Written Public Comments on the *Strategic Plan for the U.S. Climate Change Science Program*
Chapter 14: International Research and Cooperation (p 155-161)
Comments Submitted 11 November 2002 through 18 January 2003
Collation dated 21 January 2003

Page 155, Chapter 14: This chapter is a good start, but unfortunately provides only a sketchy overview of international organizations which support and sustain climate research and policy analysis.

GERALD GEERNAERT, LANL

Page 155, Chapter 14: International collaboration and cooperation on the SI prediction and application problem can be a key contributor to the international goals of the U.S. climate change science program.

An example is provided by the training institute on Climate Variability and Food Security mentioned by panel member H.Virgi (START) during the panel discussion on the International Chapter. This institute is being coordinated by IRI and is building capacity and developing research methodologies on the use of downscaled climate information for adapting agricultural strategies to enhance food security in developing countries. We emphasize the combined aspect of training and collaborative research and development in methodologies for using climate information. The IRI, by generally focusing on regions with strong predictability on seasonal to interannual timescales, is able to participate in methodological development for use of probabilistic climate information, that can provide general lessons for using climate information in other contexts, such as seasonal predictions and global change projections for the U.S. Thus developing such collaborations and research methodologies provides a learning opportunity for adaptation to climate information (p156, line 20), and this type of work could be referenced in this context.

The IRI has also led capacity building and research methodology development in the more specific climate science issues of downscaling of seasonal to interannual climate predictions. These activities blend regional climate science expertise with international perspectives (p156, line 24), and could be mentioned in this context. Downscaling global change scenarios for mid-latitude regions like North America will require accurate representation of the climate of tropical regions, because of the tropical-extratropical inter-connectivity of the climate system, encouraging investment in an international community of climate expertise.

It may be valuable to seek as wide input as possible from the stakeholder oversees international institutes at the earliest time. Developing countries may be particularly concerned with predicting droughts and floods on a year-to-year basis, and be more motivated to enhance data availability when it contributes to this immediate goal (p155, line23-24), while such data also can contribute to the global change goal. As mentioned in the chapter (p159, line 37-41), the IRI is hosted by the U.S. and is an institute that emphasizes cooperation with developing countries. This has led the institute to develop a number of partners on the international stage and this network (and associated experiences in capacity building and research methodology development) may prove to be of value to the international program.

IRI, STEPHEN E. ZEBIAK AND STAFF

Page 155, Chapter 14: There is frequent reference to the US's cooperation and participation with the international community and established international research programs. Some of the most frequently mentioned such programs are the World Climate Research Program (WCRP) and Global Atmospheric Watch (GAW). What is not acknowledged is the already extensive participation by US scientists in theses particular projects. This should be done to demonstrate the already strong international cooperation we have at this time.

References:

NRC, 1996. National Research Council, Panel on Aerosol Radiative Forcing and Climate Change, *A Plan for a Research Program on Aerosol Radiative Forcing and Climate Change* (Washington, DC: National Academy Press).

Karl, T.R. et al. 1999. Adequacy of Climate Observing Systems. National Research Council Commission on Geosciences, Environment and Resources. National Academy Press, Washington, DC.

NOAA/CMDL

Page 155, Chapter 14: First Overview Comment: The term uncertainty is utilized without any clear definition of the term. As this is the main theme of much of the report, it portrays an incorrect image of climate science that everything is uncertain and that no one can or should act until the uncertainty levels are diminished. It then goes on to lay out a high risk strategy of waiting until an unknown day for uncertainties to be reduced before any action can be taken. The risks are high as the lifetime of greenhouse gases in the atmosphere is long and mitigation efforts will not take immediate effect, unlike some other pollutants. This also ignores decades of research by US institutions and others that have reduced uncertainty levels on a wide range of climate issues. A guide to the uncertainty levels is clearly included in the IPCC's Third Assessment Report.
We would therefore strongly recommend that the report and the research efforts around it not revolve around reducing uncertainties per se, but rather provide new and useful information for policymakers. Finally, to infer that policymakers must have 100% certainty before taking any decisions is not consistent with the current situation. As the report notes, there are many uncertainties surrounding terrorism, but the government is not waiting for 100% certainty before taking preventative measures such as increasing security in airports.

