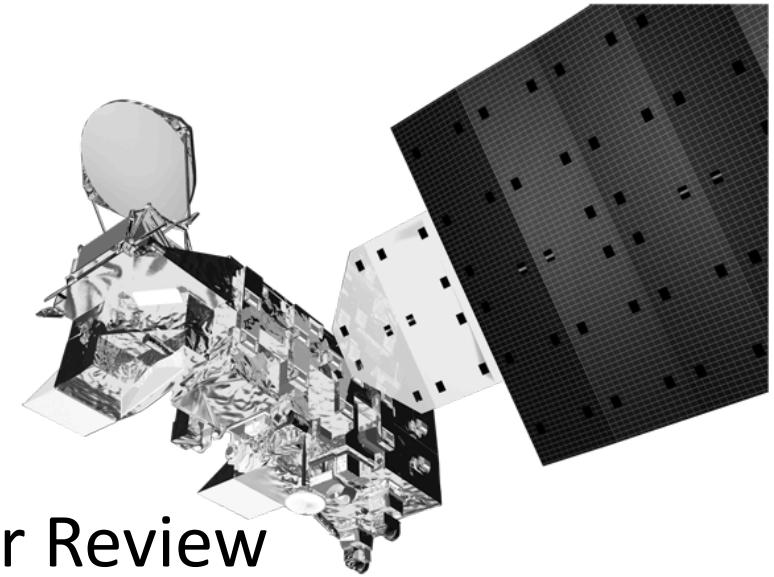


# The 2009 Aqua Senior Review and Other Aqua Updates

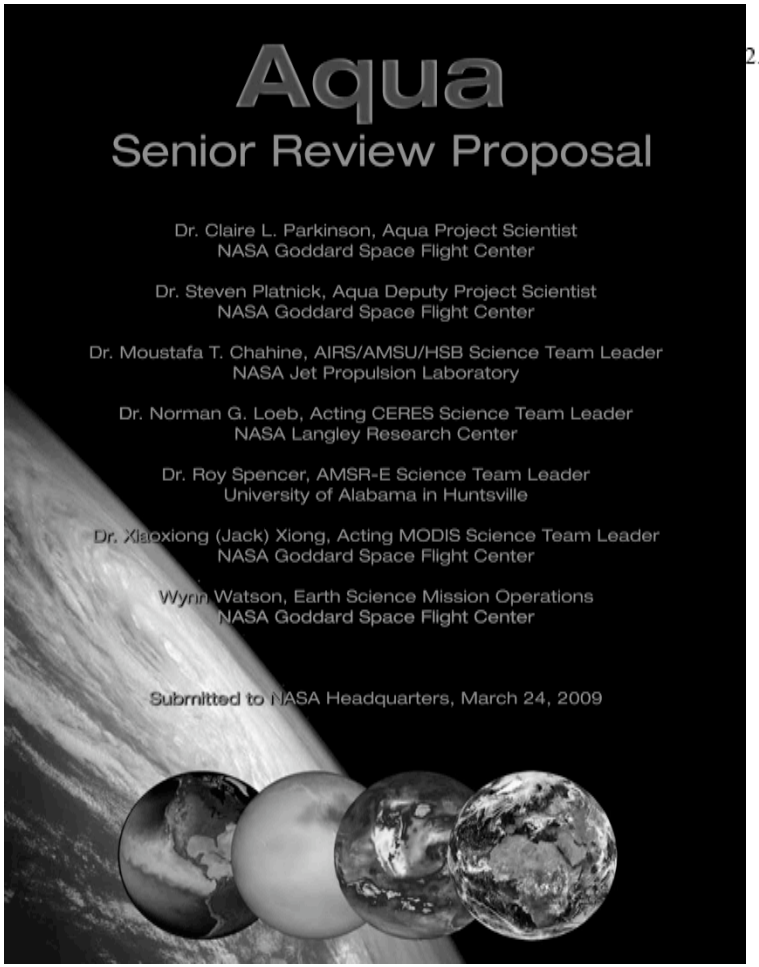
Claire L. Parkinson
Aqua Project Scientist

