NASA ADVISORY COUNCIL

Earth Sciences Subcommittee

October 10, 2014

Teleconference

MEETING MINUTES

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Steven Running, Chair

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Lucia S. Tsaoussi, Executive Secretary

Table of Contents

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Zantech IT

Friday, October 10, 2014

Opening Remarks/Meeting Introduction

Dr. Lucia Tsaoussi, Executive Secretary of the Earth Science Subcommittee (ESS) of the NASA Advisory Committee (NAC), began the meeting by calling roll of the ESS members.

Earth Science Division Research Performance for Fiscal Year 2014

Dr. Tsaoussi explained that the teleconference had been called with the purpose of evaluating NASA's Earth Science Division (ESD) under the Government Performance and Results Act (GPRA) Modernization Act (GPRAMA). GPRAMA is a tool to improve the efficiency of all Federal agencies. As part of the GPRAMA process, NASA's Federal Advisory Committee Act (FACA) committees and subcommittees provide required "expert external review" in evaluating the Agency's work. Therefore, ESS was being asked to evaluate how ESD has demonstrated progress in meeting key science objectives in context of the resources invested.

The 2014 GPRAMA review was to cover events in Fiscal Year 2014 (FY14). All activities considered must have been fully or partly funded by NASA, and results should have been reported by a peer-reviewed journal or some other noncontroversial, reliable source. ESS was to provide an official vote on each criterion, along with supporting text that identified any particularly noteworthy items.

The Science Mission Directorate (SMD) criteria for GPRAMA voting are as follows:

- Green – Expectations for the research program fully met in context of resources invested.
- Yellow – Some notable or significant shortfalls, but some worthy scientific advancements achieved.
- Red – Major disappointments or shortfalls in scientific outcomes, uncompensated by other unusually positive results.

Before the teleconference, Dr. Tsaoussi had sent ESS members a background document containing programmatic accomplishments organized into six focus areas. One of the GPRAMA tasks would be to edit selected accomplishments into a summary report.

Focus Area: Climate

Dr. Raymond Schmitt began the discussion of the climate focus area by noting that the Aquarius mission has been going extremely well with no problems. The data have been fantastic and many papers came out in July and August. The mission has provided information related to hurricane prediction, is doing high-resolution studies, and has revealed crucial facts about sea surface salinity and more. Dr. Schmitt thought that the climate program was doing well in monitoring the global water cycle, and that NASA's climate program is in great shape. He added that the issue of ice sheet decay into the ocean is very important, and evidence from Greenland and Antarctic studies show deep ocean interactions, meaning that glaciers are in full contact with ocean waters and that melting has accelerated. NASA should continue studying this.

Another ESS member noted that while it has taken some time, the needed data are now finding their way into models, and papers are focusing on future changes. Dr. Sivaprasad Gogineni said that existing assets are doing a good job of tracking long-term trends. Operation IceBridge (OIB) is paying off in terms of improved projections of sea level rise and sea ice. He did not see the need for edits to the document, but promised to send Dr. Tsaoussi any additional comments he might have.

Regarding the modeling program, Dr. Richard Rood said that there have been interesting results, but he felt that there needs to be a better understanding of the various roles of modeling within NASA, as well as NASA's role within larger modeling efforts. He would like to get the Headquarters perspective, as

modeling at NASA comes across as relatively fragmented. The 2012 National Academy of Sciences (NAS) report on modeling asked about NASA's role. There were questions about what was going on with simulation and what was being advanced with climate and weather. How it fits together is an ongoing issue that should be better understood and articulated. Headquarters should say what is expected from the modeling program rather than just percolating up the work from the centers. Dr. Tsaoussi explained that ESS had previously agreed that a future meeting would address modeling, which was outside the charge of the GPRAMA evaluation. Dr. Steve Running, ESS Chair, agreed.

Dr. Tsaoussi asked that any edits or additional comments related to the Climate section be sent to her. She called for a vote on the rating, which was unanimous in favor of Green.

Focus Area: Carbon Cycle
Dr. Hank Shugart said that the carbon project is very healthy, the work is outstanding, and there is an excellent record of publication in some key journals. This is a very strong program that leads other Federal agencies in this area. Given the funding environment, the NASA carbon cycle program is making a wonderful contribution. It also has healthy argumentation without being contentious.

