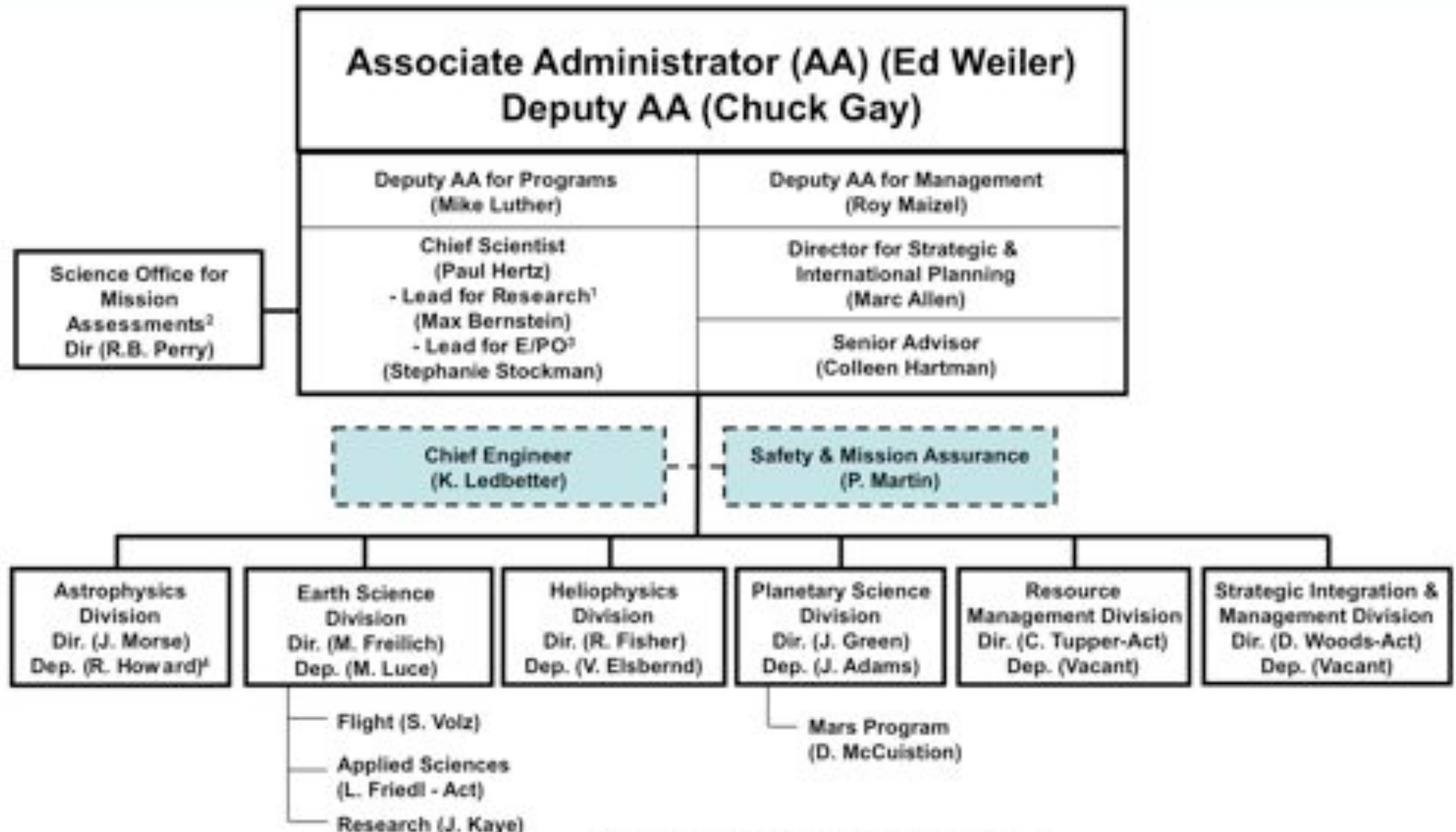# MODIS Program Science

Paula Bontempi

MODIS Program Scientist
National Aeronautics and Space Administration HQ
MODIS/VIIRS Science Team Meeting
26-28 January 2010

SMD Organization

Associate Administrator (AA) (Ed Weiler)
Deputy AA (Chuck Gay)

Deputy AA for Programs (Mike Luther)	Deputy AA for Management (Roy Maizel)
Chief Scientist (Paul Hertz) - Lead for Research[1] (Max Bernstein) - Lead for E/PO[3] (Stephanie Stockman)	Director for Strategic & International Planning (Marc Allen)
	Senior Advisor (Colleen Hartman)

Science Office for Mission Assessments[2] Dir (R.B. Perry)

Chief Engineer (K. Ledbetter)

Safety & Mission Assurance (P. Martin)