Presented at the AIRS Science Team meeting, Greenbelt, October 13, 2009

# 2009 Senior Review

- Purpose: Determine which of the reviewed missions warrant continued operation and how much funding each should receive.
- Missions involved: ACRIMSAT, Aqua, Aura, CALIPSO, CloudSat, EO-1, GRACE, ICESat, Jason-1, QuikSCAT, SORCE, Terra, and TRMM (i.e., 13 missions all beyond their prime mission lifetimes).
- Period covered: FY2010 – FY2013.
- Proposal requirements: science section, technical/budget section, appendices providing a data product inventory, budget spreadsheets, references, and a list of acronyms.
- Key Dates:
  - March 24, 2009, proposals due to NASA Headquarters (HQ).
  - May 12-14, 2009, meeting of the Senior Review Panel (Aqua presentation May 13).
  - September 1, 2009, letter received from Mike Freilich (Director for Earth Science, NASA HQ) regarding the Senior Review results.
  - September 24, 2009, Aqua response provided to NASA HQ.

# 2009 Aqua Senior Review Cover Page and Table of Contents



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# Compelling Aspects of the Aqua Proposal

- Strong science
  - Four productive science teams (AIRS/AMSU/HSB, AMSR-E, CERES, and MODIS).
    - Over 600 publications using Aqua data in each of the last two years.
    - Over 7,000 citations to publications using Aqua data in each of the last two years.
  - Significant contributions to each of NASA's six interdisciplinary Earth science focus areas (especially the first five).
  - Role in extending many key climate data records.
- Many contributions to National Objectives/Applied Science
  - Many Aqua data products being used in weather forecasting.
  - Contributions to each of NASA's 12 Applied Science Program Elements.
  - Value of the Aqua data to the U.S. Forest Service, USDA, EPA, FAA, NOAA, DOD, USAID, USGS, U.S. Coast Guard, Dartmouth Flood Observatory, Washington Volcanic Ash Advisory Center, Alaska Volcano Observatory.
- Healthy spacecraft and instruments
- Enough fuel to last at least through 2018
- Cheap to continue relative to the initial investment

# May 13, 2009 Meeting with the Senior Review Panel

- Very nice opening and closing compliments from the Panel regarding the Aqua mission and the proposal.
- Presentation centered on 8 sets of questions that the Panel provided ahead of time.

