Overview of the Decadal Review

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for presentation at

workshop on
Soil Moisture Active-Passive (SMAP) Mission
Planning Meeting

Arlington, VA

July 9, 2007

Organization of Study

- Executive Committee (18 members)
- Seven Thematically-Organized Panels
  1. Earth Science Applications and Societal Needs
  2. Land-use Change, Ecosystem Dynamics and Biodiversity
  3. Weather (incl. space weather and chemical weather)
  4. Climate Variability and Change
  5. Water Resources and the Global Hydrologic Cycle
  6. Human Health and Security
  7. Solid-Earth Hazards, Resources and Dynamics

Executive Committee

1. Rick Anthes, UCAR, co-chair, atmospheric science
2. Berrien Moore, U. New Hampshire, co-chair, biogeochemical cycling
3. Jim Anderson, Harvard, atmospheric science, chemistry
4. Bruce Marcus, TRW (ret), remote sensing
5. Bill Gail, Ball Microsoft Virtual Earth, civil space and IT
6. Susan Cutter, U. South Carolina, hazards and risk
7. Tony Hollingsworth, ECMWF, weather forecasting
8. Kathie Kelly, U. Washington, physical oceanography/satellite obs
9. Neal Lane, Rice, policy
10. Warren Washington, NCAR, climate
11. Mary Lou Zoback, RMS, solid earth

Panel Chairs

12. Tony Janetos, PNL/U. Md., ecology and land remote sensing
13. Brad Hagar, MIT, solid earth
14. Ruth DeFries, U. Maryland, land cover change and remote sensing
15. Susan Avery, CIRES and CU, meteorology, space weather
16. Eric Barron, U. Texas, climate, paleoclimate
17. Dennis Lettenmaier, U. Washington, hydrology
18. Mark Wilson, U. Michigan, infectious disease and remote sensing

Charge to Panels

1. Identify needs and opportunities for observations from space to advance Earth science and applications for the next decade and beyond;
2. Propose programs or missions to meet these needs and opportunities, in priority order;
3. Describe each proposed mission in terms of
   - Contributions to science and applications
   - How it meets prioritization criteria
   - Benefits to society
   - Technical aspects
   - Schedule
   - Costs
4. Briefly identify needs for obs that are needed to complement space-based obs
5. Identify essential other components (telemetry, data processing, management and stewardship)

Criteria for Prioritization

- Contributes to the most important scientific questions facing Earth sciences today (scientific merit-discovery, exploration);
- Contributes to applications and policy making (societal benefits);
- Contributes to long-term observational record of the Earth;
- Complements other observational systems, including national and international plans;
- Affordable (cost considerations, either total costs for mission or costs per year);
- Degree of readiness (technical, resources, people);
- Risk mitigation and strategic redundancy (backup of other critical systems);
- Makes a significant contribution to more than one thematic application or scientific discipline.

Above not in priority order

Water Panel priorities

Mission Ranking	Parameters Measured	RFI Source Mission(s)	Mission Concept Name
1	Surface Freeze/Thaw Soil Moisture	Hydros, WOWS, MOSS	Soil Moisture Active Passive
2	River and Lake Elevation Ocean Circulation	WaTER Hydrosphere Mapper or OOLM	Surface Water and Ocean Topography
3	Snow Water Equivalent	CLPP	Snow and Cold Land processes
4	Water Vapor Wind Speed and Direction	AIRS, GPS RO WOWS	Water vapor transport
5	Sea-Ice Thickness, Glacier Surface Elevation Glacier Velocity	ICESAT++ InSAR	ICESAT 2
6	Ground Water Glacier Mass Balance Ocean Mass Distribution	GRACE follow-on, ICESat++	GRACE 2
7	Inland and Coastal Water Quality	FLORA, SAVII	Inland and coastal water quality

FINAL REPORT

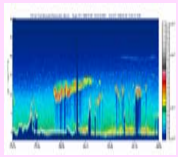
- Recommends a Path Forward that Restores US Leadership in Earth Science and Applications and averts the Potential Collapse of the System of Environmental Satellites
- Presents an Integrated Suite of Missions
  - Panel recommendations rolled-up
  - Missions sequenced
  - Overall cost matched to anticipated resources plus reasonable growth
- Highest Priorities of Each Panel Preserved
- Some Guidance on How To Handle Budget or Technology Development Problems

MAIN RECOMMENDATION
(for next decade)

- NOAA and NASA should undertake a set of 17 recommended missions, phased over the next decade