JENNIFER MORGAN, WORLD WILDLIFE FUND

Page 155, Chapter 14: This is a troubling chapter. It is largely a listing of existing partnerships and various acronyms involved in international programs. A global program needs far more than this! We are faced with serious issues with regards to observing system decay, data access policies, access to international graduate students (tightened visa rules, ITAR requirements, etc.) and collaboration that are not addressed in this chapter. Instead the chapter takes a narrow focus on existing structures, rather than the challenges of the future. For example, the "International Framework" on page 157 is a listing of joint satellite missions. However, NASA is moving towards explorer-class missions for processes studies and relying on NPOESS for systematic measurements. Where do international partners fit? Although there has been some progress along these lines with ocean altimetry, it is far more complicated than it used to be to forge international partnerships. As another example, where is US support for US scientists to work with international satellite data? This chapter needs significant revision.

MARK R. ABBOTT, OREGON STATE UNIVERSITY

Page 155, Chapter 14: 1. International collaborations should be fostered to as great a degree as possible; care should be taken not to duplicate the network/monitoring devices established by other countries. Coordination of establishing new monitoring sites needs to be done with other countries such that they help share the costs where possible.

2. The US must take responsibility for its own greenhouse gas emissions and reduce them accordingly; to just "support transfer of energy and sequestration technologies (p. 160, line 28) without the US doing its part will not be enough. There does not seem to be any recognition that international collaboration will be hindered unless the US does its share in reducing emissions. Why should we expect our allies to aid us in military missions when we do not give them help with reducing emissions that we are generating in disproportionate amounts to our population?

3. Carbon cycle, hydrological cycles must be assessed on global basis.

4. Sustainability needs to be the focus of international research efforts; increased emphasis should be put on energy, transportation, and agriculture.

5. International efforts should include capacity building by supporting training of scientists in research areas related to developing sustainability and managing global change.

6. Plan for international collaboration would be strengthened if it clarified it support for IPCC.

- A. CCSP must not become an alternative effort to IPCC or a competitor
- B. Effort needs to be to refine rather than refine the work of IPCC.
- C. US could focus increased effort on regional impacts while continuing involvement in and participation with IPCC consistent with earlier efforts.

7. Co-operative effort should be made to identify and assess international opportunities for mitigation

8. Identify and compare costs of climate change impacts, adaptation and mitigation at global, regional and local level—many may be possible only at global level, i.e. reduction

of gases, carbon cycle, etc.; cost of not doing anything is apt to be very high for countries with limited geographical options for food production

9. There appears to be no agency commitment to international efforts; this must be added and built into strategy for dealing with climate change.

1. Efforts to assist Third World countries with assessment need to be followed up with efforts to help them manage.

Add more specificity to how the Global Climate Observing plan is to be implemented.

Leadership from U.S. is needed; need to define mechanism for how standards for observations will be developed

STELLA M. COAKLEY, OREGON STATE UNIVERSITY

Page 155, Chapter 14: Regional Cooperation, page 160, line 6: The importance of building upon ongoing ocean subsurface flux measurements should be mentioned (e.g., Arctic Subsurface Ocean Fluxes, ASOF; Nansen/Amundsen Basin Observing System, NABOS; Canadian Basin Observing System, CABOS). Insert:

International cooperation is essential for capitalizing upon opportunities presented by ongoing programs for the measurement of subsurface ocean fluxes in high latitudes, where thermohaline forcing is strong. In particular, the Arctic Ocean and its peripheral seas are key parts of the global climate system. There is a need for an observationally based assessment of the ocean circulation, water mass transformations, and their mechanisms in the high-latitude oceans. Moored sensors in the Arctic Ocean and its surrounding seas, such as those planned for the NABOS/CABOS program, can also provide crucial information on oceanic changes that may have global implications.

GUNTER WELLER, ET AL, UNIVERSITY OF ALASKA FAIRBANKS

Page 155, Chapter 14: Overview Comment - This Chapter is full of generalities, but provides no recommendations on CCRI/CCRP actions to meet specific program objectives or intent. The verbs used on pp160 lines 35-41, 161 lines 1-12 : "intends to ... encourage, promote, enhance, work closely" ... are gratuitous and essentially meaningless in the context of achieving near term results. International collaboration is essential for progress in reducing uncertainties, and some explicit actions would appear appropriate. In the context of most immediate concern to us, in the Arctic, we suggest for example CCRI support for and participationn in "joint actions ... to improve and augment the global climate observation system; research to reduce significant uncertainties in climate science; and efforts to promote the development and dissemination of new technologies to address the climate issue", and development of a U.S.-Russian agreement on cooperation in world ocean research, as agreed to at the Dec 5 2002 Regular Session of the US-Russian Joint Committee for Science and Technology. We further note, for example, efforts by the International Arctic Research Center to provide US scientists access to Japan's Earth Simulator. We cite these only as examples, and urge discussions with senior State Department representatives to assess opportunities for specific actions.