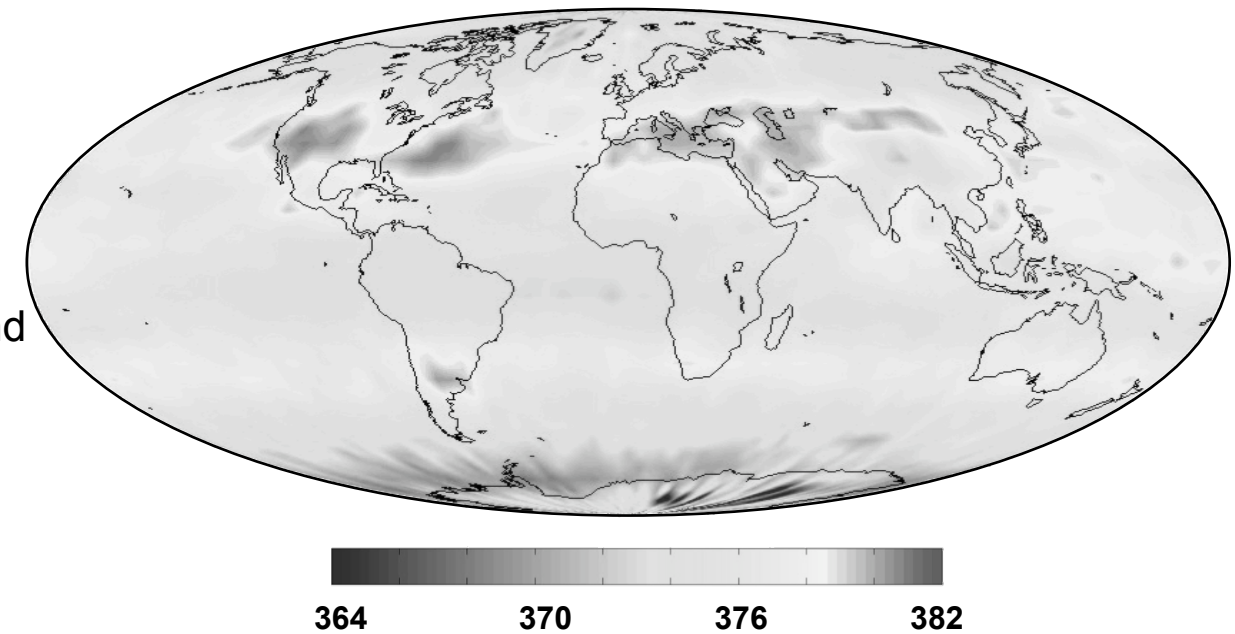
# Question Set #1

*“ Please present your optimal proposal budget; describe the additional work which will be funded by the optimal budget, the benefits of the added work, and justify the additional budget requested. ”*

# ‘Optimal’ Additions: Mission Operations (ESMO) and AIRS/AMSU

- ESMO: Additional funds are requested for FY10 (only) to complete key security upgrades to the ground systems.
- AIRS/AMSU: 2.1 FTE/yr are requested to enhance the AIRS $CO_2$ product, to produce retrievals in the stratosphere and lower troposphere.

AIRS mid-troposphere $CO_2$ concentrations (ppm) for July 2003 (from Mous Chahine and the AIRS Science Team).



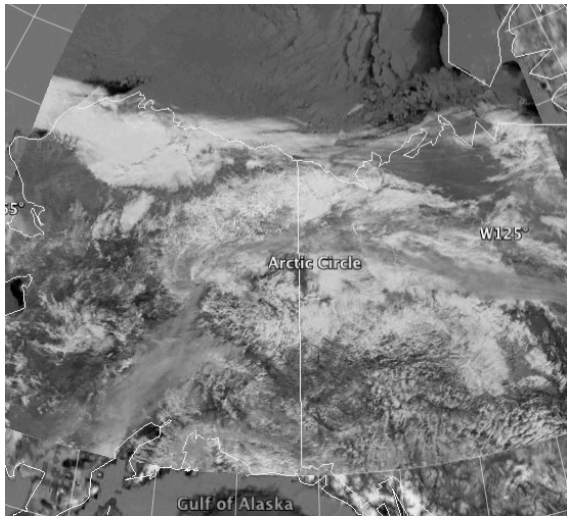
# AIRS/AMSU Mid-Tropospheric $CO_2$ Product
# September 2002 – July 2008

(animation from Mous Chahine, the AIRS Science Team, and the NASA GSFC Scientific Visualization Studio)

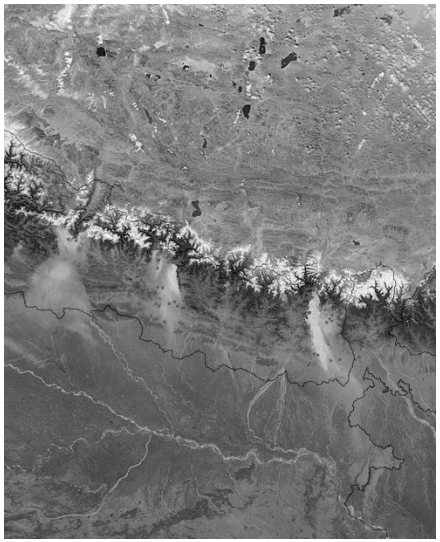
# ‘Optimal’ Additions: AMSR-E, CERES, and MODIS

