Next-Generation Ecosystem Experiments – NGEE Arctic

Quarterly Report
September 30, 2011

A progress report submitted to

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NGEE Team Travels to Alaska to Learn More about Arctic Ecosystems

Ten participants in the NGEE project traveled to Alaska during mid-August. The group included staff scientists and engineers from ORNL (Graham, Norby, and Wullschleger), LANL (Wilson), LBNL (Hubbard and Torn), BNL (Lewin and Rogers), and the University of Alaska Fairbanks (Hinzman). Roy Kaltschmidt (LBNL) joined the group as photographer. The team visited Nome and Council on the Seward Peninsula and Barrow on the North Slope. These two areas have been home to many prominent national and international research programs and were identified for evaluation by the NGEE team as areas where rapid environmental change, ecosystem dynamics, strong surface and subsurface interactions, and permafrost degradation would facilitate Phase 1 objectives of the project. A series of informational meetings with local community leaders were scheduled so that project participants could share research plans with people who were familiar with the area. These meetings were helpful as they allowed residents to contribute local insights and traditional knowledge to the process of site selection. Field visits allowed the team to begin gaining practical information about vegetation, hydrology, and active layer depth. Having visited the field sites the team had an opportunity to discuss research support with two logistical service providers (e.g., CH2MHill Polar Services and Barrow Arctic Science Consortium). Finally, a charter flight with Era Aviation from Nome to Barrow allowed the group to learn more about Arctic ecosystems at remote areas of Kougaruk, Kotzebue, Ivotuk, and Atqasuk.

Ecosystems in Council (left) are characterized by complex dynamics as they lie along the edge of boreal forest, shrub lands, and tundra. Barrow ecosystems (right) are characterized by strong surface and subsurface interactions and presence of polygonal ground.

Details at a Glance

Activities during the July 1 thru September 30, 2011 quarter include:

- Geophysical data collected at Barrow, Alaska
- New LDRD project in land surface modeling initiated at ORNL
- NGEE presentation highlights Arctic during Office of Science Graduate Fellowship Program
- Panel review for NGEE proposal held in Crystal City
- NGEE team members help co-organize workshop to promote data-model integration
- Geophysical survey scheduled for Barrow, Alaska

Progress and Accomplishments

Geophysical data collected at Barrow, Alaska:

A team of NGEE researchers capitalized on favorable fall weather to collect what they hope will be a unique geophysical data set at the Barrow Environmental Observatory, Barrow, Alaska. The team led by Susan Hubbard and others from LBNL, UAF, and ORNL, focused on measurements along a 450-m transect across the tundra. The goal of the September 24 to October 2, 2011 survey is to characterize surface and subsurface features of polygonal ground in various stages of degradation. More specifically, the field campaign seeks to gain a better understanding of the relationship between polygonal ground zonation and associated topography and hydrogeology, with a focus on characterizing the distribution of active layer thickness, soil texture, moisture content, and stratigraphy. NGEE participates in the survey included John Peterson, Craig Ulrich, Baptiste Dafflon, Alessio Gusmeroli (UAF), and Stan Wullschleger.

Geophysical measurements being conducted in Barrow, Alaska.

New LDRD project in land surface modeling initiated at ORNL:

A new project entitled "Coupled Simulation of Surface-Subsurface Hydrologic Processes and Terrestrial Ecosystem and Climate Feedbacks: From Arctic Landscapes to the Continental United States" was recently funded through the ORNL Laboratory Directed Research and Development (LDRD) program. This two-year modeling activity is led by Richard Tran Mills