GUNTER WELLER, ET AL, UNIVERSITY OF ALASKA FAIRBANKS

Comments on Chapter 14

Page 155, Chapter 14: This chapter needs to acknowledge the role of the Integrated Global Observing Strategy Partnership (IGOS-P). It forms the overarching structure in relation to observations for many of the international organizations that are discussed.
JOHN TOWNSHEND, UNIVERSITY OF MARYLAND

Page 155, Chapter 14: The Pew Center encourages broad cooperation with the international community as it pursues its research goals. The global nature of climate change necessitates monitoring and data collection and exchange among many nations. The scientific, economic, and policy implications of climate change for the U.S. cannot be fully assessed without consideration for the human component of climate change in other countries. Furthermore, many of the existing limitations in global monitoring are due to inadequate resources in other nations, particularly developing nations. Therefore, an important component of increasing the U.S. understanding of climate change is to enhance the capacity of other nations to assist in achieving international research goals.
VICKI ARROYO AND BENJAMIN PRESTON, PEW CENTER ON GLOBAL CLIMATE CHANGE

Page 155, Chapter 14 International Research and Cooperation: How about an international exchange program for post-docs and scientists that would bring foreign scientists to the US and send US scientists abroad for climate science exchanges? This would help the US learn lessons from successful programs in other countries (especially modeling and assessment programs) and would help scientists from other countries understand US perspectives on climate science and policy. If this were billed as a prestigious program, it could also draw talented people from other fields into climate science.
DIAN SEIDEL, NOAA/ARL

Page 155, Chapter 14: New Zealand welcomes the opportunity to comment on the Draft Strategic Plan for the Climate Change Science Programme.

The international component of the Draft Strategic Plan (Chapter 14) and the December workshop focused on US participation in the major international programmes such as WCRP, IGBP, IHDP, and Diversitas. New Zealand is an active participant in these and in initiatives within the programmes (e.g. CLIVAR, JGOFS, SOLAS). The workshop breakout session on international co-operation consisted of selected external groups describing their own research programmes. It would be useful if any future sessions could also explore specific collaboration within existing and new initiatives, and allow time for discussion.

New Zealand welcomes the commitment of the US to work through international programmes and enhance the effort with specific international partners. Bilateral activities that have relevance and benefits for the New Zealand region (New Zealand, the SW Pacific, Southern Oceans and Antarctica) are based on the importance of the region in the global climate system, i.e. low sources of pollutants, island states in large ocean areas and sparse data gathering networks. Work should complement our aims of observing, understanding and predicting the seasonal and longer-term climate of the region. Specific areas for discussion include:

- Extending and intensifying observations of climate related parameters, particularly in data sparse regions such as the Pacific and Southern Ocean.
- Developing regional climate models that have sufficient skill and precision to help developing counties in their planning will also be of great benefit. This is particularly relevant to the vulnerable small island states of the Pacific.
- Validation of (satellite) remote sensing of greenhouse gas and climate parameters.
- Climate impacts on natural hazards in the region.
- Climate impacts on biodiversity.

New Zealand recognizes the importance of the global benefits of US investment in climate science and in technology to create solutions to improving energy efficiency, reducing emissions (sequestration), and realizing new energy sources. New Zealand is committed to partnering these efforts and welcomes the opportunity to work with the US scientific community in the above areas.

NEW ZEALAND

Page 155, Chapter 14: Build on existing and available information and coordinate with ongoing processes, including:

- the Intergovernmental Panel on Climate Change and the UNFCCC;
- the Millennium Ecosystem Assessment;
- relevant international scientific and research bodies (e.g., Diversitas, International Council for Science, the Scientific Committee on Problems of the Environment); and
- relevant committees and rosters of experts under other multilateral environmental agreements (e.g., the Convention on Biological Diversity, the Ramsar Convention on Wetlands of International Importance and the Convention on Migratory Species).