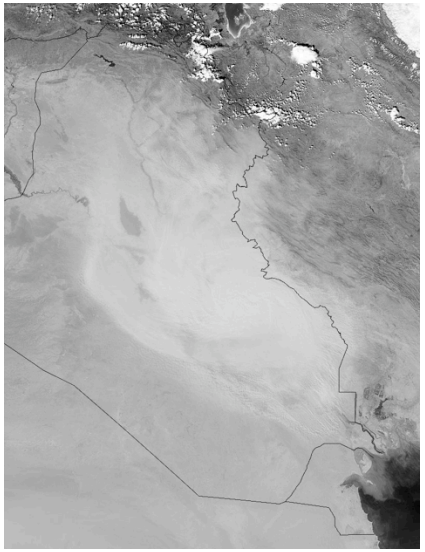
- AMSR-E: 0.6 FTE/yr are requested to increase the Team Leader Science Computing Facility (TLSCF) staffing to 2 full-time people.
- CERES: 1.75 FTE/yr are requested to bring the CERES Data Management Team back to its level of staffing prior to funding cuts begun in FY08, and thereby to increase the efficiency of CERES data processing.
- MODIS: 0.75 FTE/yr are requested from Aqua and 0.75 FTE/yr from Terra for the MODIS Rapid Response effort, to bring to full funding the sole Rapid Response scientist and to add 1.0 FTE for software development (website redesign, vector imager processing, etc.).

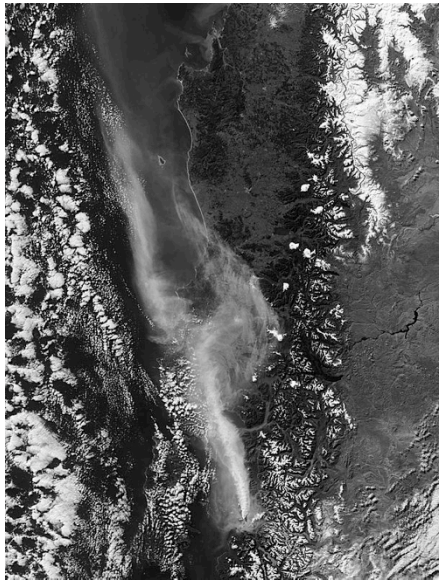
Sample Rapid Response Imagery



ARCTAS image over Alaska, 5/08


Fires in Nepal, 3/12/09


Dust storm in Iraq, 9/16/08

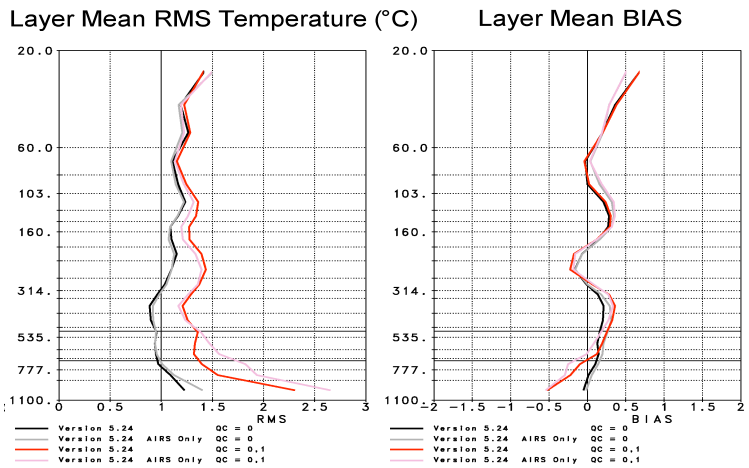

Ash plume, Chaiten volcano, Chile, 5/28/08

# Question Set #2

*" … The AMSU instrument has experienced anomalies … it is unclear how AIRS product quality and accuracy would be affected by the loss of AMSU … Have potential synergies between AMSU (23-90 GHz) and AMSR-E (6.9-89 GHz) been investigated? Could AMSR-E provide a similar role as AMSU in the production of AIRS retrievals? "*

## Abbreviated Answers

- Several test studies indicate that AIRS-only results show only minor degradation versus the AIRS/AMSU Version 5.0 algorithm (see plots).
- AMSR-E would not be able to replace AMSU because of not viewing the same air mass at the same time and viewing angle.
- AMSR-E data help the AIRS team in other ways.