Dr. Mahta Moghaddam agreed, adding that the program is doing very well, with excellent airborne and spaceborne assets. Many investments are coming to fruition in a good way. The modeling is strong and there are synergies with other agencies. There is also a good balance in distribution across the various regions and areas of interest, and the results are interesting. She offered to email Dr. Tsaoussi edits to a couple of details in the document. Regarding modeling, a couple of key papers are mentioned in the document, but their relation to remote sensing is unclear.

Dr. David Siegel explained that there are three areas of interest in below-sea-level investigation. The first set of papers are out following the Impacts of Climate on EcoSystems and Chemistry of the Arctic Pacific Environment (ICESCAPE) field campaign, addressing a phytoplankton bloom that accentuates the possible future interactions of warming oceans with ocean biology. Next is the synthesis of data on coastal waters, and the Moderate Resolution Imaging Spectroradiometer (MODIS) models are productive. The document Dr. Tsaoussi sent was good, but there is additional material from the past year regarding what gives rise to the large North Atlantic phytoplankton blooms and whether the blooms are related to a heat process or something else. These have been very well-cited and are not in the report, but they should be. Dr. Siegel said he would send in a short paragraph and some citations.

Dr. Anna Michalak asked if this was the section was where the Orbiting Carbon Observatory (OCO) should be called out. Dr. Tsaoussi said that OCO was in the section on atmospheric composition, adding that this was not to be a report on specific missions, but rather on science results and accomplishments. The papers in each focus area have an obvious relationship to NASA funding. It was agreed that if the OCO results were not in the atmospheric composition section, Dr. Michalak would draft a piece to include in the report.

Dr. Tsaoussi called for a vote on the rating, which was unanimous in favor of Green.

Focus Area: Earth Surface and Interior (ESI)
Dr. Thomas Herring said that the Space Geodesy Program (SGP) has produced large volumes of data. Investigators are reprocessing GPS data and 25 years of results. The program is doing very well in that regard, and while it never goes as fast as one would like, it is important to do the work carefully. In the science highlights, there have been some great results coming out in major journals like in Science. Those analyses are only possible with this type of well-maintained reference system.

Dr. Roland Burgmann added that those addressing natural hazards use space geodesy research. A particular focus has been on making products available in near real-time to enable early warnings of earthquakes and volcanoes, which affects disaster response. Some of the international satellites have enabled rapid distribution of these products as well. Another effort, where he has some skepticism, is earthquake prediction with QuakeFinder. NASA continues to work to make these data available, which should have been done all along. Dr. Herring pointed out that earthquake predictability is critical. California has a program, the Collaboratory for the Study of Earthquake Predictability (CSEP), and it would be useful to have the NASA effort associated with that.

Craig Dobson said that the points about QuakeFinder are well taken. There is open access to the data, which will be housed at Goddard Space Flight Center (GSFC). A subset of the data will be available through an arrangement with Amazon Web Services in order to provide greater public insight. The team is also working with CSEP.

It was noted that the Gravity Recovery and Climate Experiment (GRACE) data are being used to study earthquakes, address water storage, etc. The National Research Council (NRC) panel thought earthquakes would be difficult to detect, so this effort has exceeded expectations. Dr. Burgmann said that there was a broken link, and Dr. Joughlin found some minor typos, but otherwise there were no edits.

Dr. Tsaoussi called for a vote on the rating, which was unanimous in favor of Green.

Focus Area: Weather
Dr. Christian Kummerow explained that he found this section more difficult than the others. NASA does not predict weather, and he assumed that this area was about improving prediction capabilities. The section makes it clear that precipitation observations fall under weather. The high-level scientific accomplishments start with the Tropical Rainfall Measuring Mission (TRMM), which is more about climate than weather. Dr. Kummerow saw confusion in this section and thought some of the material belonged with the water cycle.

Dr. James Marshall Shepherd said that when he read the weather summary, it looked like NASA's weather efforts involved only TRMM and the Global Precipitation Measurement (GPM) mission, which actually truncates NASA's work in this area. He thought there were activities that were under-represented in the summary document. Dr. Kummerow added that were other relevant missions, and the document should address the role of the NASA centers in predicting weather. Dr. Shepherd noted that this area can be difficult, given that there are other agencies involved with weather. He also saw a disconnect between the document and NASA's own description of its weather program. There was good material that belonged in this section. Dr. Efi Foufoula-Georgiou pointed to the absence of discussion related to extreme events involving the water/energy cycle.