STAS BURGIEL, DEFENDERS OF WILDLIFE

Page 155, Chapter 14: Section 3 is embarrassingly narrow, weak, and incomplete. As just one example, the extensive bilateral programs of USAID are not described. At the recent COP-8 meeting in New Delhi, USAID distributed a summary of its climate change related programs in India alone, which is an impressive list. These sorts of initiatives are an essential part of the story.

THOMAS J. WILBANKS, ORNL

Page 155, Chapter 14:
First Overview Comment: Chapter 14 should stress that international cooperation in "climate science research" needs to address research that applies climate science to other domains (e.g., public health). This might require a change in terminology.

Comments on Chapter 14

Second Overview Comment: Chapter 14's focus on "education, training, and capacity-building" should include organizations that apply climate science to other domains (e.g., public health). The science community and the end-user community have distinct needs.

Third Overview Comment: Chapter 14 should stress the need for better sharing of information across US, bilateral, multilateral, and global-scale programs in global change research. This will help enable interdisciplinary studies.

Fourth Overview Comment: Chapter 14 should call for an examination of the financial and institutional barriers that limit the networking of available information. Some international products that were supported in part by U.S. agencies have no explicit connection to information systems for the US Global Change Research Program.

JOAN L. ARON, SCIENCE COMMUNICATION STUDIES

Page 155, Chapter 14: Reference to International Collaboration is made at several points in the document, but at least once oit is called Key Linkages. A decision will have to be made if the international collaboration opportunities should be discussed in individual paragraphs where they are appropriate or if a potentially more repetitive approach should be used whereby all items are synthesized in a separate Chapter as it is now. Material should be moved accordingly. In general, most potentially useful international programs have been covered somewhere in the text. If all such references are collected in their own Chapter, I would suggest structuring the items as follows: 1. Cooperation to obtain global and regional data for monitoring and validation of hypotheses (including modeling). 2. Cooperation with regard to research on process studies that require major resources or multiple model efforts to obtain future or historic climate simulations (multi-model approach) and participation in future IPCC efforts. 3. Cooperation on dissemination of results from global change research (as in START or IAI) and bi- or multi-lateral agreements.

LYDIA DÜMENIL GATES, LBL

Page 155, Line 6-13: The early climate research was global, not local. See Manabe and Wetherald 1967.

RONALD STOUFFER, GFDL/NOAA

Page 155, lines 19-20: There should be a major section in this chapter on IPCC and international assessments—and the US commitment to them.

MICHAEL MACCRACKEN, LLNL (RETIRED)

Page 155, Line 30: **CHALLENGES**

Insert: At present not all data are integrated, making them difficult for policymakers – Etc…

GARY D. SHARP, CENTER FOR CLIMATE/OCEAN RESOURCES STUDY

Page 156:

list in-situ international programs such as:

Comments on Chapter 14

ARGO
TAO/TRITON/PIRATA
Repeat Hydrography
MARTIN VISBECK, COLUMBIA UNIVERSITY

Page 156, Lines 4-6: The sentence in lines 4-6 of page 156 is awkward, as written.
GERALD GEERNAERT, LANL

Page 156, line 6: add after word "cooperation" the words "and to participate in appropriate internationally-coordinated programs".
W. LAWRENCE GATES, LLNL

Page 156, line 9: The language about "US climate science research" suggests, first, a focus on climatology and, second, scientists studying the natural world (physics, chemistry, biology). This should also directly address research that applies climate science to other domains (e.g., public health).
JOAN L. ARON, SCIENCE COMMUNICATION STUDIES

Page 156, lines 13-14: There should be a major description of the international framework involving WCRP, IGBP, IHDP, CEOS, etc. and how the US will be undertaking scientific efforts within this framework rather than going it alone.
MICHAEL MACCRACKEN, LLNL (RETIRED)

Page 156, lines 15-17: The exchange of information internationally needs to be linked to Chapter 12 (Grand Challenges in Modeling, Observations, and Information Systems), Chapter 13 (Reporting and Outreach), and Chapter 15 (Program Management and Review). This will help enable interdisciplinary studies.
JOAN L. ARON, SCIENCE COMMUNICATION STUDIES