Comparisons for global averages on 9/6/2002, 1/25/2003, and 9/29/2004 (plots courtesy of Susskind, Blaisdell, Iredell, and Molnar)

# Question Set #3

*" Aqua has two CERES instruments (FM-3, FM-4) … the shortwave channel on CERES FM-4 ceased to operate properly in 2005 ... Does this failure affect continued product generation, product accuracy and the full range of variable retrievals? ... which of these two modes (cross-track or rotating azimuth) is currently used and does this activity perform synergistically with CERES on Terra? "*

Abbreviated Answers

- The failure of the FM-4 shortwave (SW) channel has no effect on continued product generation, product accuracy, or the full range of variable retrievals.
- Aqua's FM-3 is operating in cross-track mode.
- There is no effect on the synergistic Terra and Aqua measurements.

# Question Set #4

*" There are currently 36 core MODIS products ... Most of these products are listed at stage II maturity; there are also two provisional products and eight other products at stage I maturity. Are there specific plans to bring these products to stage III maturity during the proposed mission continuation? "*

## Abbreviated Answer

The answer provided to the Review Panel included three slides, one providing definitions of four levels of validation (provisional and stages 1, 2, 3) and the other two listing each of the MODIS data products, with their current level of maturity and eventual final level of maturity, along with the comment on most of them that the validation activities are funded through ROSES (and hence dependent on ROSES funding).

# Question Set #5

*" The AMSR-E and CERES core product algorithms are listed in the proposal as mature; does this mean that the resulting products have reached a level of maturity that requires algorithm maintenance only? Can more detailed information be provided regarding the level of product (not algorithm) maturity ... similar to what is presented for MODIS and AIRS/AMSU/HSB? "*

## Abbreviated Answer

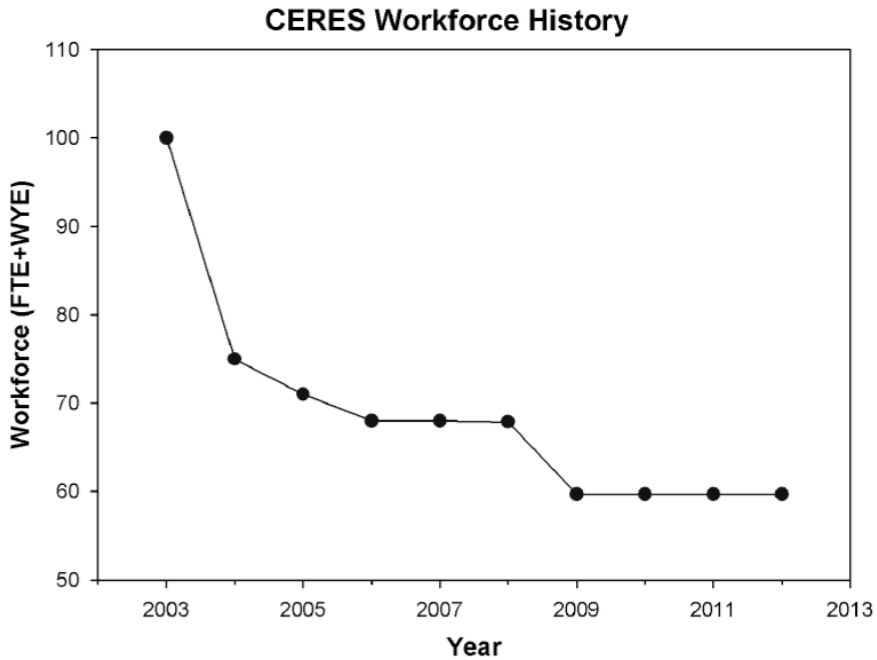
Details were provided to the Review Panel on the maturity level of each of the AMSR-E and CERES data products, many of which were listed as having reach Stage 3 maturity. However, it was also stated that even with Stage 3 maturity, algorithm refinements continue to be made (i.e., in general more work remains than 'algorithm maintenance only', the primary exception being the CERES Edition 2 products).

