NASA ADVISORY COUNCIL

Earth Science Subcommittee

August 28, 2015

Teleconference

MEETING MINUTES

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Steve Running, Chair

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Lucia S. Tsaoussi, Executive Secretary

Table of Contents

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Friday, August 28, 2015

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.

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). The 2015 GPRAMA review was to cover events in Fiscal Year 2015 (FY15). All activities considered must have been fully or partly funded by NASA, and ESS was to provide an official vote on each criterion.

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.

GPRAMA Discussion

The discussion addressed six annual performance indicators.

Carbon Cycle

Annual Performance Indicator ES-15-6: Demonstrate planned progress in detecting and predicting changes in Earth's ecological and chemical cycles, including land cover, biodiversity, and the global carbon cycle.

Dr. Herman (Hank) Shugart, Jr. said that the background document indicated much good work had been done in this area. He thought some of the statements should be more direct, but the productivity was good and the relevant projects accomplished their purposes. He was in favor of a green rating.

However, he had two concerns about ESD's overall direction. First, he was concerned about the lack of interaction with, and data from, China and Russia. Second, while remote sensing products have been incorporated into models, it seems they are not being used to test the models. He felt that there were unaddressed opportunities. Dr. Steve Running, ESS Chair, replied that these concerns would be discussed at the Subcommittee's October meeting.

Dr. David Siegel also reviewed this section, noting that while the examples document past successes, they also indicate directions NASA could take. He thought the rating should be green. Dr. Mahta Moghaddam agreed, though she thought the section should mention airborne activities. She advised reconsidering the organization of the document, as some discussions were fragmented while others rambled. She also had some editorial and stylistic comments that she planned to send to Drs. Running and Tsaoussi.

Dr. Anna Michalak also thought the document should mention airborne activities, as well as recent Earth Venture (EV) selections. She did not see updates on the Orbiting Carbon Observatory 2 (OCO-2). Not all of the publications tagged as relevant to OCO-2 were applicable. She wondered about the extent to which the supporting documentation was complete. Dr. Tsaoussi replied that the appendix included everything that NASA funded, and noted that the review was not meant to be comprehensive.

Dr. Running said that the document should start each section with three to five highlights as one-sentence bullets, with the details to follow. As presented, the key results were buried in the text. Dr. Michael Freilich, ESD Director, agreed, adding that the goal was to create an executive summary with key results rather than ESD program manager assessments. Dr. Running asked that the ESS members specializing in each area write these highlights.

Dr. Tsaoussi took the vote on the rating for this area, which was unanimous for green.

Atmospheric Composition

Annual Performance Indicator ES-15-1: Demonstrate planned progress in advancing the understanding of changes in Earth's radiation balance, air quality, and the ozone layer that result from changes in atmospheric composition.

Dr. Greg Carmichael began the discussion of this area, noting that this is a very broad program. The documentation shows the integration of the observations and models to drive important information. He thought there were some good examples and supported a rating of green.

Dr. Andrew Dressler was concerned about the "data dump" in the Appendix. As for the summary document, his notes centered on whether the topics were important. He felt that it was not as good as the previous report. Dr. Freilich replied that his understanding was that the task before ESS was to penetrate the substance of the research and determine whether the program results merited a green, yellow, or red. They were not addressing editorial elements. The final report was to come from ESS. The program managers sent a first draft for the Subcommittee to use as a working document.

Dr. William Large raised the issue of overestimation of NOx emissions from mobile sources, which had a single sentence and should be revisited.

The voting on this section resulted in a rating of green. Ms. Jennifer Kearns of SMD noted that the ratings should be based on the progress made by the program. Dr. Tsaoussi said that ESS members should edit and modify the document as they saw fit. The draft was meant to help them assess the program, given the budget and science goals. She asked the members to send her their bullet points and any other changes.

Climate Variability and Change

Annual Performance Indicator ES-15-9: Demonstrate planned progress in improving the ability to predict climate changes by better understanding the roles and interactions of the ocean, atmosphere, land, and ice in the climate system.

