GC72B-0236 1330h POSTER

Coarse Resolution Vegetation Phenology Modeling

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Vegetation phenology refers to recurring changes in vegetation and their connection to climate. Monitoring vegetation phenology helps to quantify the timing and length of the vegetative period for a given plant functional type (PFT). Our objective was to develop an improved and generic vegetation phenology model using remotely sensed datasets and ecophysiological modeling. Remotely sensed datasets included Leaf Area Index (LAI) from a recently developed 1989-1997 1 km database for the conterminous US. For this period and region, we calculated the potential gross primary production (GPPpot) and then used analytical functions to derive PFT-specific relationships between observed LAI and GPPpot. For each PFT, half of the observed LAI were used for model development and half for generating error statistics. The resultant model thus related the timing of leaf growth and senescence to an environmental index (GPPpot) that integrated multiple limiting environmental factors without any a priori knowledge of specific PFT phenological controls. The phenology model is prognostic, i.e., can be run independently of remote sensing, is simple to calculate and could be easily incorporated into a variety of modeling approaches.

GC72B-0237 1330h POSTER

Future Global Carbon Cycle and Climate Simulation Based on Satellite Data and Simple Earth System Model: Sensitivity to the Light Saturation Effect

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A simple Earth system model, the Four-Spheres Cycle of Energy and Mass model (4-SCEM), was developed to simulate global warming due to anthropogenic CO2 emission. The model consists of the Atmosphere-Earth Heat Cycle model (AEHC), the Four Spheres Carbon Cycle model (4-SCC), and their feedback processes. The AEHC is a one-dimensional radiative convective model, which includes the greenhouse effect of CO2 and H2O. The 4-SCC is a box-type carbon cycle model, which includes CO2 fertilization, vegetation area variation, the vegetation light saturation effect, and HILDA ocean model. Following feedback processes were included, (1) water vapor feedback, (2) biospheric CO2 fertilization, and temperature dependencies on (3) soil decomposition, and (4) ocean surface chemistry.

Previous studies on future projection of atmospheric CO2 have a problem because of few time-series constraints on the model especially in the biospheric processes. Then, the recent NPP trends from the 4-SCEM and satellite data were directly compared for validation. The satellite-based one showed the NPP increase in past 20 years at a rate of 3.8 % per 10 years. Although 4-SCEM based analysis also showed a recent increase in NPP, the result was a half (with climate feedback) or one-eighth (without climate feedback) of satellite based one. Although large discrepancies are still remained, we can conclude that the carbon cycle model with climate feedback is more reasonable than that without climate feedback.

The future status of the global carbon cycle and climate was simulated up to the year 2100 based on the IS92a emission scenario. The atmospheric CO2 concentration reaches 645 ppmv in 2100. Sensitivity analysis showed that uncertainties derived from the light saturation effect of vegetation and land use emissions were the primary cause of uncertainties in projecting future CO2 concentrations. Satellite-based net primary production trends analyses can somewhat decrease the uncertainty in quantifying CO2 emissions due to land use changes.

URL: http://sys.eps.nagoya-u.ac.jp/∼ichii

GC72B-0238 1330h POSTER

A Better Representation of European Croplands into a Global Biosphere Model

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Croplands cover a quarter of Europe's surface (about an hundred million hectares), their impact on carbon and water fluxes must therefore be estimated. Global biosphere models such as ORCHIDEE (http://www.ipsl.jussieu.fr/ ssipsl/) were conceived to simulate natural ecosystems only, so croplands are often described as grasslands. Not only cropland productivity depends on climate and soil conditions but also on irrigations, fertilisers impact, date of sowing... In addition crop species are usually selected genetically to shorten and accelerate their growth. Agronomic models such as STICS (Brisson et al. 1998) give a more realistic picture of croplands as they are especially designed to account for this human forcing. On the other hand they can be used at the local scale only. First we evaluate the ability of the two models to reproduce the seasonal behaviour the leaf area index (LAI), the aerial biomass, and the exchanges of water vapour and CO2 with the atmosphere. For that we compare the model outputs with measurements performed at five sites that are representative of most common European crops (wheat, corn, soybean). As expected the agronomic STICS better behaves than the generic model ORCHIDEE in representing the seasonal cycle of the above variables.