and his colleagues Forrest Hoffman, Gautam Bisht, Jitendra Kumar, Liyuan Liang, Melanie Mayes, Peter Thornton, and Stan Wullschleger. Richard and his team argued that representation of hydrologic processes in current land surface models suffer from an over-simplification or complete omission of physical processes. For example, most land surface models have a one-dimensional representation of subsurface flow and heat transport, a unidirectional flow from surface to subsurface, and no freeze-thaw dynamics. To enable to facilitate future data-model interactions, several important aspects of climate change impacts on hydrology and associated feedbacks, this project seeks to integrate detailed surface-subsurface thermal, hydrologic, and biogeochemical reaction models with comprehensive models of geophysical and land surface processes, using leadership-class supercomputers. Richard and others will develop models of rigorously coupled surface-subsurface hydrologic interactions and subsurface freeze-thaw dynamics, and integrate these into the massively parallel subsurface flow and reactive transport model PFLOTRAN. This extended PFLOTRAN model will be coupled with the Community Land Model (CLM), the land component of the Community Earth System Model (CESM), to enable novel studies, at field to regional scales, of the interactions between surface-subsurface hydrologic and biogeochemical processes and the terrestrial ecosystem and associated climate feedbacks, especially those related to hydrologically induced surface and subsurface carbon cycling. A particular motivation for this project comes from the desire to study permafrost degradation and the poorly-understood yet potentially large carbon-climate feedbacks that are believed by many to be taking place in the Arctic.

NGEE presentation highlights Arctic during Office of Science Graduate Fellowship Program:

Stan Wullschleger was invited to participate in the DOE, Office of Science Graduate Fellowship Annual Research Meeting. The meeting was held at ORNL on July 19th and featured over 150 DOE graduate fellows from across the country that are conducting research in one of the six Research Offices under the DOE Office of Science. Stan's presentation was entitled "Global Change Biology and the Future of Climate Science: A Tale of Two Scales" and highlighted the use of advanced user facilities in support of climate-related missions of the Biological and Environmental Research (BER) program.

Panel review for NGEE proposal held in Crystal City:

The NGEE proposal was reviewed on August 4, 2011. Ten team members traveled to Crystal City just outside Washington DC to participate in the review of our proposed field, laboratory, and modeling activities. Susan Hubbard and Peter Thornton presented information on our planned field and laboratory and modeling tasks, respectively. Stan Wullschleger provided an overview of the goals and objectives of the NGEE project and then concluded the team presentation with thoughts on outcomes and deliverables of Phase 1 and 2 activities. The NGEE team and panel reviewers engaged in general discussions and then were asked to address a series of questions that were of specific interest to reviewers.

Santa Fe Conference to emphasize climate impacts and feedbacks in the terrestrial Arctic:

Los Alamos National Laboratory (LANL) will host the Third Santa Fe Conference on Global and Regional Climate Change during October 31 to November 4, 2011. This conference will focus

on climate change and variability from observational, theoretical, and modeling perspectives. Special emphasis will be on climate forcing and feedbacks on global and regional scale, including polar region. The goal is to bring together researchers with varied interpretations of current and past global and regional climate change, to present the latest research results (observations, theory, modeling and analysis), and to provide discussion opportunity to top climate experts and students. This year marks the first time that an Arctic terrestrial process session will be included in the conference. That session is entitled "Understanding and predicting climate impacts and feedbacks in the terrestrial Arctic". Cathy Wilson, Larry Hinzman, and Stan Wullschleger are co-sponsors of this session. The Conference will consist of invited and contributed oral presentations and posters. Presented papers will be considered for publication in a special section of the Journal of Geophysical Research.

Community outreach during trip to Barrow, Alaska:

The recent trip to Barrow provided a good opportunity for NGEE members to continue their communication with local residents. Courtney Hammond, an intern from Dartmouth working with the Barrow Arctic Science Consortium (BASC) arranged tours of the NGEE field research activities for two groups of students. Susan Hubbard spoke to students from the Barrow high school and presented a hands-on demonstration of how geophysical techniques can be used to study subsurface processes. Stan Wullschleger spoke to an energetic group of third graders from the Fred Ipalook Elementary School and talked about climate and ecosystems. Later in the week Stan also presented a community-wide seminar on how global change biologists study ecosystems in a future world. That seminar was presented in the new Barrow Arctic Research Center (BARC).

Third grade students learn how experiments conducted on the tundra can be used to better understand ecosystem response to a changing climate.

