

NASA ADVISORY COUNCIL

EARTH SCIENCES ADVISORY COMMITTEE

NASA Headquarters  
Washington, D.C.  
October 22, 2020

TELECONFERENCE  
MEETING REPORT

---

J. Marshall Shepherd, Chair

---

Lucia Tsaoussi, Executive Secretary

*Prepared by Joan M. Zimmermann  
Zantech IT, Inc.*

October 22, 2020

Introduction

Dr. Lucia Tsaoussi, Executive Secretary of the Earth Science Advisory Committee (ESAC), opened the teleconference, which was devoted to the annual Government Performance Reporting Act Modernization Act (GPRAMA) review. Dr. Tsaoussi reminded the meeting participants of the meaning of the grades associated with GPRAMA outcomes (Green, Yellow, and Red), which are associated with reporting requirements. The committee reviewed reports of the science focus areas that document progress as measured by the GPRAMA identified annual performance goals.

Ms. Sandra Cauffman, Deputy Director for the Earth Science Division (ESD), made brief remarks and thanked everyone for participating in the GPRAMA ESD research review.

Dr. J. Marshall Shepherd, ESAC Chair, initiated the discussion, and commended the Program Managers (PMs) on the report that the committee had reviewed in preparation for voting. Dr. Tsaoussi requested that for the record, ESAC members should touch briefly on the focus areas under the goals before providing their votes.

**Annual Performance Goal 1.1.8: NASA shall demonstrate progress in characterizing the behavior of the Earth system, including its various components and the naturally-occurring and human-induced forcings that act upon it.**

**1.1.8.1**

***Atmospheric Composition (1.1.8.1)***

Dr. Daven Henze briefly characterized the report's subtopic organization as a very clear, concise read, covering aerosol and cloud, and radiative effects, as well as international activities. He remarked that the section included good overviews that qualitatively described several scientific outcomes, which collectively demonstrated satisfactory performance for the total performance goal.

Dr. Andrew Dessler was asked to comment; he said that he concurred with Dr. Henze's description without further comment.

***Carbon Cycle and Ecosystems (1.1.8.2)***

Dr. Nancy Glenn addressed this subgoal, first commenting that she had some minor edits in the area of biodiversity, that she would later send on to the appropriate party. Dr. Glenn said the section represented a nice synthesis of the science, particularly with a focus on biogeochemistry and terrestrial ecology, as well as human impacts on ecosystems. She felt that given the audience for the report, ESD would need to explicitly spell out instances of US contributions in both goals 1.1.8.2 and 1.1.9.2. Dr. Tsaoussi noted this remark for the record.

Dr. Anastasia Romanou agreed with Dr. Glenn's assessment, adding that the report provided a good coherent description of improvements in scientific understanding, particularly in marine and terrestrial ecosystems. She noted a few typos and added that the report should highlight the types of measurements being carried out.

Dr. Colleen Mouw commented on progress in ocean biology, and said the report contained a good description of how different observations are being integrated, especially with regard to how water column processes are being characterized through innovative measurements, and observations on

phytoplankton and coral reefs. She appreciated how the report highlighted how many disparate observations are now being integrated.

#### ***Climate Variability and Change (1.1.8.3)***

Dr. Ian Joughin felt that the section read well, and that it satisfactorily described progress in all four areas; everything seemed consistent in style and tone. He added that he had minor editorial comments to be passed along, and recommended that special terms be parenthetically defined for the benefit of non-specialist readers.

Dr. Romanou focused her comments on ocean and climate, and Earth system modeling, and recommended including ice in the first paragraph that addressed the discussion of climate change. In terms of ocean dynamics, she agreed that the report aptly conveyed that the cited paper represented non-novel research, and was simply another way of saying the same thing. Dr. Romanou also referenced a 2020 carbon cycle paper that would be advisable to include in this section.

Dr. Dessler commented that the NASA Goddard Institute of Space Science (GISS) is doing quite a good job on Earth system modeling, as is the Global Modeling and Assimilation Office (GMAO); Earth system modeling is a particularly hard problem.

Dr. Ray Schmitt offered comments on the ocean section, which he described as doing a nice job on ocean heat content; he suggested including a paper on haline circulation in this section. Data on sea level rise and water cycle are nicely referenced (particularly Yu *et al.*). He added that the research has been detecting linear trends in changing salinity patterns over the past 30 years, representing one of the most important topics in ocean science.