Astrophysics Division Dir. (J. Morse) Dep. (R. Howard)[4]	Earth Science Division Dir. (M. Freilich) Dep. (M. Luce)	Heliophysics Division Dir. (R. Fisher) Dep. (V. Elsbernd)	Planetary Science Division Dir. (J. Green) Dep. (J. Adams)	Resource Management Division Dir. (C. Tupper-Act) Dep. (Vacant)	Strategic Integration & Management Division Dir. (D. Woods-Act) Dep. (Vacant)

Flight (S. Volz)

Applied Sciences (L. Friedl - Act)

Research (J. Kaye)

Mars Program (D. McCuistion)

Blue dashed boxes denote individuals who report to other organizations, but support SMD

[1] Co-located from Planetary Science Division
[2] Co-located at LaRC
[3] Co-located from Earth Science Division
[4] Felicia Jones-Seldon is Acting Deputy until 2/28/10.

Draft: December 2, 2009

What's New/FY10 Budget

- FY10 – Appropriated

- NASA FY10 Operating Plan not yet approved

Current and Future Research….

Continued MODIS Team Challenge - reap the full scientific benefits of MODIS, Terra, Aqua, & EOS

- Maintain/refine existing data products the best they can be (3.1 on 2006 EOS Rec.) focusing on core production, plus ESDRs (3.2 on 2006 EOS Rec.) for existing or new data product(s)

- Develop new data products to enable important, new scientific and applied uses (3.3 SDA on 2006 EOS Rec)

- Utilize MODIS (and EOS) data products to create new scientific understanding of planet Earth and how it is changing – and new applications of this knowledge for decision support

- Review of algorithms for the new and alternative MODIS algorithms
  - Current algorithms/products – Algorithm refinement PIs to provide
    - compelling justification for the importance/utility of the algorithm and (as needed) improvements;
    - plan for transition to core production (recognizing infusion of new knowledge)
    - data product documentation broadly reviewed by user communities (web-based posting for review/comments?)
    - regular data product/algorithm reviews – maintain, refine, review as needed
  - New algorithms/data products – draft new proposal, documentation and requirements, follow with review and endorsement by user communities

- Develop new data products to enable important, new scientific and applied uses (3.3 SDA on 2006 EOS Rec) – 18 December 2009

  - **MAIAC: Multi-angle Implementation of Atmospheric Correction for MODIS (08-ATBD-1)** – Alexei Lyapustin - the theoretical basis for the algorithm is sound, and the algorithm is ready for coding and production

  - **MODIS Canopy Water Content (CWC) Product (08-ATBD-2) –** Susan Ustin – theoretical basis has minor deficiencies, needs more development

  - **Mapping High-Resolution Land Surface Radiative Fluxes from MODIS: Algorithm Theoretical Basis Document (08-ATBD-3) – Shunlin Liang -** the theoretical basis for the algorithm is sound, but the algorithm is not ready to go into production

- Review of algorithms for the new and alternative MODIS algorithms
  - Current algorithms/products – Algorithm refinement PIs to provide
    - compelling justification for the importance/utility of the algorithm and (as needed) improvements;
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    - data product documentation broadly reviewed by user communities (web-based posting for review/comments?)
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  - New algorithms/data products – draft new proposal, documentation and requirements, follow with review and endorsement by user communities
  - Assess quality and importance of data product suites (and their components)
  - Prioritize EOS/MODIS data products relative to each other and relative to other needs of the community they serve
  - Recommend changes, improvements, level of service by data systems and archives
  - Must involve community (peer review by mail, panel, telecon)
  - Must take into account NASA (or other) resources / program components required to support the products; involve data system and archive management, NASA HQ Focus Area Leads (program/project managers)

Future Research….

The Continuity and Evolution of Earth System Science

- How does MODIS, Terra, and Aqua fit into a changing Earth System?
- NASA Mission:
- **Strategic Goal 3 (6 total)**: Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of the human spaceflight program to focus on exploration.
  - Sub-goal 3A (7 total): Use Earth-orbiting satellites to study global change and enable better predictions of climate, weather, and natural hazards

BUT…

New NASA Strategic Plan coming out next month (where this goal has been changed) and update in NASA's Science Plan to be reviewed by the FACA committees etc. in spring/summer 2010, with somewhat modified science questions.

Progress on the Challenge – Future Research

The Continuity and Evolution of Earth System Science
- NASA – advance planning for SMD (new Administration)
- Earth Science is continuing evolution from mission science teams to measurement-oriented science teams (ESDRs) – tomorrow
  - ROSES 2010 program element in Earth Science data records & uncertainties
- Development of and Linkage to Global Earth Observing System of Systems (GEOSS) + CEOS (Virtual Constellations, GCOS, etc.)
- International Partnerships – missions, JSTs, field campaigns, etc.
- Ocean Policy Planning underway, revisit of U.S. Commission on Ocean Policy Ocean Research Priorities Plan; Climate Change Science Program back to US Global Change Research Program, considering Strategic Planning effort in 2010; US Carbon Cycle Science Plan (2010)
- R2O
- NRC NASA/NOAA/USGS Decadal Survey – January 2007, implementing mission concept studies now, aspects of first group funded; other NRC surveys underway
- Merged products (NPP) + revised and new ATBDs
- Linkages from MODIS to NPP VIIRS FM-1, 2, etc.