In order to get a realistic representation of croplands areas at the regional scale, we decided to couple ORCHIDEE with STICS. First we present the main steps of the coupling procedure. The principle consists in forcing ORCHIDEE with five more realistic outputs of STICS: LAI, date of harvest, nitrogen stress, root profile, and vegetation height. On the other hand, ORCHIDEE computes its own carbon and water balance. The allocation scheme was also modified in ORCHIDEE in order to conserve the coherence between LAI and leaf biomass, and we added a harvest module into ORCHIDEE. The coupled model was validated against carbon and water fluxes observed respectively at two fields (wheat and corn) in the US. We also conducted at European scale two experiments where all arable lands are covered by corn for the first one, and by natural grasslands for the second one. We compared the fluxes between these two simulations. In the case of corn cover, the vegetative period is reduced and the absorption of carbon is more enhanced (until 15 per cent) during the maximum extension of vegetation.

This work shows that croplands can be integrated into global biosphere models to simulate CO2 and water vapour regional fluxes, which should allow a better representation of those ecosystems for climate studies.

GC72B-0239 1330h POSTER

Experimental warming increases soil carbon flux in a recently burned Alaskan boreal forest

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The response of boreal forest soils to global warming remains controversial despite their significance in the global carbon cycle. In particular, our understanding of soil carbon storage is critical to our ability to predict the future response of boreal forests to global warming due to their large carbon sink capacity. Historically, boreal forests have been thought to be carbon sinks over time due to the short growing season which prevents soil microbes from completely decomposing annual primary production. However, recent empirical evidence indicates that climate change, and warming in particular, is already decreasing the amount of carbon stored in boreal forest soils. In addition, forest fires claim an increasing average area of boreal forest each year (1 x 106 acres in Alaska in 2002), and affect a significant portion of this ecosystem. Fire-affected boreal forests may have different responses to global warming than mature forest. Here, we present results from a study in which we experimentally raised the average daily ambient temperature of a recently burned black spruce forest in central Alaska during the growing season by 1 °C (mid-day temperatures increased by 4 °C) using twelve, 1.77 m2 open-top greenhouse chambers and twelve control plots for 3 years after fire. Soil CO2 flux was significantly higher in greenhouses than controls for all measurements taken during the third summer of warming (greenhouse mean: 89 g C m-2 ; control mean: 66 g C m-2 ($p < .04$); repeated measures ANOVA). BIOLOG ecoplate™ analysis indicates that bacterial diversity and abundance were slightly higher in greenhouse plots. The change in bacterial community composition may be partially responsible for the elevated soil CO2 flux. These results suggest that in a warmer climate, fire-disturbed boreal forests may store less carbon than their present carbon storage. Furthermore, the interaction between global warming and fire may result in a positive feedback to atmospheric CO2, and therefore, a positive feedback to global warming.

GC21A MCC: Hall D Tuesday 0830h

How Can Scientists Improve Public Understanding of Climate Change and Variability? Posters *(joint with A, B, H, PP, PA)*

Presiding: **E T Sundquist,** U.S. Geological Survey**; A J Stevermer,** NOAA Air Resources Laboratory, University of Colorado

GC21A-0148 0830h INVITED POSTER

Don't be Shy: The Public Really Wants to Know About Your Latest Research

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Scientists could do a lot to improve the flow of information to the general public on their climate change research. Unfortunately, very few take initiatives in this regard, and some feel it would be unseemly to do so. AGU typically issues a half dozen press releases each year on climate research published in our journals, yet virtually never has one of the researchers called our attention to an upcoming paper and suggested that it would be newsworthy.

Similarly, at most AGU meetings, we organize several press conferences on climate change research, but rarely does a scientist tell us in advance that he will be presenting some provocative results that might be of interest to the media. As with journal papers, we learn of the research indirectly and approach the scientists, seeking their cooperation. Almost always, they say yes and do help us inform the media about their work.

Climate change is in fact one of the two top subject areas for media response, both in terms of requests for full journal papers and articles actually published about them. Repeatedly, however, public information officers at universities, government agencies, research institutions, and journal publishers complain that "their" scientists do not talk to them about their projects. Since most institutions have professional science writers on their staffs, this disconnect represents untold missed opportunities. Scientists should see it as one of their key obligations to inform the public on how effectively they have used their grants.

AGU helps advance the dialogue between scientists and the public, via the media, in various ways: through our online publication, "You and the Media," by sponsoring journalism awards to encourage good science writing, through Mass Media Fellowships for young scientists, and, of course, by disseminating press releases and holding press conferences.