#### ***Earth Surface and Interior (1.1.8.4)***

Dr. Thomas Herring commented that this section was well done, and did a good job in characterizing the behavior of systems, with appropriate inclusion of research that has evolved over the last decade; sea level is a tough problem, and researchers are starting to look at surface mineralogy, as well as magnetic field work that has relevance to the workings of Earth's interior [e.g., the future NASA-ISRO Synthetic Aperture Radar (NISAR) mission, unmanned aerial vehicle missions]. He agreed that international collaboration was absolutely critical to this type of research, which also has relevance to problems in relativity.

Dr. Roland Burgmann said he was impressed at the comprehensive yet concise report, which ranged from the lithosphere all the way to core dynamics, and that there seemed to be significant progress in the areas covered.

Dr. Joughin commented that while he was a great NISAR fan, he thought some of the detail in the report was too mission-focused, and could be trimmed down. Dr. Tsaoussi noted the comment for action.

#### ***Water and Energy Cycle (1.1.8.5)***

Dr. Sara Tucker said that this interesting section covered water in all phases and locations (surface, soil, oceans, atmosphere) and did a nice job of highlighting the scientific results. Notably, this research is enabled by a number of ESD space-based missions. The report also made clear much work is being done in support of future missions, and enabling enhanced research. There was a lot of focus on flux, and risks of drought and flood, as well as high-mountain science efforts to look at the impact of mountain water supply sources. There was also a good discussion of P-band algorithm development associated with

Department of Defense (DOD) satellites. The report did a good job in covering a broad area, as well as highlighting the connections between research areas.

Dr. Shepherd commented that this was a well-done section, especially given that it had had to weave together a range of disparate topics.

#### ***Weather and Atmospheric Dynamics (1.1.8.6)***

Dr. Shepherd said that this was a well-done section, but pointed out that the discussion on page 59 did feel like more of a climate/atmospheric composition discussion rather than a weather discussion, and thus seemed a little out of place. He thought that the IMERG discussion was nicely done showing good work emerging. Data on frozen precipitation, a key goal of the Global Precipitation Measurement (GPM), shows the evolution of mission.

Dr. Sara Tucker thought there was interesting work shown on the AIRS observations on 3D tracking of winds, work that shows the potential of infrared sounding techniques for describing wind products, the Cyclone Global Navigation Satellite System (CYGNSS) mission, and lightning mapping.

*\*\*ESAC concluded the discussion of Goal 1.1.8. Dr. Shepherd proposed a Green grade for this section. There was unanimous agreement.*

**Annual Performance Goal 1.1.9: NASA shall demonstrate progress in enhancing understanding of the interacting processes that control the behavior of the Earth system, and in utilizing the enhanced knowledge to improve predictive capability.**

#### ***Atmospheric Composition (1.1.9.1)***

Dr. Henze discussed the section's focus on unconstrained emissions from particular sectors of the world-impact of COVID lockdowns on carbon dioxide, biogenic emissions, recent airborne activities and analyses of previous field campaigns. He had some small edits to pass on, and offered to pass forward an additional paper that would further support this section.

Dr. Dessler said he did not note much distinction between 1.1.8 and 1.1.9, but felt that research on Air Quality had been superior. Understanding aerosols is a hard problem, but significance progress is made. Regarding the upper atmosphere, NASA's bailiwick, there has been very good work all around.

ESAC paused briefly at 2:13pm to hear remarks from Dr. Karen St. Germain, the recently appointed Director of ESD. Dr. St. Germain thanked the ESAC for their efforts and their important role as "thought partners" in these dynamic times, where science is more impactful than ever. Dr. Shepherd welcomed Dr. St. Germain, and said he looked forward to working with her.

#### ***Carbon Cycle and Ecosystems (1.1.9.2)***

Dr. Glenn said that it had been hard to distinguish what should go where in some cases, but she understood that was due to the necessary interweaving of many observations. In the section on interactive processes, she felt that some wording could be moved down from 1.1.8, as there is much overlap in content, e.g. in ocean biology and biogeochemistry. Commenting on land cover and land use change, in which there was a large emphasis on central/SE Asia and Ukraine, Dr. Glenn suggested adding some US observations to achieve balance, given the audience for the report.

Dr. Romanou agreed with Dr. Glenn's comments, adding that recent work has enhanced the ability to predict better how the Earth system sequesters carbon.

Dr. Mouw said she concurred with the discussion, and had nothing further to add.

#### ***Climate Variability and Change (1.1.9.3)***

Dr. Joughin felt the section read well and fit together, but with regard to the discussion of ice, he felt it would be better to restructure the report into different, distinct sections (i.e. sea ice, land ice, continental shelf).

