment (Long & Shepherd, 2014; Tilmes et al., 2020)	G	P
1b) Slowing Warming	Temporary SRM only to reduce the rate of warming, CDR unavailable (Keith & MacMartin, 2015)	G	P
1c) Temperature-optimized SRM	Use of SRM to reach and maintain specific global temperature (Kravitz et al., 2017; Vioni et al., 2019)	G/Reg	P
1d) Impact-optimized SRM	Optimized SRM use for climate impacts such as water availability, crop production, or heat stress (e.g., Fan et al., 2021 on crop yields)	G/Reg	P
1e) Cocktail Geoengineering	Combined deployment of SRM technologies, such as SAI + MCB (Boucher et al., 2017; Cao et al., 2017)	G	P
2a) Response to Tipping Points	SRM deployment to counter abrupt warming from climate tipping points	G/Reg	Reac
2b) Response to Volcanic Eruptions	Adjusting already deployed SRM to abrupt cooling from volcanic eruptions	G/Reg	Reac
2c) Counter-Geoengineering	“Arms Race” responses to undesired SRM deployment (Parker et al., 2018)	Reg	Reac
2d) Temporary Termination	Temporary interruption (< 10 years) of SRM deployment and subsequent restart (Parker & Irvine, 2018)	G	Reac
2e) Technology Switch	Switchover from one SRM technology to another, such as SAI to MCB	G/Reg	Reac
3a) MCB over ocean regions	Regional and temporary deployment of MCB for specific applications such as protecting coral reefs and weakening hurricanes (Latham et al., 2013)	Reg	P



Implementation and Sustainment

Change agents and sustaining agents needed

Key Stakeholders (current and future; globally distributed):

- Early career, mid-career, senior researchers (diverse fields and disciplines)
- Students (undergraduate and graduate)
- “Rights holders” in first nations
- Industry leaders (small start-ups, mid-size, large multinationals)
- Government policy makers (collaborating nations and nations operating independently)
- Funding organizations (public and private)
- Community/citizen scientists
- Parties at in situ initial application locations (though impacts may be global)

Sample interests that are “At Stake”:

- Anticipating ethical implications during modeling and lab projects
- Managing the transition/scaling from research to application
- Identifying and supporting “pre-competitive” and public data
- Developing monitoring and registration processes
- Reporting “near miss” incidents
- Conducting “after action” reviews
- Addressing non-collaborating parties



Change agents and sustaining agents needed (cont.)

Potential Implementation and Sustainment Elements:

- Town halls and other **community events**
- Initial **stakeholder alignment map** (points of alignment and misalignment of stakeholders and interests)
- Policy review and adoptions by **professional societies** (lateral alignment processes)
- Guidance statements by **funding and regulatory organizations** (public and private)
- **Monitoring and registration** mechanisms for climate intervention projects (voluntary processes and mechanisms that do not depend on voluntary compliance)
- **Data repository** for “pre-competitive” and public climate intervention data (open and broad use)
- Ongoing **stakeholder alignment platform** (open and broad use)





Session :5 Path Forward & Open Mic

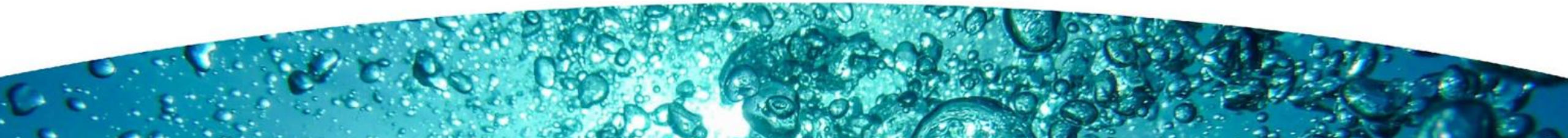
Ethical Framework Outreach and Engagement

Module Summaries on Website for Public Engagement

Upcoming Scheduled Meetings

- **November 6-18, 2022: UN Climate Change Conference (COP 27: Sharm El Sheikh, Egypt)** – please let us know if you plan to participate
- **December 12-16, 2022: AGU Annual Meeting (Chicago)** – ethical framework-related technical sessions, invited speakers (tbd) and town hall meeting.

(Additional International Meetings TBD for Phase 2 & 3)



Open Mic

Session 6: Adjourn Open Session

Networking Reception : 3:30-4:30 p.m. Conference Center Lobby
Advisory Board zoom meeting 3:30 – 4:00 p.m. 5th Floor Prow CR

Thank you!