NGEE team members help co-organize workshop to promote data-model integration:

Integrated experiment-model approaches are urgently needed to improve Earth system modelling. Process-oriented models are a primary and defensible tool for the projection of future

states of ecosystems and climate in the Earth system in response to global change. However, current model intercomparison and data-model comparison continue to indicate large uncertainties in predicted carbon cycle-climate change feedback. To reduce uncertainties in model predictions, it is essential to constantly evaluate and improve models against experimental data and vice versa. To shift the philosophy and culture of research toward these integrated approaches, a workshop is planned for early 2012 to explore and develop a variety of strategies to encourage integrated experiment-model research (see Appendix). The workshop will be sponsored by the BER and led by scientists at the University of Oklahoma (Luo), ORNL (Wullschleger), LBNL (Torn), the University of California, Irvine (Randerson) and the University of California, Berkeley (Baldocchi). The general goal of the workshop is to promote a new philosophy of having modeling activities to guide field research activities, which in turn informs modeling activities. This *a priori* and iterative process of information exchange between the experiment and modeling communities should maximize the intellectual investments and result in high quality predictive models and more scientific discovery. A series of case studies will be used as appropriate to explore what would be most effective strategies to promote the integrated approaches. The case studies involved will include experimental and observational projects sponsored by the Biological and Environmental Research (BER) program. For example, Next-Generation Ecosystem Experiments (NGEE Arctic), SPRUCE, FACE, AmeriFlux, and others. The FACE projects and the AmeriFlux network have had many *ad hoc* modeling activities. The NGEE Arctic and SPRUCE projects have already gone through several iterations of model-experiment interactions, but will provide a good test bed for how new experiments can benefit from in-depth modeling exercises prior to implementation of field measurements. A pre-workshop planning session is being planned with BER Program Managers in mid-February.

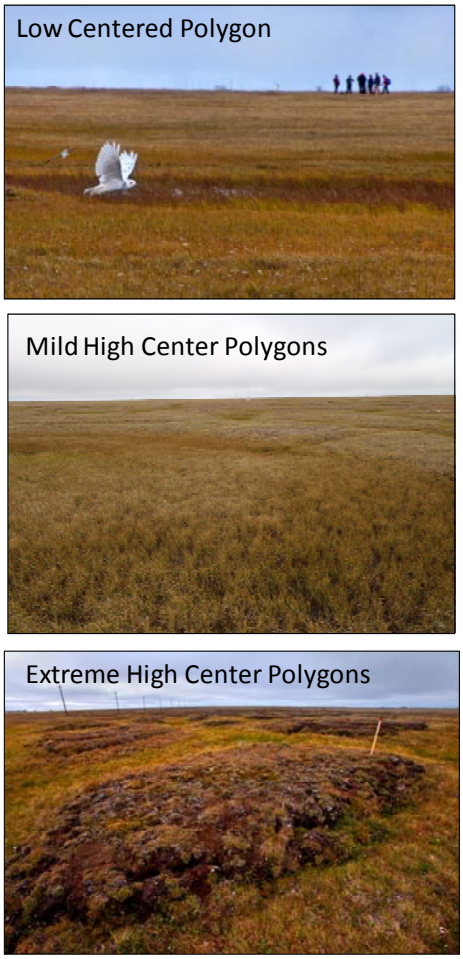
<u>Geophysical survey scheduled for Barrow, Alaska</u>:

A field campaign in Barrow was scheduled for the last week of September, with an objective of collecting geophysical data needed to identify NGEE study plots. The area was preliminarily identified by the NGEE lead team during the August trip to Alaska, and is located on the south-western side of the Barrow Environmental Observatory (BEO). The area was chosen for an initial geophysical a variety of reasons, including:

- Close juxtaposition of low centered polygons with mild and extreme centered polygonal ground, which would allow investigation of a range of thermokarst conditions,
- Proximity to infrastructure, including boardwalks, power lines, and instrument shed, and
- Proximity to existing (previous and current) research study sites, offering the potential for leveraging.

The goal of the field campaign was to gain an understanding of the relationship between polygonal ground zonation and associated topography and hydrogeology, with a focus on characterizing the distribution of active layer thickness, soil texture, moisture content, and stratigraphy. A field plan was developed and included spatially extensive (but indirect) geophysical measurements and direct (but localized) point measurements. More specifically:

- A grid of electrical conductivity measurements were acquired using a Geonics EM-38 system in horizontal and vertical dipole mode by walking along the grid with the system held above the ground surface. This approach will provide information about effective electrical conductivity in the upper ~1.5m of the ground surface (although the different dipole orientations have different depth sensitivities) in a non-destructive manner. Compared to the other geophysical measurements described below, this approach provides more continuous but lower resolution and vertically averaged geophysical attribute information. This dataset is expected to be useful for providing zonation information about active layer thickness as well as distribution of ice and water.
- Along the length of the study grid, electrodes were installed (at 0.5m spacing) and electrical resistivity tomography (ERT) and select induced polarization (IP) data will be collected using an AGI supersting system. The electrical resistivity information obtained from this method is expected to be sensitive to the same properties as the EM-38, but this method will provide both deeper and vertically resolved information about electrical conductivity distribution. Because we anticipate that the phase data will eventually be useful for identifying the spatial distribution of freeze-thaw onset, the IP data collected during this campaign will serve as a baseline for comparison with other subsequent transects collected at the same location.
- Ground penetrating radar (GPR) transects were collected along both sides of the central ERT/IP transect using several frequency antennas. The GPR data will be acquired along the transect using a sled-pulled common offset mode with ~0.2m trace spacing. Additionally, common midpoint gathers will be collected – minimally one in each of the three identified polygonal ground zones. For the GPR acquisition, two systems will be tested with a variety of different antenna frequencies (ranging from 100MHz-1.3GHz). Care will be taken to tread lightly on the ground surface within the study grid while collecting the GPR data. For this reason, a 'comparison' transect may be first set up on the western-most boundary of the grid to test the different systems and antennas, and analysis of the acquired data would then be used to choose optimal configurations for acquiring GPR data within the study grid. The GPR reflection data is expected to provide the most detailed information about the active layer variations and may also provide information about deeper ice wedges and other controls on the thermokarst expressions. With calibration (and especially if the active layer is not yet partially frozen), both the GPR groundwave and reflected wave arrivals will be assessed for water content.



Range of polygonal ground observed along a 450-m transect in the study region.

- We also collected a variety of point measurements and samples along one of the GPR transects to provide direct (but spatially sparse information) about soil texture, moisture, and active layer thickness. Approximately twenty point measurements will be made along the GPR transect; the location of the point measurements will be chosen to sample the rims and troughs of the different thermokarst features. Point measurements will be useful for initial characterization of the site and will be additionally useful to constrain the interpretation of the more spatially extensive geophysical data. Point measurements to be collected include: active layer thickness and temperature; active layer core photography and qualitative texture description; select active layer soil samples; and time domain reflectometry using the SoilMoisture Trace system and 8cm and 15cm probes for measuring water content.
- The location of all geophysical transects and point measurements were identified using GPS measurements.

An offsite health and safety plan was developed to identify hazards and protocols associated with the field campaign and site.

Interactions with other Agencies, Universities, and National Laboratories

A series of discussions were held in September with Hank Loescher, NEON, Inc. Hank and the NEON team anticipates field sites in Alaska and we discussed where sites were located and why those specific sites were selected. Hank shared several data sets with the NGEE team which were useful as we evaluated NEON goals and objectives against those of the NGEE projects. A central topic of discussion was the field site in Barrow. It was agreed that this site in particular, if indeed selected by NGEE, would allow considerable interaction between the two groups. A follow-up meeting in either Boulder or at the upcoming AGU meetings in San Francisco is being planned.

Publications, Presentations, and Posters

Publications:

Graham D.E., M.D. Wallenstein, T.A. Vishnivetskaya, M.P. Waldrop, T.J. Phelps, S.M. Pfiffner, T.C. Onstott, L.G. Whyte, D. Gilichinsky, D.A. Elias, R. Mackelprang, N.C. VerBerkmoes, R.L. Hettich, D. Wagner, S.D. Wullschleger and J.K. Jansson (2011) Microbes in thawing permafrost: The unknown variable in the climate change equation. The ISME Journal: Multidisciplinary Journal of Microbial Ecology (accepted).

Presentations:

July 19, 2011. S.D. Wullschleger, Global Change Biology and the Future of Climate Science: A Tale of Two Scales. DOE Office of Science, Graduate Student Fellowship Program. Oak Ridge, TN.

August 20, 2011. M.S. Torn, Trees in Mountain Alpine Zones? Schoolyard Saturday Project, Barrow Arctic Science Consortium (BASC), Barrow, Alaska.