Dr. Romanou remarked on how research on oceans within the climate system addressed predictive abilities well, as well as modeling projections. Further work from Estimating the Circulation and Climate of the Ocean (ECCO) framework re: sea level rise, and changes in ocean circulation continues to enhance predictive capabilities. With regard to Earth system modeling, she noted that a 2020 paper that came out a month prior, the MERRA-2 reanalysis, also added to the satisfactory overview of advances.

Dr. Schmitt remarked on the importance of a long continuous data series to a functional modeling program within ECCO. Important work has also been done on Miami-area flooding and tidal predictions, which might be good to include in the report.

Dr. Dessler commented that an immense amount of work had been done at GISS on Earth system modeling, which has done a good job at improving their model. MERRA-2, using data on the surface, cryosphere, and chemistry, has also done quite a good job in describing an enormous body of work.

#### ***Earth Surface and Interior (1.1.9.4)***

Dr. Herring commented on the sections descriptions of improving predictive capabilities for volcanoes, landslides, and some limited capabilities for better predicting earthquakes.

Dr. Burgmann noted that there is less of a focus on probabilistic predictions, with models getting at a better understanding of components of these systems, such as the relationship between slow slip events and earthquakes.

#### ***Water Cycle (1.1.9.5)***

Dr. Tucker noted that this section, while also overlapping with items under 1.1.8, did a good job of highlighting the improvements in understanding that enhance prediction, and the relationship with other areas, as well as extreme events, and impacts on lives. It would be good to highlight in this section the NASA efforts that collaborate with end-user partners, globally.

#### ***Weather and Atmospheric Dynamics (1.1.9.6)***

Dr. Shepherd commented, saying he had no major issues with the section beyond one typo on p. 100. Regarding a paragraph on lightning on p. 106, he suggested broadening the heading to capture other aspects of what is being described, such as lightning flash rates and snowfall rates.

Dr. Tucker said she had some editorial comments that she would send on, and remarked on the good focus on the JEDI interface, prediction, and new methods of retrieval.

*\*\*ESAC concluded the discussion of Goal 1.1.9. Dr. Shepherd proposed a Green grade for this section. There was unanimous agreement.*

Dr. Tsaoussi thanked all members for their participation, and reminded Dr. Shepherd that the ESAC will formalize a letter describing the grading. She expressed hope that the ESAC could undertake a full meeting before the end of the calendar year. She noted that NASA has also been asked to review the size of the committee, thus she would be in contact with each member of the ESAC as the effort moves

forward. Dr. Tsaoussi adjourned the meeting at 2:39pm.

**APPENDIX A  
ATTENDEES**

Earth Science Advisory Committee Members

**J. Marshall Shepherd, ESAC Chair, University of Georgia**

Roland Burgmann - University of California, Berkeley

Andrew Dessler - Texas A&M University

Thomas Herring - Massachusetts Institute of Technology

Ian Joughin - Applied Physics Laboratory

Ray Schmitt - Woods Hole Oceanographic Institution

Anastasia Romanou - Columbia University

Colleen Mouw - University of Rhode Island

Daven Henze - University of Colorado

Jasmeet Judge - University of Florida (absent)

Lucy Hutyra - Boston University

Nancy Glenn - Boise State University

Sara Tucker - Ball Aerospace & Technologies Corp.

**Lucia Tsaoussi, Executive Secretary, NASA Headquarters**

Non-NASA Attendees

Joan Zimmermann, Zantech IT

**APPENDIX B  
ESAC MEMBERSHIP**

**J. Marshall Shepherd, ESAC Chair**  
University of Georgia

Roland Burgmann  
University of California, Berkeley

Ginny Catania  
University of Texas at Austin

Greg Carmichael  
University of Iowa

Andrew Dessler  
Texas A&M

Nancy Glenn  
Boise State University

Kass Green  
Kass Green and Associates

Daven Henze  
University of Colorado

Thomas Herring  
Massachusetts Institute of Technology

Lucy Hutyra  
Boston University

Ian Joughin  
University of Washington

Jasmeet Judge  
University of Florida

Christian Kummerow  
Colorado State University

Colleen Mouw  
University of Rhode Island

Anne Nolin  
Oregon State University

Anastasia Romanou  
Columbia University

Richard Rood  
University of Michigan

Raymond Schmitt  
Woods Hole Oceanographic Institute

Sara Tucker  
Ball Aerospace