Page 156, lines 17-19: The grouping of "the science and end-user communities for climate-related satellite observations" should not blur the distinct needs and roles of the science community and the end-user community.
JOAN L. ARON, SCIENCE COMMUNICATION STUDIES

Page 156, Line 22: In section 1, quality control over data should be added to either the 6th or 7th bullets.
GERALD GEERNAERT, LANL

Page 156, Line 27: Section 2 is embarrassing. It represents mainly a catalog of NASA and other satellite programs designed to support climate research and monitoring. What happened to input from NOAA and DOE? The authors also need to consult the International Programs Division of NSF for input.
GERALD GEERNAERT, LANL

Comments on Chapter 14

Page 156, lines 33-34: The focus on "education, training, and capacity-building" should include organizations that apply climate science to other domains (e.g., public health).

JOAN L. ARON, SCIENCE COMMUNICATION STUDIES

Page 157, line 1: replace word "cannot" with "can"

W. LAWRENCE GATES, LLNL

Page 157, line 6: **(57-ES)** You can take advantage of what's in the document by saying it this way:

> A few illustrative examples, in addition to those mentioned in the "Linkages" sections of the previous chapters, include the following:

HP HANSON, LANL

Page 157, lines 6-21: There are much better examples of international **collaborations**, where researchers and satellite agencies have worked together to produce real climate data products and/or key improvements in satellite analysis methods: the International Satellite Cloud Climatology Project (ISCCP), the Global Precipitation Climatology Project (GPCP), and the International TOVS Working Group (ITOVS).

WILLIAM B. ROSSOW, NASA GODDARD INSTITUTE FOR SPACE STUDIES

Page 157, lines 12-14: Correct the spelled-out version of AMSR-E to either "Advanced Microwave Scanning Radiometer for EOS" or "Advanced Microwave Scanning Radiometer for the Earth Observing System (EOS)". Also, spell out HSB as "Humidity Sounder for Brazil".

CLAIRE L. PARKINSON, NASA GODDARD SPACE FLIGHT CENTER

Page 157, lines 21-41: In order to be full partners we need to be organized on the US side to do this.

ANTONIO J. BUSALACCHI, EARTH SYSTEM SCIENCE INTERDISCIPLINARY CENTER (ESSIC), U. MARYLAND

Page 157, lines 21-40: Information about global-scale international research programs should be better linked to US research programs. This issue requires linkage to Chapter 12 (Grand Challenges in Modeling, Observations, and Information Systems), Chapter 13 (Reporting and Outreach), and Chapter 15 (Program Management and Review).

JOAN L. ARON, SCIENCE COMMUNICATION STUDIES

Page 158, lines 1-8: The issues about better sharing of information apply to bilateral programs in science and technology as well as global-scale programs. This issue requires linkage to Chapter 12 (Grand Challenges in Modeling, Observations, and Information Systems), Chapter 13 (Reporting and Outreach), and Chapter 15 (Program Management and Review).

JOAN L. ARON, SCIENCE COMMUNICATION STUDIES

Page 158, Line 2: Section 3 is incomplete. The authors allude to "efforts underway" but give no examples. Where are the descriptions of contributions from USAID, joint programs with other donor aid organizations (including the World Bank), and/or support via NGO's, among others?

GERALD GEERNAERT, LANL

Page 158, line 3ff: This is so vague as to be useless.

MICHAEL MACCRACKEN, LLNL (RETIRED)

Page 158, line 5 of Chapter 14: on 25 October New Zealand and the United States announced their intention to enhance bilateral cooperation on climate change. 'New Zealand' should therefore be added to the list of countries with whom the United States is undertaking bilateral cooperation on climate change.

Page 158, lines 26-35: The issues about better sharing of information apply to multilateral programs in science and technology as well as global-scale programs. This issue requires linkage to Chapter 12 (Grand Challenges in Modeling, Observations, and Information Systems), Chapter 13 (Reporting and Outreach), and Chapter 15 (Program Management and Review). Some products that were supported in part by U.S. agencies have no explicit connection to information systems for the US Global Change Research Program (and may be stored, for example, on only one website in the UN system). There should be an examination of the financial and institutional barriers that limit the networking of available information.

JOAN L. ARON, SCIENCE COMMUNICATION STUDIES

Page 159, line 1: change "Program" to "Programme"

W.L. GATES, LLNL

Page 159, line 1: Change "Program" to "Programme".