- Tremendous disciplinary and interdisciplinary science progress
  - Intrasensor (MODIS) interdisciplinary and intersensor challenge
- Public outreach
  - Newsworthy publications
  - NASA Science Update – interdisciplinary with a flavor of Applied? Perhaps high latitude or IPY?
  - Inspiration for the next generation of explorers and researchers
- DAACs – reaching the research communities, operational managers, and public
- Tighter coordination with international programs and partners – missions and international programs (e.g., GEOSS, CEOS)
- Coordination telecons by discipline? Suggested at MCST session and in the disciplinary sessions.

Progress on the Challenge: ESDRs (May 2008)

- Utilize MODIS (and EOS) data products to create new scientific understanding of planet Earth and how it is changing – and new applications of this knowledge for decision support
- Systematic observations from current NASA sensors (MODIS) – what products are key for climate and Earth System research
  - e.g., TOA radiances or aerosol optical depth?
  - Need for white papers (e.g. land community)
  - Gaps in systematic obs vs. new obs needed (DS Role/ timeline?)
- Future Sensors – VIIRS (NPP – 2011; NPOESS C1 - 2014) – agency that has responsibility for climate? What products? Requirements/Funds for data (re)processing,   calibration, validation? New science challenges?

Missions to Measurements: May 2008

- One data system to ensure a "seamless" time series
- Scientific guidance and priorities must represent broad user community
- Terra and Aqua Science Team Meetings – interdisciplinary science team meeting that focuses on science questions that require properties of the Earth System from multiple sensors – 6 month time frame – became ESS@20 Symposium (http://eospso.gsfc.nasa.gov/), but in the future? (A-Train Science Team? Shift to more discipline-based measurement groupings?)
- Evolution of efforts to support current missions, prepare for NPP/NPOESS era (and any associated NASA responsibilities – research quality data?) as well as any future DS missions being planned or under study as they advance

Mission Extension/Senior Review Process

- Effort coordinated by Steve Volz at NASA HQ
- Process for extending missions beyond the prime life
- 2-year cycle
- Up for renewal in April 2011:
  - Terra (CERES, MOPITT, MISR, ASTER, MODIS)
  - Aqua (AIRS, MODIS, AMSR-E, CERES)

  Plus rest of ES portfolio except for Aquarius, pending successful launch.

  Results from talk by Claire Parkinson this morning on feedback from Terra and Aqua proposals in 2009.

Issues for MODIS Team

- More interdisciplinary algorithm development approaches, Terra/ Aqua/EOS intersensor science – talk tomorrow
- Certain algorithm developers and validation investigators should address important deficiencies in key data products
- Algorithm developers need to represent broader community needs by working with them
- Algorithm refinement PIs need to provide compelling justification for the importance/utility of the algorithm improvements and/or new data products + plan for transition to core production (recognizing infusion of new knowledge)
- Established process for regular data product and algorithm reviews – done for three new ATBDS, but need to maintain, evolve, refine, review as needed
- Last meeting (5.2008): need for tighter internal MODIS Land, Ocean, & Atmosphere Groups as well as need to work interactions across the team
- Bridge to NPP –what is the role of the science community (Diane Wickland's talks this morning and tomorrow)

Upcoming MODIS-Relevant Competitions

- EOS Recompete - Now entitled "The Science of Terra and Aqua" – Talk Weds the 27th, 8:45am

- FYI: Amendment 12.14.2009 - ROSES 2009 A.24 Remote Sensing Theory

  - a new multidisciplinary/interdisciplinary program to support fundamental scientific advances in remote sensing theory and radiative transfer, including advancement of retrieval algorithms to be used for space-based remote sensing of the Earth's atmosphere, oceans, biosphere, cryosphere, land surface, and/or Earth interior

  - *Theoretical algorithm advances* - research to develop fundamental advances to radiative transfer theory and calculations

  - *Data "fusion"* - research to develop new approaches for integrative analysis of disparate data sets

  - *Advanced corrections* - research to develop improved approaches and/or algorithms for correcting satellite data in order to take into account known confounding effects

  - Proposals due 4.30.2010; ~$1.5M/yr; ~10 awards; lucia.s.tsaoussi@nasa.gov

- Update on team (PI) progress, integration
  - Algorithm Refinement and Validation
  - ESDRs
  - Science Data Analysis Results
  - MCST: calibration/instrument issues for Aqua and Terra MODIS
- Thursday Summary: Issues encountered
  - Oceans
  - Land
  - Atmosphere