28th ASTER Science Team Meeting 2005

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The 28th joint Japan/U.S. Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Science Team meeting was held December 12-16, in Palm Springs, CA. About 70 people attended the meeting, including science-team members from Japan and the U.S., and participants from other affiliated organizations.

Following welcoming remarks by **M. Abrams** [NASA/Jet Propulsion Laboratory (JPL)] and **H. Tsu** [Earth Remote Sensing Data Analysis Center (ERSDAC)] presentations were made on the status of NASA and the Earth Observing System (EOS) by **W. Turner** [NASA Headquarters]; on the ASTER instrument by **F. Sakuma** [National Research Laboratory of Metrology]; on the Land Processes Distributed Active Archive Center (LPDAAC) by **B. Bailey** and **K. Duda** [US Geological Survey]; on the Ground Data System (GDS) by **Y. Kannari** [ERSDAC]; and on scene acquisitions by **K. Okada** [ERSDAC].

NASA-EOS information included details of the EOS competition and the shift in emphasis away from refinement of algorithms toward scientific analysis, and on a discussion of the 2006 budget and other unknowns. The LPDAAC report included an update on the status of the on-demand Level 1B (L1B) system upgrade which will optimistically be implemented in April 2006 both in Japan and in the U.S., an update on data pricing and redistribution policy, description of a new processing system, which will make it easier for users to download multiple granules, and an evaluation of four Digital Elevation Model (DEM) production generation systems and the reasons for choosing either *Silcast* software or the software used by GDS.

The ASTER instrument is in remarkably good health even though the Visible Near-Infrared (VNIR) pointing operation is near the design lifetime, as are the Shortwave Infrared (SWIR) and Thermal Infrared (TIR) coolers. There has been a temperature jump in the SWIR detector which is not understood but has stabilized. There has also been a gradual degradation in the radiometric responses of the VNIR and TIR. As of December 5, 2005, 1,080,347 total scenes have been collected, of which 434,600 are daytime scenes with less than 20% cloud cover. Scene collection continues according to a series of criteria including their deemed importance to investigators, and whether good data have already been acquired. Some important acquisitions have not been met due to an enforced reduction in pointings because of the approach of the projected lifetime of the pointing mechanism.

Also in this session **Y. Yamaguchi** [Nagoya University] discussed the status of the global mapping task, the gap-filler task, the nighttime TIR regional-mapping task, and an issue with VNIR pointing. **M. Abrams** [JPL] discussed Landsat data gap issues. **S. Hook** [JPL] discussed ASTER follow on opportunities. **M. Abrams** reported on ASTER related publications including a special issue of *Remote Sensing of the Environment* that featured 17 papers, as well as 10 articles in *IEEE Transactions on Geoscience and Remote Sensing* and a highlight article in *Photogrametric Engineering and Remote Sensing*.

Items which needed to be discussed and decided on in this session include a third round of global mapping which may include areas considered critical by the World Wildlife Federation and may be heavily impacted by Landsat failures; operational scenarios beyond the original ASTER instrument-design lifetime determined by VNIR pointing health, SWIR temperature rise and how to calibrate SWIR in response; and issues related to completing a nighttime TIR map. The failure of the scanning mirror on Landsat 7 has generated a number of ideas to *fill in* for commitments made to provide a decadal and mid-decadal reasonably high resolution map of the globe. One suggestion has been put forth to use ASTER data to fill in the gaps. The ASTER team should assess how it would impact the planned collection of data should this happen.

Working Group Reports – December 16

Operations and Mission Planning Working Group and Science Scheduling Support Group (OMPWG – SSSG)
Chairs: M. Abrams [JPL] and Y. Yamaguchi [Nagoya University]

Among the decisions made by this working group were to continue to submit request packages (STARS) especially for 70–82° N to fill in gaps and to proceed according to the plans presented by **Yamaguchi** for the third round of global mapping. They are waiting for recommendations from Japan Resources Observation System Organization (JAROS) for re-setting the parameters for pointing in the scheduler. Meanwhile the threshold of 100 pointings will be reset as often as needed to avoid pointing shutdown, a mode they have been operating under for the past several months. They are awaiting more input before making a decision on collecting for a nighttime TIR global map.

Radiometric Calibration/ACT Working Group
Chairs: S. Biggar [University of Arizona] and K. Arai [Saga University]

Discussion in this group centered primarily on the SWIR temperature problem, which is manifested as a 1-5 DN change in offset due to a temperature change of 77-to-78.3 K along with a variation in temperature of about

0.4 K peak-to-peak. This is corrected for in the L1B data for normal gain, but not other gain settings. The temperature is expected to rise to 79 K in about April 2006. The offset will probably be fine until about 80 K, which may happen after 2006. This will reduce the dynamic range and may decrease the signal-to-noise at higher temperatures. Several options as to how to deal with the problem were offered, but the group suggests that no action except monitoring be taken at this time (the safest position) and that the instrument team applies the appropriate correction for offset for all gain settings.