# Question Set #6

*" ... the minimum staffing request (60 FTE/yr) for CERES is roughly twice the level requested for MODIS. Why? "*

## Abbreviated Answer

- CERES is a PI instrument, and hence the CERES Senior Review budget includes support for an integrated instrument-algorithm-validation science team covering all CERES data products (Levels 1-3).
- In contrast, MODIS, AIRS/AMSU, and AMSR-E are Facility instruments. Hence MODIS Level 2 and 3 algorithm improvement and validation are funded separately through ROSES.

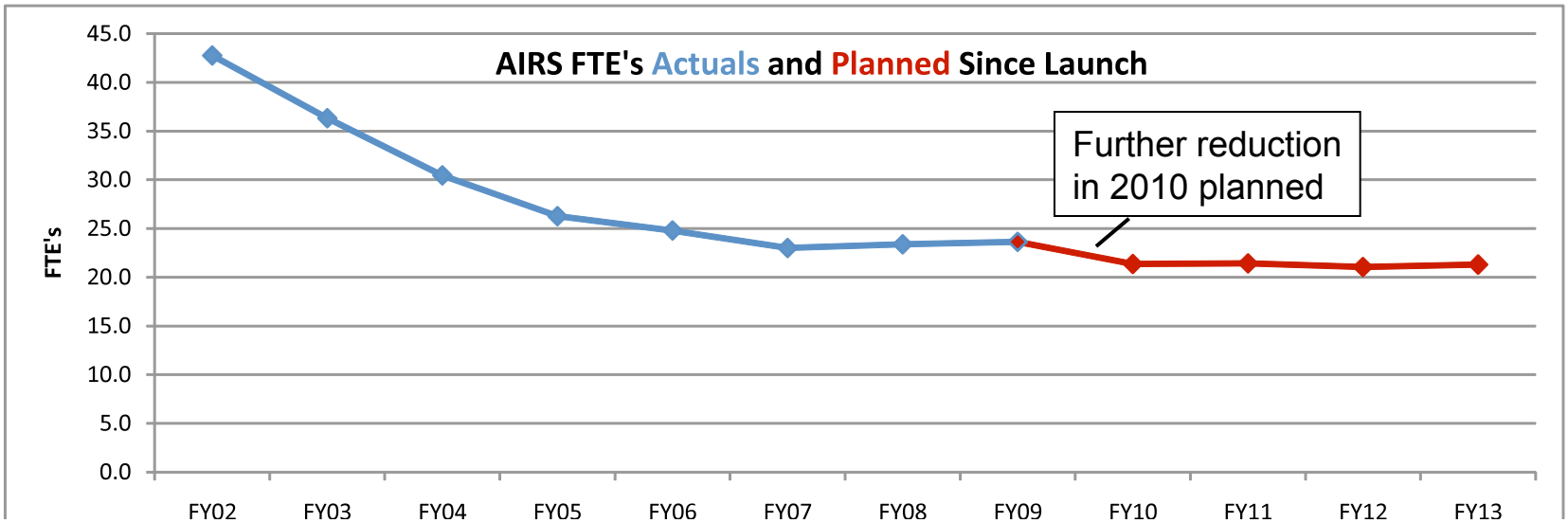


# Question Set #7

*" The budget request for AIRS/AMSU for science algorithm development and processing is significantly higher (9.8 FTE/yr) than other Aqua instruments. Why isn't this covered through ROSES ...? The AIRS/AMSU team is requesting an additional 2.1 FTE/yr to enhance the utility and achieve quality retrievals of CO2 in the stratosphere and boundary layer; how is this request different from the proposed science algorithm development activities? "*

# ROSES vs. Senior Review Funding for AIRS/AMSU Science Algorithm Development and Processing

- Despite the terminology used, the AIRS Project is in general not developing data product algorithms. As with MODIS and AMSR-E, the algorithm development is being done through ROSES.
- The relevant funding for the AIRS Project is for:
  - Science integration, testing, and validation. Total: 4.6 FTE/yr.
  - Software and data operations. JPL integrates software received by the science team into a single processing system, etc. Total: 5.2 FTE/yr.
- AIRS staffing levels have decreased by 50% since launch.