September 22, 2011. S.D. Wullschleger, Next-Generation Ecosystem Experiments (NGEE Arctic); DOE Climate and Earth System Modeling PI meeting. September 19-22, 2011. Grand Hyatt, Washington, DC

Workshops Attended:

September 19-22, 2011. DOE Climate and Earth System Modeling PI meeting. Grand Hyatt, Washington, DC

Posters: None at this time.

Upcoming Meetings:

Third Santa Fe Conference on Global and Regional Climate Change, October 31 to November 3, 2011. Santa Fe, New Mexico.

American Geophysical Union (AGU) Fall Meeting; December 5-9, 2011. San Francisco, CA

Press Releases and News Clips

NGEE Arctic Blog (http://ngee-arctic.blogspot.com/).

David Graham (ORNL) interviewed by Atmospheric Pictures (http://atmospherepictures.com/) for a potential photo-documentary on climate science in the Arctic. September 13, 2011.

A Trip to Alaska in Search of Future Climate Change:
http://newscenter.lbl.gov/feature-stories/2011/09/14/alaska-climate-change/

Appendix

Position Title:
Postdoctoral Research Associate, Controls and Consequences of Vegetation Dynamics in the Arctic

Project Description:
The Oak Ridge National Laboratory invites applications for a Postdoctoral appointment within the Climate Change Science Institute and the Environmental Sciences Division. The successful candidate will join a multidisciplinary team of investigators who are studying how permafrost degradation in a warming Arctic, and the associated changes in landscape evolution, hydrology, soil biogeochemical processes, and plant community succession, will affect feedbacks to the climate system. Research will focus on interactions that drive ecosystem-climate feedbacks through greenhouse gas fluxes and changes in surface energy balance. This position focuses on field studies that seek to quantify the biophysical and biogeochemical response of tundra ecosystems to permafrost degradation, ground subsidence, thermokarst formation, and changes in local hydrology. Interactions among vegetation dynamics, nutrient availability, soil water content, and net energy balance will be central components of this position. Plot studies at sites in Alaska will target important properties and processes involved in these interactions, as will the use of remote sensing or other approaches to characterize and extrapolate observations to that of the larger landscape. Results from these multiscale investigations will be used to evaluate and improve our mechanistic representation of critical processes in the Community Land Model (CLM) component of the Community Earth System Model (CESM).

Qualifications:
The successful candidate will have a Ph.D. with experience in one or more of the following discipline: Micrometeorology; terrestrial biogeochemistry; dynamic vegetation modeling; remote sensing and analysis of hyperspectral data sets; biophysics and energy balance; permafrost modeling and/or experimentation. Prior experience with managing large data sets and knowledge of computing infrastructure is highly desirable. A strong interest in the synthesis and integration of observational, experimental, and modeling research as part of a multi-disciplinary team is also desirable. Field research will require extended periods in Alaska. The successful candidate will have a proven record of translating research into high-quality journal publications. Applicants cannot have received the most recent degree more than five years prior to the date of application and must complete all degree requirements before starting their appointment.

Additional Information:
- Climate Change Science Institute
- Next Generation Ecosystem Experiment (NGEE-Arctic)
- Environmental Sciences Division

Technical Questions:
Questions regarding the position can be directed to Stan Wullschleger, wullschlegsd@ornl.gov. Please include the position title and number when corresponding.

Santonu Goswami
Postdoctoral Research Associate Candidate
Controls and Consequences of Vegetation Dynamics in the Arctic

Tuesday, September 20, 2011

Travel from El Paso, TX to Knoxville, TN
Flight arrival: 5:30 PM, TYS (rental car pick up at the airport)
Accommodations: Oak Ridge Doubletree Hotel