GC21A-0149 0830h POSTER

Exploring Local Approaches to Communicating Global Climate Change Information

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Expected future climate changes are often presented as a global problem, requiring a global solution. Al-

though this statement is accurate, communicating climate change science and prospective solutions must begin at local levels, each with its own subset of complexities to be addressed. Scientific evaluation of local changes can be complicated by large variability occurring over small spatial scales; this variability hinders efforts both to analyze past local changes and to project future ones. The situation is further encumbered by challenges associated with scientific literacy in the U.S., as well as by pressing economic difficulties. For people facing real-life financial and other uncertainties, a projected "1.4 to 5.8 degrees Celsius" rise in global temperature is likely to remain only an abstract concept. Despite this lack of concreteness, recent surveys have found that most U.S. residents believe current global warming science, and an even greater number view the prospect of increased warming as at least a "somewhat serious" problem. People will often be able to speak of long-term climate changes in their area, whether observed changes in the amount of snow cover in winter, or in the duration of extreme heat periods in summer. This work will explore the benefits and difficulties of communicating climate change from a local, rather than global, perspective, and seek out possible strategies for making less abstract, more concrete, and most importantly, more understandable information available to the public.

GC21A-0150 0830h POSTER

Arctic Change Information for a Broad Audience

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Demonstrable environmental changes have occurred in the Arctic over the past three decades. NOAA's Arctic Theme Page is a rich resource web site focused on high latitude studies and the Arctic, with links to widely distributed data and information focused on the Arctic. Included is a collection of essays on relevant topics by experts in Arctic research. The website has proven useful to a wide audience, including scientists, students, teachers, decision makers and the general public, as indicated through recognition by USA Today, Science magazine, etc. (http://www.arctic.noaa.gov)

Working jointly with NSF and the University of Washington's Polar Science Center as part of the Study of Environmental Arctic Change (SEARCH) program, NOAA has developed a website for access to pan-Arctic time series spanning diverse data types including climate indices, atmospheric, oceanic, sea ice, terrestrial, biological and fisheries. Modest analysis functions and more detailed analysis results are provided. (http://www.unaami.noaa.gov/). This paper will describe development of an Artic Change Detection status website to provide a direct and comprehensive view of previous and ongoing change in the Arctic for a broad climate community. For example, composite metrics are developed using principal component analysis based on 86 multivariate pan-Arctic time series for seven data types. Two of these metrics can be interpreted as a regime change/trend component and an interdecadal component. Changes can also be visually observed through tracking of 28 separate biophysical indicators. Results will be presented in the form of a web site with relevant, easily understood, value-added knowledge backed by peer review from Arctic scientists and scientific journals.

GC21A-0151 0830h POSTER

Concept, Design and Implementation of a climate game within the framework of a climate exhibition in the German Museum for Science and Techniques

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In November 2002 a special exhibition on climate issues opened in the German Museum for Science and Techniques ('Deutsches Museum') in Munich. Within this exposition we present an interactive area where visitors should control future climate policy virtually by adopting the role of either the government, a CEO (Chief Executive Officer) of a global company or a typical private household of an industrialized country. All actors endeavor to maintain a sustainable climate in the future (global goal) and in addition pursue their own individual welfare goal. Task of the exhibition visitor is to combine the personal interests of the actor he is adopting with the global goal. The individual goal of government is to stay popular. This is derived from economic production Government also tries to avoid conflicts due to inter-regional inequalities. The CEO seeks to maximize total profits (business earnings) summed over all business sectors (shareholder values). The goal of households is to maximize wages and interest earnings. The evolution of the economic system is governed by the decisions of the actors. Government sets economic side conditions in terms of carbon taxes, subsidies for R&D or market infusion support for climate-friendly technologies, and transfers or subsidizes the transfer of development aid to less advanced regions. The CEOs decisions are: how much to invest in a number of alternative investment options and in which region. Households influences the economy by their purchasing and savings decisions.

The model considers four regions, three real actors (mentioned above) and two different goods (climate-adverse and a climate-friendly). We introduce four different kinds of energy (coal, oil/gas, nuclear, renewable). Due to the existence of several goods and trade between regions we need to establish the concept of money and price. This includes a World Bank to handle money flows. At different points in time the actors are motivated to cooperate with other actors in order to reach the global goal.

We use a touch-screen monitor with user friendly interface to present some animations and videos. An animated climate scientist uses a climate simulator to compute future climate scenarios under the condition of the actors decisions. This should show that all climate forecasts are not facts but model results which has to be interpreted by scientists. The goal of this project is not to indoctrinate the visitors but to give them a feeling for the problem and show them that a sustainable future climate can be combined with individual welfare goals.