# AIRS $CO_2$ Optimal vs. In-Guide Efforts

- Maintenance of the mid-tropospheric AIRS $CO_2$ product is part of the in-guide budget.
- The Optimal budget includes funding for the development of corresponding $CO_2$ products for the stratosphere and near surface. Proposed activities include:
  - Channel selections.
  - Retrieval optimization.
  - QC algorithms.
  - Software development.
  - Testing and diagnostics.
  - Validation.
  - Product generation.
  - Documentation (GES DISC, journal publications).
  - User support.

# Question Set #8

*" There are large differences in the number of publications, data users, and data volume downloads between MODIS and other Aqua sensors. There are many potential reasons for these differences, including the broad range of products and user communities addressed by MODIS. However, are there other reasons ... ? "*

Answer

- The MODIS science team is by far the largest.
- The MODIS publication numbers cover Terra as well as Aqua.
- The Terra MODIS has been operating since February 2000, whereas no AIRS or AMSR-E was in space until May 2002.
- The CERES science team is focused on long-term climate information, whereas the MODIS team also has a considerable focus on much shorter-term events.
- MODIS has the highest resolution of the Aqua instruments, allowing local details that have generated great interest and usage, e.g., for imagery of forest fires, dust storms, and phytoplankton blooms.

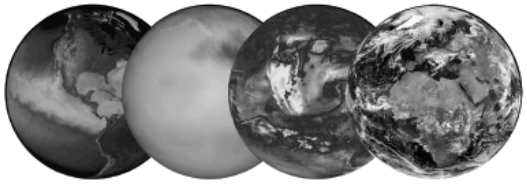
# Senior Review Panel Report on Aqua

- Both the Science and National Interests Panels gave Aqua their highest ratings ('Outstanding' and 'Very High Utility' respectively).
- Many very complimentary statements were made. For example:
  - "NASA should undertake any and all efforts necessary to sustain this irreplaceable mission."
  - "... the proposed Aqua mission continuation plan is robust with no apparent weaknesses."
  - The in-guide budget was "at a bare bones level".
- Suggestions.
  - Add $CH_4$ to the AIRS/AMSU core product list.
  - Identify the root causes of any operator errors.
  - Redouble efforts to make the AIRS/AMSU and AMSR-E data available and useful to the broader scientific community.
- Funding recommendations: Fund at the requested 'optimal' level with the sole exception of funding the AIRS/AMSU $CO_2$ enhancement efforts for the first two years rather than all four years, shifting the effort to ROSES funding after FY2011.

# Aqua E/PO Implementation Plan
(submitted September 29, 2009)

- Dynamic Planet
- ViewSpace
- S'COOL
- AIRS Outreach
- Aqua Vodcast Series
- Earth & Sky Radio Show
- E/PO budget (over half is for AIRS E/PO)
- Collaborations with the other EOS E/PO efforts

Goddard Space Flight Center
Aqua Project Science Office
aqua.nasa.gov



## Aqua E/PO
### Implementation Plan

Prepared for: Dr. Ming-Ying Wei, Earth Sciences Division, NASA Headquarters
Ms. Stephanie Stockman, Science Mission Directorate, NASA Headquarters

Prepared by: Steven Graham, Aqua Outreach Coordinator
Dr. Claire Parkinson, Aqua Project Scientist

*With contributions from:*
Dr. Lin Chambers, S'COOL Project Director, NASA Langley Research Center
John Godfrey, ViewSpace Production Team Lead, Space Telescope Science Institute
Sharon Ray, AIRS Outreach Coordinator, NASA Jet Propulsion Laboratory

September 29, 2009

# Earth & Sky Aqua Radio Series

- Interview of Claire Parkinson, on Aqua, aired on September 7, 2009.
- Interview of Mous Chahine, on AIRS $CO_2$, aired on September 14, 2009.
- Upcoming interviews
  - Lorraine Remer, on aerosols and public health using MODIS Data.
  - Norman Loeb, on climate data records using CERES data.
  - Chelle Gentemann, on either hurricane cold wakes or ecosystems and fisheries management using AMSR-E data.