Linkage between terrestrial water, energy, and carbon cycle

SMAP
Launch 2010-2013

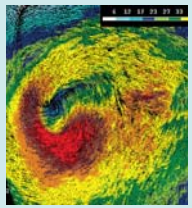


Cloud and aerosol height

ACE
Launch 2013-2016

Pressure/ temperature/ water vapor profiles

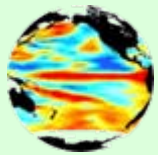
GPSRO
Launch 2010-2013



High resolution ocean vector winds

XOVWM
Launch 2013-2016

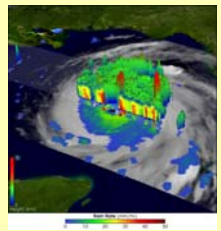
Temperature and humidity profiles



Sea surface temperature

PATH
Launch 2016-2020

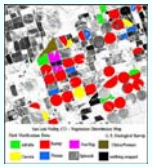
Three dimensional tropospheric wind profiles



Hurricane wind fields

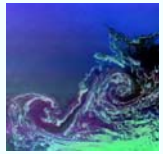
3D-Winds
Launch 2020+

Societal Challenge: **Improved Weather Prediction**
Longer-term, more reliable weather forecasts



Nutrients and water status of vegetation, soil type and health

HysplRI
Launch 2013-2016



Ocean eddies and currents

SWOT
Launch 2013-2016

CO_2 measurements: Day/night, all seasons, all latitudes

Inventory of global CO_2 sources and sinks

ASCENDS
Launch 2013-2016

Height and structure of forests

DESDynI
Launch 2010-2013

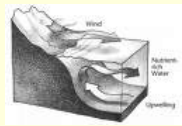
Dynamics of coastal ecosystems, river plumes, tidal fronts

GEO-CAPE
Launch 2013-2016

Soil freeze/ thaw state

Soil moisture effect on vegetation

SMAP
Launch 2010-2013



Improved estimates of coastal upwelling and nutrient availability

XOVWM
Launch 2013-2016

Organic material in surface ocean layers

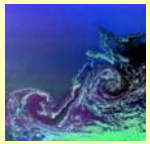
ACE
Launch 2013-2016

***Societal Challenge:* Ecosystem Services**

Improved land use, agricultural, and ocean productivity forecasts to improve planting and harvesting schedules and fisheries management

Linkage between terrestrial water, energy, and carbon cycle

SMAP
Launch 2010-2013



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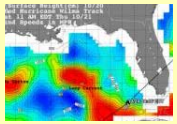
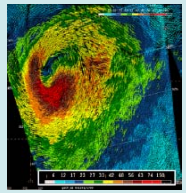


Sea level measurements extended into coastal zones

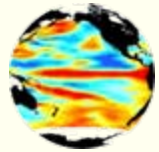
SWOT
Launch 2013-2016



High resolution ocean vector winds

XOVWM
Launch 2013-2016

Temperature and humidity profiles



Sea surface temperature

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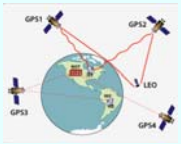

Pressure/ temperature/ water vapor profiles

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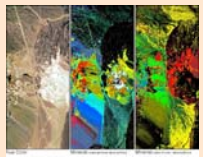

Spectra to identify locations of natural resources

HyspIRI
Launch 2013-2016

CO_2 measurements: Day/night, all seasons, all latitudes

Inventory of global CO_2 sources and sinks

ASCENDS
Launch 2013-2016

Three dimensional tropospheric wind profiles

3D-Winds
Launch 2020+

***Societal Challenge:* Energy Security**

Improved energy security through more effective oil and gas exploration, safer extraction through improved marine forecasts, optimized placement of wind farms through measurement of global winds, better energy conservation through improved heating/cooling forecasts, and support of carbon trading and energy policy.

Soil Moisture Active-Passive (SMAP)
Launch: 2010-2013
Mission Size: Medium

Soil freeze/ thaw state

Soil moisture effect on vegetation

Linkage between terrestrial water, energy, and carbon cycle

Drought early warning and decision support

Predictions of agricultural productivity

More accurate, longer-term weather forecasts

Response to the Decadal Survey

- Numerous editorials (e.g., NY Times, Washington Post, …)
- Testimony by committee co-chairs Berrien Moore and Rick Anthes, and others, before many congressional committees (most recently House Science ~ 2 weeks ago)
- Position statements by professional organizations, including AAAS, AMS, AGU
- Ongoing congressional interactions at university federal relations level
- Various congressional proposals for dealing with NASA earth science budget issues brought to light by Decadal Review

AGU position statement on NASA earth and space sciences (May 2005)

"AGU calls for the U.S. Administration, Congress, and NASA to continue their commitment to innovative Earth and space science programs. This commitment has placed the U.S. in an international leadership position .. it is, however, threatened by financial demands placed on NASA by … the space shuttle, space station, and the Moon-Mars initiative.

… Earth and space sciences have become a lower priority at NASA. NASA's proposed 2006 budget reduces science research by $1.2 billion over the next five years … These cuts will decimate effective programs …. These losses will degrade our weather forecasting, search and rescue, and life and property protection capabilities …

NASA is being asked to do more than it can with the resources provided. Shifting financial resources from science threatens vital investments and capabilities …. AGU asks the U.S. Administration, Congress, and NASA to renew their commitment to Earth and space science research."