MICHAEL MACCRACKEN, LLNL (RETIRED)

Page 160: **The chapter states (p. 160):**

> Climate modeling capabilities have improved dramatically in recent years and can be expected to continue to do so. As a result, U.S. scientists are now able to model Earth system processes and their coupling on a regional and global scale with increasing precision and reliability.

This statement is inconsistent with comments made about modeling reliability in Chapter 1. For example, Chapter 1 states (p. 7):

> However, at this point model projections of the future regional impacts of global climate change are often contradictory and are not sufficiently reliable tools for planning.

We are particularly concerned about the reliability of model projections of the future regional impacts of global climate change.

EDISON ELECTRIC INSTITUTE, FANG/HOLDSWORTH

Comments on Chapter 14

Page 160: line 4**: Insert:** There are numerous Ocean Science Collaborations, around the Globe, usually stimulated by common interests of the scientists involved, ranging from animal behavior and biodiversity, to living resource management and ecosystem functioning. The relative losses of regional ocean ecosystem research funding as Climate Change research has taken over the mainstream justification for routine observations, has left many regions with mere shadows of previously important coordinated physical and all-important ecological monitoring and research efforts, that allow proactive System Management.

An example is the demise of the USA's most advanced, and information rich ocean ecosystem science, the California Cooperative Ocean Fisheries Investigation (CalCOFI) Program. CalCOFI was initiated based on the insights of two senior ocean ecologists, Ollie Sette and Ehlbert Ahlstrom, who in the early 1940s recognized the role of natural ocean variabilities in the dynamics of coastal upwelling ecosystems. Their efforts eventually initialized international training programs in fish larval identification, and eventually the decision by many nations and regions e.g., the Benguela Ecology Program, Peruvian/Chilean ocean fisheries studies, and other coastal upwelling regions to do cooperative monitoring and process studies that have helped explain the coming and going of various components of regional fisheries ecosystems.

This, in turn led FAO and IOC to initiate their collaborations in fisheries oceanography-related research, and expanded into the Indian Ocean via the internationally mediated development of the western Indian Ocean's high seas fisheries, involving island communities, and various partners. The result has been a remarkable bump upward in ocean observations, with multiple users, which in the long run will contribute to Climate studies.

By turning such multi-use observing programs off, the world is much worse off than before, as the day-to-day questions about regional ecosystems cannot be answered, and decisions go unmade - and Climate Scale information become filled with data voids, and realistic questions go unanswered.

Today, much of the innovation in the living resources sciences is being made through the efforts of private Foundations, and as described previously, such Programs as Sloan and Packard Foundations' TOPP (Tagging of Pacific Predators) project – under the auspices of CoML. These programs generate the new tools of use for connecting ocean variability with species responses.

The recent adoption by the Global GLOBEC – of CLIOTOP (Climate and Oceanography, Tagging Ocean Predators) program's collaborative multi-ocean basin activities will lead to another generation of interactive researchers, and Global insights, long overdue. It is not unreasonable to expect that from a few years to decades of such studies and information integration will not only help Climate Science, but may actually lead the way to understanding more realistic scale processess, and generate more credible scientific conclusions than are available from extant ocean climate modeling efforts. The growing insights from a few hundred animals of several species have been more than just interesting. These animals can and do tell us a lot more than any other source about the ocean's dynamics on many time and space scales compared with almost any active sensing system. The plans to release thousands of animals, involving many species, will quickly help us revise our concepts of ocean dynamics. When their observations are analyzed within proper instrumental and other information contexts, these studies will provide many researchers with opportunities to verify, and validate their now-cast and forecast modeling efforts.

Real-time dynamics are the first questions needing answers, and eventually Climate Dynamics, and the related forcings, will 'fall out' of those insights. This prospect, alone, justifies these efforts to deploy as many living sensors, as possible.

And, just as important as any option, and clearly missing from any of the Plan: The recruitment of cooperative fishing people into the global observation system will not only help with enhancing the in situ instrumental records, but the 'anecdotal' observations that fishermen and seafarers make in their logbooks can help clarify related biological and environmental patterns and processes. All their potential contributions will help utilize all the ocean observation sets in more applications, including resource management, weather forecasting, and eventually Climate Dynamics, as these are inter-related.