Wednesday, September 21, 2011

7:30 a.m.	Check-in at the Visitor Center	
8:00 a.m.	Stan Wullschleger to pick up from the Visitor Center	
9:00 a.m.	Discussion with Rich Norby, Colleen Iversen, David Weston, Jeff Warren and others	Building 2040, Room E208
9:45 a.m.	Set-up for Seminar	Building 1505, Room 189 (Ocoee)
10:00 a.m.	Seminar – "Monitoring Ecosystem Dynamics in an Arctic Tundra Ecosystem using Hyperspectral Remote Sensing and Robotic Tram System"	Building 1505, Room 189 (Ocoee)
11:00 a.m.	Discussion with Dan Hayes, Mac Post and others	Building 2040, Room E208
12:00 p.m.	Lunch	Building 5200, ORNL Cafeteria
1:00 p.m.	Discussion with Paul Hanson	Building 2040, Room E216
1:30 p.m.	Discussion with David Graham and others	Building 1505, Room 190
2:15 p.m.	Discussion with Gary Jacobs	Building 2040, Room E211
2:45 p.m.	Data Management Discussions (Santonu to present)	Building 2040, Conference Room E278
3:30 p.m.	Discussion with Bob Cook, Giri Palanisamy, Les Hook and Ranjeet Devarakonda	Building 2040, Conference Room E278
4:15 p.m.	Discussion with Liyuan Liang	Building 2040, Room E208
4:45 p.m.	Wrap-up discussion with Stan Wullschleger	Building 2040, Room E212
6:30 p.m.	Dinner	Location TBD

DOE Workshop: Strategies to Promote Integrated Experiment-Model Approaches to Terrestrial Ecosystem Study

Organization committee:

Yiqi Luo, University of Oklahoma
Stan Wullschleger, ORNL
Margaret Torn, LBL
James Randerson, University of California, Irvine
Dennis Baldocchi, University of California, Berkeley

Background

Experiment/observation and process modeling are two foundational approaches to scientific inquiry. Observations record in data the states of ecosystems at the time when the measurements were made. Process modeling represents our theoretical and/or conceptual understanding of the mechanisms that operate in a system. A model should be continuously evaluated and improved as we advance our understanding based on accumulated empirical observations of the real system. Theory- and model-guided experiments and observations are often most productive for scientific discovery and process understanding. Iterative integration of models with experiments using formal methods rather than ad hoc activities is a powerful way of combining theory and empiricism for science advance.

Integrated experiment-model approaches are urgently needed to improve Earth system modelling. Process-oriented models are a primary and defensible tool for the projection of future states of ecosystems and climate in the Earth system in response to global change. However, current model intercomparison and data-model comparison continue to indicate large uncertainties in predicted carbon cycle-climate change feedback. To reduce uncertainties in model predictions, it is essential to constantly evaluate and improve models against experimental data and vice versa.

While explicit model-experimental interactions have not been common, data-driven modeling research is currently very active for evaluation and improvement of land process models. The most noticeable are benchmark analysis and data assimilation. The benchmark analysis allows the evaluation of model performance against observations and data model products. Data assimilation infuses data into models via parameter estimation, evaluation of model structure, and uncertainty analysis. Although the data assimilation technique has been proposed to guide network design for data collection in a few studies, the application of data-driven modeling has not been extensively explored in the context of experiment-model integration.

Overall, the idea about integrated experiment-model approaches has been discussed in workshops and publications (e.g., Hanson et al. 2008 DOE report; Luo et al. 2011 *GCB*). Even so, experimental scientists and modelers mostly work in communities separated by communication barriers. Experimental scientists have often viewed modeling activities as an afterthought of data collection, resulting in experimental data that are not readily assimilated by modeling efforts. Conversely, modeling efforts have not effectively communicated results to the field science community nor helped guide data collection aside from gross identification of areas that are not adequately represented in models.

To shift the philosophy and culture of research toward these integrated approaches, we need to explore and develop a variety of strategies to encourage integrated experiment-model

research.

Workshop objectives

The general goal of the workshop is to promote a new philosophy of having modeling activities to guide field research activities, which in turn informs modeling activities. This *a priori* and iterative process of information exchange between the experiment and modeling communities should maximize the intellectual investments and result in high quality predictive models and more scientific discovery.

Discussion topics for the workshop

This workshop will discuss topics related to models informing experiments, experiments informing models, and their integration. Sample questions are:

How can models be used to inform experiments and observations?

1. *Site selection*: How can models help identify where experiments and observations should be conducted? How to identify hotspots? How to maximize likelihood of finding meaningful and significant results? How many environments are needed in a large system model to represent a given landscape?
2. *Experimental treatments*: What do models tell us about the rates and magnitudes of process changes in response to a given environmental variable? Should we conduct single or multi-factor studies? If multi-factor studies are warranted, which ones of the factors should be studied? What should the level of a particular treatment be?
3. *Processes to measure*: How can models help prioritize a suite of processes to measure to the exclusion of others? How can we use models to conduct sensitivity test and uncertainty analysis on those measurements?
4. *Experiment duration*: How can models help identify duration an experiment should last? Can models suggest lags or thresholds that one needs to be prepared to capture?
5. *Scientific serendipity*; How can we leave the door open enough for understanding new processes? How can we avoid experiments becoming too driven by models?