Dr. Schmitt addressed the oceans and sea level change, where he saw much progress in understanding the topic and advancing the area of study. However, he felt that sea surface salinity did not receive sufficient attention in the summary; he planned to send in revisions in order to expand on it. Dr. Schmitt recommended a rating of green.

Dr. Ian Joughin reviewed work having to do with the cryosphere. He liked that NASA had formed a sea level team rather than focusing on individual disciplines, and he thinks the team has good breadth. The IceBridge mission is doing good work and he was disappointed that it might disappear when ICESat-2 comes on line. He did think there were omissions and some programs that should have been mentioned in more than one place rather than being pigeonholed. He rated the area green.

Dr. Richard Rood said that he was impressed with the work in this area. In general, the cryospheric and oceanic parts were impressive, with the Greenland ice sheet work being an example. He thought the

modeling was good in and of itself, but the actual predictions and the tasks of prediction do not constitute an especially strong system. He was not seeing predictive products to support missions. The updated Modern Era Reanalysis for Research and Applications (MERRA), known as MERRA2, has been quite successful. The "Nature Run" is a unique resource with the potential for broader applications, but it is not clear how to access it despite it being touted as a community resource. The atmospheric chemistry modeling work within NASA and in collaboration with Harvard is very strong and getting stronger. All in all, Dr. Rood thought this area was stronger than 2014, with some good advances that helped frame the more strategic issues.

Dr. Large endorsed the idea of selecting highlights. Overall, he thought this area was green, with very important data. He did have some recommendations for edits of the text, and he advised ESS to think of the future in climate variability research.

The ESS vote on this performance goal was for a rating of green.

Earth Surface and Interior

Annual Performance Indicator ES-15-11: Demonstrate planned progress in characterizing the dynamics of Earth's surface and interior, improving the capability to assess and respond to natural hazards and extreme events.

Dr. Roland Burgmann said that the natural hazards research is very important, and NASA's efforts under this performance indicator characterize events as rapidly as possible substantially help the agencies working in the response. It has been a successful year in that regard. Dr. Burgmann gave the examples of the South Napa and Nepal earthquakes. The Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) has provided useful information about lithospheric processes as well.

Dr. Thomas Herring said that a highlight of this program is the way the data are made available to the community to use. This is particularly true in the area of deep-Earth processes, with the focus of GPS, as well as the Gravity Recovery and Climate Experiment (GRACE), and the studies of Antarctica's ice sheet. The move from GPS to the Global Navigation Satellite System (GNSS) will help provide better quality results. The Space Geodesy Program brings together the various measurements to analyze problems. He endorsed a rating of green.

Dr. Burgmann noted that NASA does not yet have its own geodetic imaging mission and must work with international agencies in this area. As a result, the data are subject to the restrictions of NASA's international partners. Therefore, it is important that the NASA-ISRO Synthetic Aperture Radar (NISAR) mission move forward. UAVSAR has been making good progress as well. He endorsed a rating of green.

The Subcommittee vote resulted in a rating of green.

Weather

Annual Performance Indicator ES-15-3: Demonstrate planned progress in improving the capability to predict weather and extreme weather events.

Dr. Christian Kummerow pointed out that NASA's role in weather is to improve the *capability* for prediction, not improvement of the operational prediction services. The latter is the National Oceanic and Atmospheric Administration's (NOAA's) purview. He felt that the summary should state that directly. He also suggested subheads for the main four areas under this performance goal: Utilizing NASA Observations to Improve Weather Forecasts; Supporting Advances in Modeling; Understanding Convection and Perturbation Extremes; and Developing New Technologies to Improve Weather Forecasts. Following an April workshop, there has been greater effort to define the areas and the

corresponding recommendations. The core of the workshop report, addressing the utilization of NASA assets to improve prediction, has emphasized the Short-term Prediction Research and Transition (SPoRT) program. He did feel that the document placed too much emphasis on NOAA and not enough on NASA. He could see a member of Congress taking this in the wrong direction. He also felt that the Nature Run was sold a bit short in the report. The report does a reasonably good job addressing precipitation missions, though it could do more regarding extreme temperatures. As the workshop report describes, there is more work to be done in defining NASA's role in this area.