Dr. Tsaoussi agreed to fix a reference to GPM, and asked that the ESS members let her know what they wanted to have moved. The document reflected how the programs that fund these projects report out. Dr. Tsengdar Lee observed that there has not been much in the way of well-documented publication in this area, making it hard to reference the activity. There has not been much reporting in the scientific journals, for example, and conference presentations are hard to document. Dr. Shepherd noted that there are weather-related applications on the tornado prediction element of SMAP data. While finding the peer reviewed publications can be difficult, there should be a paper on this, and it should be included. He and Dr. Kummerow offered to identify some of the additional documentation.

Dr. Kummerow added that there is work that is not in the water cycle but relates to climatology. It is funded out of the weather office but does not exactly line up with the topic. Dr. Tsaoussi said that if he felt that this section should include some language that referred to a point made in another focus area, that

would be fine, though she would prefer to strengthen it here. She wanted to hear from ESS members who felt there should be additional emphasis in other portions of this area, like extreme weather. She added that this document was for FY14 results, not activities that were about to occur.

The vote on the rating was unanimous in favor of Green.

Focus Area: Atmospheric Composition
Dr. Carmichael thought this area was producing good air quality data and accomplishments. Satellites are providing data that help link information about the surface and help inform the next generation of retrievals. These are nice experiments from a science perspective and link well to other Federal agency efforts. He liked the continuous evolution of using multiple assets together to drive better modeling and estimates. Putting together multiple sensors is a strong example of both the science that is being done and how it is integrated into relevant questions. He had no edits beyond what was noted earlier about the OCO mission, for which there are some papers that could be brought forward.

Dr. Patrick McCormick agreed. He thought there was material that could be added. He wondered if the Global Hawk information would continue to be used and was surprised that there was nothing from the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) regarding stratosphere results. He asked if there was something that could be added, as well as on the A-Train and the CloudSat/CALIPSO combination. Dr. Tsaoussi said that it was possible that there have not yet been results published, especially since NASA had just started funding some of the science. Dr. Jack Kaye of ESD noted that there has been funding of the science teams that evaluated the suitability of environmental data records produced through the operational algorithm, and that could be in the published literature. Moving forward, there will be more climate-oriented products and more documentation.

Dr. Andrew Dessler said that about a year before, the Aura group came out with NOx improvements that were publicized well, but the document did not mention this. The project continues doing a good job of monitoring the ozone hole. However, he had also heard that the Airborne Tropical Tropopause Experiment (ATTREX) had gone quite badly due to poor planning by the Global Hawk team. There has not been much progress in aerosols, either. Dr. Dessler added that he was struck by how many papers get written and wondered if they might all be better off with fewer.

Dr. Michalak wanted to review the appendix further and possibly write a short paragraph or move some of the material. Dr. Tsaoussi explained that if NASA funded a given project during the performance period, they could include that. The list was made up of selected items, and ESS members were free to bring forward publications that were not mentioned. OCO is funded through atmospheric composition, though it could be mentioned in other focus areas. Dr. Michalak volunteered to write something about it.

The vote on the rating was unanimous in favor of Green.

Focus Area: Water Cycle
Dr. Foufoula-Georgiou said that this focus area had a good balance over time, and through processes and areas. The water and energy cycle is well-represented, as are extreme events. However, for the latter, the document lists only GRACE data for real time assessment of water supply; there is more. She liked the way satellite and ground data were pulled together. However, she noted a gap with regard to extremes and the weather/water cycle, and she would edit out the word "important" in some places, as it was overused.

Dr. Anne Nolin thought that, in comparison with the other areas, this was not a well-rounded list of accomplishments, and she doubted that some even merited consideration as accomplishments. She thought the last paragraph did not make sense, there was a reference to a campaign that has not happened yet, and there were lists that did not hold together. She thought the items in the section were not really

supported. She gave the example of the snow campaign, in which the text claimed credit for a community-sponsored effort that had little NASA involvement, and reimbursements were still pending. In addition, not all of the publications were related to water and should be removed. There are important links that should be brought out between the water cycle and the cryosphere, but they were missing. She saw no publications from the airborne field observatory. Dr. Nolin said that she was unwilling to give the area a Green rating at that time. The text was scattered and disorganized, and it lacked coherence.

Dr. Kummerow saw a lack of balance in the investments, and observed that items of completely different magnitudes were given similar weights. Dr. Nolin pointed out that the text did not "follow the water" in the science. Dr. Foufoula-Georgiou said that she made her own connections, and still thought they were present, but agreed that they were not in the document.