# Earth & Sky Aqua Radio Series

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Earthsky Interviews

## Mous Chahine: 'No area on Earth immune from effects of greenhouse gases'

Photo Credit: NASA

90 SECOND INTERVIEW

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09-14-2009 - EARTH

*Mous Chahine*: There is no area on Earth immune from the effects of carbon dioxide regardless of whether that area produces carbon dioxide or not.

OUR THANKS TO:

Moustafa Chahine

Moustafa 'Mous' Chahine studies the effects of increased carbon dioxide on the Earth's hydrological cycle, and the comparative climatology of Mars, Venus, and Earth. He is chief scientist of the Jet Propulsion Laboratory in California. Dr. Chahine has served as a member of the NASA Earth System Sciences Committee and is currently chairman of the World Climate Research Programmer's Global Energy and Water Cycle Experiment.

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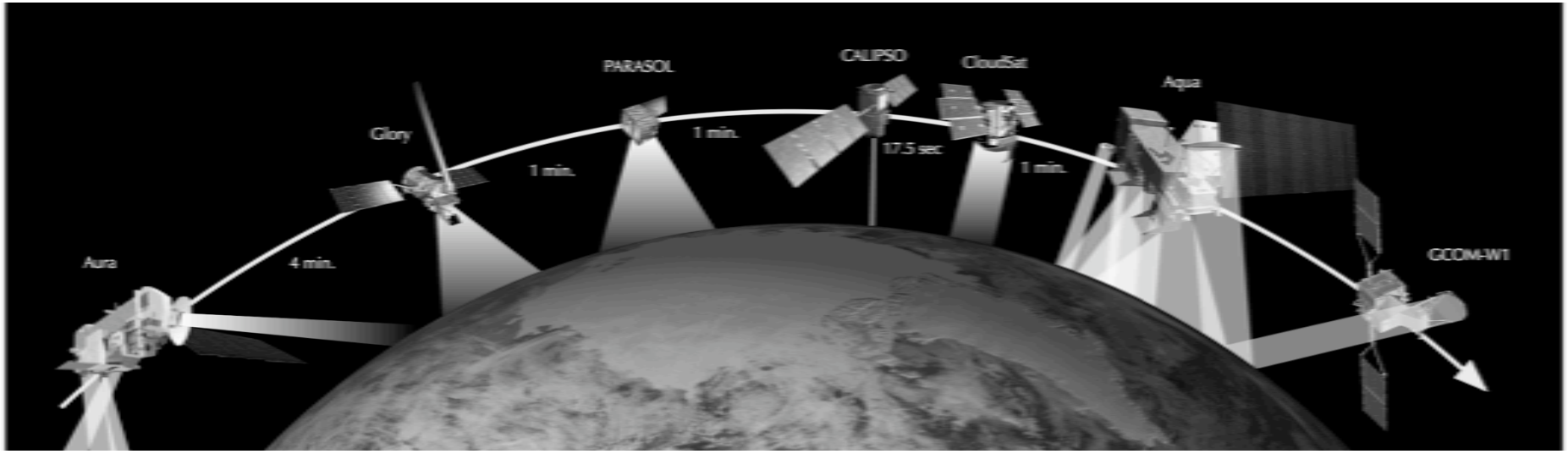
- Bruce Wielicki on clouds and Earth's energy balance
- Jerry Melillo on scientists working to document U.S. climate impacts

# A-Train Update

- PARASOL exiting the A-Train, autumn 2009.
- Glory launch date no earlier than October 1, 2010.
- Global Change Observation Mission – Water (GCOM-W) launch no earlier than November 2011.
- Possible Orbiting Carbon Observatory (OCO) replacement mission (following the failed February 2009 attempted launch), no earlier than 2012.