Dr. James Marshall Shepherd had to leave the meeting but provided his comments to Dr. Kummerow. Dr. Marshal thought the program should think about its place in the Federal weather prediction system. There are some mismatches or gaps, so the program should try to align better with the recommendations from the workshop. He rated the area green.

The Subcommittee voted for a rating of green.

Water and Energy Cycle

Annual Performance Indicator ES-15-7: Demonstrate planned progress in enabling better assessment and management of water quality and quantity to accurately predict how the global water cycle evolves in response to climate change.

Dr. Efi Foufoula-Georgiou sent her comments via email to Dr. Nolin, who remarked that they were similar to her own. Both rated the area green and identified some highlights. First was improvement in the annual and monthly water budget and cycle fluxes. There was also a noteworthy paper on energy balance improvements. Another highlight is the Land Data Assimilation System (LDAS). GRACE continues its great success in studying and estimating ground water depletion. The performance area also incorporated snow observations. Hyperspectral data and lidar observations from the Airborne Snow Observatory are used in conjunction with a snow melt model in research that has been particularly pertinent to the California drought. Another highlight concerns the importance of coastal and inland water bodies and water quality.

Dr. Nolin said that the Soil Moisture Active Passive (SMAP) satellite is quite important in many ways, and that section of the text should be expanded. Dr. Foufoula-Georgiou found it an omission that precipitation is not discussed in the water cycle. She wanted ESS to think about the ability to follow the water in order to integrate the approach. There is also no link to the NASA-funded work by the Snow Remote Sensing Working Group, which has had several workshops in recent years.

When discussing the LDAS simulation work, Dr. Nolin pointed out that the passive microwave measurements of snow are so inaccurate that they actually reduce the accuracy of the models. She would also like to see a link between the water and energy cycle work and the carbon cycle. Dr. Nolin supported a rating of green.

Dr. Kummerow agreed that there is an issue concerning precipitation-related research, and it should be included under both water and weather. Dr. Rood noted that at NOAA's weather services, a major NASA contribution seems to be land hydrology work, and that needs to also be reflected in the weather section. Dr. Nolin agreed.

It was pointed out that the performance goal for this section mentions water quality. Dr. Michalak observed that only a small portion of the text referred to quality, and she wondered if it was appropriate. Dr. Tsaoussi explained that the scope of the document reflected what the programs funded directly over the past year. The papers cited in the summary and the appendix were chosen by the NASA managers, and she included a list of NASA center publications. As for water quality research, it is part of the

program portfolio, and the evaluation should consider the level of investment of the program. ESD does not have complete control of the metrics, and the language does not reflect how the program writes its solicitations.

Dr. Jack Kaye added that there is less investment in quality from a remote sensing standpoint. However, the investment has increased in recent years, as has community interest. Still, the balance of the investment has not been in water quality. GRPAMA ratings address success relative to the level of investment. Dr. Kummerow added that the section should make it clear that there has been little investment in the remote sensing of water quality.

Dr. Freilich suggested noting that even given the disparity in resources, they still believe green is appropriate for the whole activity. Dr. Tsaoussi asked that the members let her know if they felt something should be mentioned in additional sections.

The Subcommittee agreed upon a rating of green for this section.

Final Comments

Dr. Tsaoussi thanked the Subcommittee members and asked them to send in their comments within a week. Dr. Running said that he would add subheads to some sections in order to be consistent. He asked the members to think about that in addition to the bullets he mentioned. Dr. Freilich thanked the members for their hard work and the thought they gave to this effort.

Adjourn

The meeting was adjourned at 4:21 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
Thomas Herring, Massachusetts Institute of Technology
Ian Joughin, University of Washington
Christian Kummerow, Colorado State University
William Large, National Center for Atmospheric Research
Anna Michalak, Stanford University
Mahta Moghaddam, University of Southern California
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
David A. Siegel, University of California, Berkeley
Lucia Tsaoussi, Executive Secretary, NASA Headquarters

Appendix B
ESS Membership

Steve Running, Chair
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University of Montana

Lucia S. Tsaoussi, Executive Secretary
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