How can experimental and observational results be used to inform the models?

1. *Benchmarking*: How can we benchmark models against data so as to evaluate model performance and identify processes potentially missing in models
2. *Data assimilation:* How can data assimilation improve models? What are the most effective techniques of data assimilation for ecological research? How to prepare data to facilitate ingestion of multiple streams of data into a data assimilation system? How can we provide enough computation facilities to permit parallel computing for data assimilation at regional and global scales?
3. *Process representation*: How can we identify needed new algorithms to do better than the black box?
4. *Extrapolation*: How many sites are required to allow “scaling”?

What are the effective strategies to promote experiment-model integration?

1. *Model deficiencies*: How can we effectively communicate the model deficiencies from modeling to experimental communities in language so that field scientists can design new experiments or conduct/continue observations to fill knowledge gaps and test model

predictions?

2. *Data model product*: What kinds of data model products can we generate from experimental and observational results to be directly used by the modelers for benchmarking and data assimilation? How can we generate those data model products?
3. *Information exchange*: Why is there often a significant lag between the experimental and observational discoveries and the inclusion of new information in models?
4. Site idiosyncrasy: How do we incorporate mechanistic and process models/observations into large models given local importance that might not be represented or drivers in large scale process?

The above questions might be used to shape the workshop. We will use case studies as appropriate to explore what would be most effective strategies to promote the integrated approaches. The case study might involve the DOE's Next Generation Ecosystem Experiment (NGEE) in the Arctic, ORNL's SPRUCE, the FACE projects, the AmeriFlux network, and others. The FACE projects and AmeriFlux have had many *ad hoc* modeling activities. The Arctic NGEE and SPRUCE projects have already gone through several iterations of model-experiment interactions and probably can further benefit from more in-depth discussion in a workshop.

Third Santa Fe Conference on Global and Regional Climate Change

Santa Fe, New Mexico, October 31 -November 4, 2011

Sponsored by Los Alamos National Laboratory Center for Nonlinear Studies, Energy Security Center, and Institute of Geophysics and Planetary Physics

Co-Sponsored by Brookhaven National Laboratory, Oak Ridge National Laboratory, University of Alaska International Arctic Research Institute, New Mexico Consortium, and American Meteorological Society

ABSTRACT SUBMISSION DEADLINE:
Sept 12, 2011 (to be considered for oral or poster presentations)
and Oct 17 (poster presentation only)

Submit abstracts (pdf or word) by email to chylek@lanl.gov
with a copy to dubey@lanl.gov

This conference will focus on climate change and variability from observational, theoretical, and modeling perspectives. Special emphasis will be on climate forcing and feedbacks on global and regional scale, including polar region. Contributions based on conventional as well as non- conventional views on climate change and variability are welcome. The Conference will consist of invited and contributed oral presentations and posters. Presented papers will be considered for publication in a special section of the Journal of Geophysical Research.

This conference will be the third in a series of conferences held at five years intervals. The purpose of these conferences is to bring together researchers with varied interpretations of current and past global and regional climate change, to present the latest research results (observations, theory, modeling and analysis), and to provide discussion opportunity to top climate experts and students. The first Conference took place in Halifax, Nova Scotia, in 2001, the second in Santa Fe, NM, in 2006. Each Conference was attended by 100-130 researchers from over 15 countries.

For more information concerning the Santa Fe 2011 Conference, to submit an abstract and to register, please, visit our website at http://cnls.lanl.gov/climate

Program Committee:
Petr Chylek, Chair (LANL)
Stephen Schwartz (BNL)
Christopher Folland (Hadley Centre, UK Met Office)
Muyin Wang (Univ. of Washington)
Glen Lesins (Dalhousie University)
Manvendra Dubey, Co-Chair (LANL)
Cathy Wilson (LANL)
Michael Cai (LANL)
Nick Hengartner (LANL)