Final General Comments: I found the workshop, and opportunity to review the document stimulating, and worth the effort. There are so many vested interests, working to obtain funding for ongoing or possible activities, that many of the more obvious missing elements that could help resolve relevant Climate Change information needs, and real-world applications get lost in the focus upon Carbon Cycle, and lesser impact issues.

Observations and synthesis are most important, and all sources of such efforts need to be addressed.

GARY D. SHARP, CENTER FOR CLIMATE/OCEAN RESOURCES STUDY

Page 160, line 5: add a sentence
The Arctic Climate Impact Assessment (ACIA), conducted under the auspices of the Arctic Council and IASC is assessing the consequences of climate change on the circum-Arctic environment, its resources, economy, and peoples.

GUNTER WELLER, ET AL, UNIVERSITY OF ALASKA FAIRBANKS

Page 160, Line 7: Section 6 mentions nothing about training programs, supported by the USAID, World Bank, and NGOís in the developing world on issues such as climate policy, carbon taxes, environmental technologies, environmental law, etc., which are relevant to the international agenda to reduce global greenhouse gas emissions via various mechanisms.

GERALD GEERNAERT, LANL

Comments on Chapter 14

Page 160, Line 11: Add sentence "The CCSP aims to build upon current relationships with international organizations that address global climate change as well as create relationships with new international partners. The CCSP will be careful not to conduct research that has already been conducted by an international partner as the CCSP aims to cooperate with rather than compete with the international community."

EESI ,CAROL WERNER AND JR DRABICK

Page 160, line 18: change "is" to "are"

W.L. GATES, LLNL

Page 160, line 21, append the following:
The continued expansion of the Earth observing systems to remote and harsh environments will require that more attention be paid to sensor stability, remote calibration, and traceability of the measurements to widely accepted national and international standards.

NIST, HRATCH SEMERJIAN

Page 160, Lines 28–29: "*Support transfer of energy and sequestration technologies to developing countries to promote sustainable development while limiting their greenhouse gas emissions growth;*"

This sentence reinforces the false, but popular, notion that any technology can be transferred from here to a developing country and work without a hitch. Without input from the recipient country, technology transfer often does not work, and what is worse, the recipient does not appreciate the patronizing attitude. What is necessary is "technology cooperation", a two-way partnership.

To the extent that "technology cooperation" and the other international components of the CCSP are actually science-based diplomacy, the Department of State needs to be significantly involved because doing so will signal to other countries that the U.S. considers global climate change to be an important international concern of high priority; however, not only is the Department of State not involved in this effort (as far as I can tell), it lacks, in any case, the scientific capacity to do so meaningfully. Both of these things must be changed for international research and cooperation on global climate change to succeed.

DAVID L. WAGGER, SELF

Page 160, line 36ff: It would be nice to have a mechanism for keeping track of all of these, and having this posted on the Web, etc.

MICHAEL MACCRACKEN, LLNL (RETIRED)

Page 160 line 40 Argos floats measure the properties in the upper 2000 meters of the water column, not the upper 200 meters.

WILLIAM B. CURRY, WOODS HOLE OCEANOGRAPHIC INSTITUTION

Comments on Chapter 14

Page 161, Line 2: add after line 2, "Data collected on the Global Climate Observing System must be made available to all seeking to use it.

STELLA M. COAKLEY, OREGON STATE UNIVERSITY

Page 161, Line 3: Suggest replace "encourage" with "Fund"

STELLA M. COAKLEY, OREGON STATE UNIVERSITY

Page 161, Line 10: Give more information about "Global Environmental Change and Food Systems" (GECAFS), e.g. "GECAFS is a new research project investigating the vulnerability of human food systems to and interactions with gloval environmental change. It involves a wide range of social physical and biological scientists (www.gecafs.org). This type of international project holds the best home of preventing and alleviating food shortages.

STELLA M. COAKLEY, OREGON STATE UNIVERSITY

Page 161, Line 13: Add: Support increased participation of U.S. scientists in international research projects through agencies currently funding global change research

STELLA M. COAKLEY, OREGON STATE UNIVERSITY

Page 161, Line 14: add: "Need effort for development of young scientists both in the U.S. and in international locations that are able to work with the interface of physical and biological data"

STELLA M. COAKLEY, OREGON STATE UNIVERSITY