GC21A-0152 0830h POSTER

Communicating Uncertainties in Weather and Climate Information: Results of a National Academies Workshop

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When a major East Coast snowstorm was forecast during the winter of 2001, people began preparing both the public and the decision-makers responsible for public services. There was an air of urgency, heightened because just the previous year the region had been hit hard by a storm of unpredicted strength. But this time, the storm never materialized and people were left wondering what went wrong with the forecast. Did something go wrong or did forecasters just fail to communicate their information in an effective way? Did they convey a sense of the likelihood of the event and keep people up to date as information changed?

In the summer of 2001, the National Academies Board on Atmospheric Sciences and Climate hosted a workshop designed to explore the communication of uncertainty in weather and climate information. Workshop participants examined five case studies that were chosen to illustrate a range of forecast timescales and certainty levels. The cases were: Red River Flood, Grand Forks, April 1997; East Coast Winter Storm, March 2001; Oklahoma-Kansas Tornado Outbreak, May 3, 1999; El Nino 1997-1998, and Climate Change Science, a report issued in 2001. In each of these cases, participants examined who said what, when, to whom, how, and with what effect. The last two cases specifically address climate-related topics.

This paper summarizes the final workshop report (Communicating Uncertainties in Weather and Climate Information: Summary of a Workshop, NRC 2002), including an overview of the five cases and lessons learned about communicating uncertainties in weather and climate forecasts. Among other findings, the report stresses that communication and appropriate dissemination of information, including information about uncertainty in the forecasts and the forecasters confidence in the product, should be an integral, ongoing part of the forecasting process, not an afterthought. Explaining uncertainty should be an integral part of what weather and climate forecasters do and is essential to delivering accurate and useful information.

URL: http://www.nap.edu

GC21B MCC: Hall D Tuesday 0830h

General Global Environmental Change Contributions Posters *(joint with C, A, B, H, OS, PP)*

Presiding: **E T Sundquist,** U.S. Geological Survey**; A J Stevermer,** NOAA Air Resources Laboratory, University of Colorado

GC21B-0153 0830h POSTER

Precise Holocene Relative Sea-level Change and Mid-Holocene Warm Period in Antarctica

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Twelve 14C dates of in situ fossil shells of Laternula elliptica from deltaic raised Kizahasi Beach with well-marked stepped topography allow us to define Holocene relative sea-level change at Skarvsnes, Lutzow-Holm Bay region, East Anatarectica. The upper edge of step usually corresponds to the upper end of topset bed of deltaic sediments. The sedimentary structures and topography from near to the present high tide line to shallow marine depths are very similar to the deltaic sedimentary structure preserved in the stepped topography. Considering this similarity, the elevation of the upper end of topset beds and relationship to foreset or bottomset beds indicates the elevation of a former high-tide level at the time the shell was alive. This relationship can be applied to the estimation of the elevation of former shorelines and the reconstruction of Holocene relative sea-level changes. Stable sea-levels are identified at 17-13 m asl during 7,000-5,500 yrBP, at 11-9 m during 5,000-4,500 14C yr BP, and at < 6 m after 4,000 14C yr BP (Fig. 15). The rapid regression occurring between 5,400 yBP (4,100 calib. yrBP) and 4,000 yBP (2,700 calib. yrBP) suggests that some glacial loading had removed around here before 5,400 yBP (4,100 calib. yrBP). In addition, the radiocarbon dating ages of abondoned penguin rookery at the foot of Mt. Riiser-Larsen shows that the great dissusion of rookeries occurred the rapid regression time. This period probably indicates the mid-Holocene warm period in the Antarctica.

GC21B-0154 0830h POSTER

Quaternary Sedimentary and Geomorphic History of River Valleys in the Lake Titicaca Basin, Peru and Bolivia

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Lacustrine sediments have become important archives of paleoclimatic history in the tropical Andes of South America. The history of lake level of Lake Titicaca (LT) has played a central role in these reconstructions. Here we report on our ongoing studies of the late Quaternary sedimentary and geomorphic histories of two of the major tributaries to LT (the Rios Ramis and Ilave) and on our earlier studies of LT's only outlet (the Rio Desaguadero). The strata and fluvial terraces in these valleys record large-scale aggradation and downcutting events that are apparently correlative with both climate changes in the LT basin and local complex response mechanisms (changes in sediment source, topographic variability, etc.).

Both the Ramis and Ilave valleys have 5 terrace tracts, ranging from less than 1 m to approximately 53 m above the river level and occurring as both paired and unpaired tracts and as cut-fill, fill-, and strath terraces. The Rio Desaguadero valley has 4, locally