After Jared Entin, the NASA manager in charge of the text for this focus area explained his process, Dr. Tsaoussi stated that the section did not describe the program well. Some ESS members did not understand if the problem was with the write-up or the program itself. She promised to eliminate the activities in which NASA had little or no involvement. She did not want to ask the Subcommittee members to rewrite the background material. Instead, she wondered if there was sufficient information to modify the document and make the section more coherent. It was important to get a rating at this meeting. There were two issues: that of the program accomplishments, and that of the reporting of the accomplishments.

Dr. Moghaddam thought there was sufficient information to determine the program accomplishments. There was quite a lot, even if the reporting could be improved. Dr. Foufoula-Georgiou said that with an updated appendix, a more accurate list of accomplishments, and another opportunity to review and edit the text, she would be happy with the piece. Regardless, she thought the rating should be Green. Dr. Nolin agreed. She pointed out that in the color code for GPRAMA, a Yellow rating indicates a significant shortfall compared to investments. That was not the case here, nor was it really the issue. The expectations were fully met, which warranted a Green. Having said that, she still wanted the appendix and bibliography to be revised, and the text to be cleaned up and edited in order to make it relevant.

Dr. Kummerow was unclear about the expectations for this area and was not sure what metric they were trying to meet. He thought there could be improvement in that part of the process. Dr. Schmitt said that he is interested in the water cycle, and this theme should be one of NASA's areas of pride. There was much that could be done here, and he felt like they were missing an opportunity.

Dr. Tsaoussi summarized the discussion by noting that there did not seem to be an issue with the rating, and that the only action was to improve the write-up. She asked that ESS members send her items that they thought should be included. She committed to ESD cleaning up the publication list, removing inflated statements, revising the text, and adding the items that would be sent to her.

The vote on the rating was unanimous in favor of Green.

Summary of Discussion
Dr. Running said that part of this discussion identified some format problems that the Subcommittee had with the document, such as priorities, budget focus, and inconsistencies. He wondered if it was in their purview to discuss the format of this document. Dr. Tsaoussi replied that she has evolved the document format, which is different from what other SMD divisions have done. She will do another version of this that is much shorter and make some improvements for next time. She asked for feedback via email so that she could address the issues. Depending on what comes up, this could warrant space on the agenda for a future meeting.

Dr. Moghaddam pointed out that the different sections reported inconsistently and should be uniform. Dr. Tsaoussi replied that the document before ESS was not a part of the record, only a first cut. Dr. Running added that the emails he had received during the meeting were helpful, and he encouraged the members to contact him with their opinions.

Adjourn

Dr. Tsaoussi thanked the members for their time and adjourned the meeting at 2:39 p.m.

Appendix A
Participants

Committee members

Steve Running, ESS Chair, University of Montana
Roland Burgmann, University of California, Berkeley
Greg Carmichael, University of Iowa
Andrew Dessler, Texas A&M
Efi Foufoula-Georgiu, University of Michigan
Svaprasad Gogineni, University of Kansas
Kathleen Green, Kass Green and Associates
Thomas Herring, Massachusetts Institute of Technology
Ian Joughlin, University of Washington
Christian Kummerow, Colorado State University
M. Patrick McCormick, Hampton University
Mahta Moghaddam, University of Michigan
Anne Nolin, Oregon State University
Richard Rood, University of Michigan
Raymond Schmitt, Woods Hole Oceanographic Institute
James Marshall Shepherd, University of Georgia
Herman (Hank) Shugart, Jr., University of Virginia
Lucia Tsaoussi, Executive Secretary, NASA Headquarters

Appendix B
ESS Membership

Steve Running, Chair
Regents Professor Ecology
Department of Ecosystem and Conservation Sciences
University of Montana

Lucia S. Tsaoussi, Executive Secretary
Earth Science Division
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Roland Burgmann
Department of Earth and Planetary Science
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Greg Carmichael
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Andrew Dessler
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Richard B. Rood
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James Marshall Shepherd
Department of Geography
University of Georgia

Hank Shugart
Department of Environmental Sciences
University of Virginia

David A. Siegel
Department of Geography and Institute
For Computational Earth System Science
University of California, Santa Barbara

Appendix D
Agenda

12:00 noon – 12:15pm	Opening Remarks/Meeting Introduction	Lucia Tsaoussi
12:15 pm – 2:30 pm	Earth Science Division Research Performance for Fiscal Year 2014	Committee members