Level 1/DEM/Geometry Working Group
Chairs: M. Abrams [JPL] and H. Fujusada [Sensor Information Laboratory Corp]

The group heard an update on Level 1A Data GDS coding because the Level 1A+ tool will be sent to the U.S. in January. The optimistic schedule is for both GDS and the DAAC to be operational in April, at which time all Level 2 products will be on demand. The Distributed Active Archive Center (DAAC) is studying options for the browse product and for a strategy for the Data Pool. The instrument geometry and inter- and intra-telescope registration continue to be excellent. It was pointed out that it is important to consider latitude differences in velocity and base to height for DEM calculations. Mention was made that the DEM software at the DAAC will be replaced soon and the choice will be either *Silcast* or GDS software. The one action item is for the U.S. to develop a procedure to actively notify users of the new Level 1A processing.

Ecology Working Group
Chairs: G. Geller [JPL] and T. Matsunaga [National Institute for Environmental Studies]

Discussion topics for this group included how to pitch in on the Landsat gap-fill issue for a 2006 global cover map. The group feels that they could support it if it doesn't substantially disrupt the existing plan for the third round of the ASTER global map. This would be less likely to be a concern if the limits on ASTER data acquisitions were loosened. The working group members were also asked to provide input on a study by the National Research Council (NRC) at the request of NASA on the measurement needs of the community. On the topic of nighttime TIR, the members felt they wanted to know who would use this data and for what purpose, and they felt the Temperature/Emissivity Working Group would provide that information. This working group had many presentations by members of the group and other team members on ecology topics.

Geology Working Group
Chairs: D. Pieri [JPL] and M. Urai [GSJ, AIST]

This group had four open action items to consider. They decided to generate a set of questions to assess how Landsat gap-filling will impact ASTER geology investigations. The group wrestled with questions such as:

- what will be the typical size of a gap request;
- what parts of the world are more likely to be requested;
- how frequently will a given request be made.

They expressed a need for the ASTER Global Volcano STAR to be continually revisited and all Geology STARS be re-evaluated because of pointing and scheduling resource limitations, and decided on a goal of at least one cloud-free baseline image of every STAR volcano. The group still needs to gather final Global Mapping 3 inputs. Inputs are due to the chairs by the first of January. There was considerable discussion of the nighttime TIR mapping issue and discussion of the strengths of such a map, and an example of a case useful to the GLIMS group by **J. Kargel** strengthening the cause. This group had many presentations on scientific results of various volcanology studies.

Temperature/Emissivity Working Group
Chairs: A. Gillespie [University of Washington] and H. Tonooka [Ibaraki University]

The group had three agenda items to cover: (1) changes to the TES software; (2) prioritization of TIR acquisitions; and (3) responding to a request for the project to justify continuing nighttime TIR acquisitions. With regard to software changes, the threshold test based on min-max spectral contrast will be disabled. This change should improve the overall appearance of images and reduce the number of strongly inaccurate products, however, users should be aware that it may lead to loss of accuracy for scenes obtained over some low-contrast surfaces in most of the standard data products. The iterative correlation for reflected downwelling sky irradiance will also be disabled.

With regard to prioritizing ASTER acquisitions and justifying continued nighttime TIR acquisitions, the two areas seem to go together. The TES group felt that the strongest justification they could give for continuing to obtain nighttime TIR data was because these nighttime scenes have the advantage of not having the effects and confusion of topographic effects and solar heating, and this makes them ideally suited to meeting a number of ASTER's formal observation priorities. For example, the ASTER instrument is uniquely equipped to acquire the imagery needed to produce a *global emissivity map*, and the completion of such a map remains a formal priority for ASTER. ASTER also prioritizes studying volcanoes and other heat islands, which are best observed using nighttime TIR acquisitions. More recently, the team decided to prioritize the study of geothermal anomalies, also best accomplished using nighttime TIR data. In addition, ASTER is used for *thermal inertia mapping,* a standard well-understood technique routinely used in planetary studies, and one that requires nighttime data.

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tute of Technology (MIT)] discussed using AIRS clear ocean data to evaluate the AMSU bias.

Chris Barnet [NOAA—*Emissivity Team Leader*] said the emissivity regression retrieval is installed in *v5*, and yet the limitations on emissivity retrieval are in the cloud clearing. **Evan Fishbein** [JPL] showed that using channels which are not sensitive to surface skin temperature in cloud clearing greatly improve the emissivity retrieval over land. **Bob Knuteson** [University of Wisconsin (UW)] used the ARM Southern Great Plains site to validate AIRS temperature and emissivity.

Sung-Yung Lee [JPL—*AIRS-Only Retrieval Team Leader*] showed the current version of the AIRS-Only retrieval works well but has more outliers. **Xavier Calbet** [European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)] and **Bill Blackwell** [MIT Lincoln Laboratory (MIT/LL)] also gave presentations on IR-Only retrievals.

John Blaisdell [GSFC] presented for **Joel Suskind** [GSFC—*Error Estimation Team Leader*] a new empirically trained error predictor. The method shows considerable skill, but more work is needed. Blaisdell also presented comparison for the accuracy of AIRS *v5* and *v4* clear column radiances and retrievals. **Larrabee Strow** [UMBC] compared AIRS cloud-cleared radiances to ECMWF.

Friday's session focused on calibration and data processing. **Hank Revercomb** [UW] presented validation of AIRS radiances using Scanning High-resolution Interferometer Sounder (HIS), and **George Aumann** [JPL] showed validation using SST. The consensus is that AIRS data are accurate to about the 0.2 K level for most channels. **Steve Broberg** [JPL] showed radiance comparisons of AIRS with MODIS and HIRS using tropical ocean and Antarctic scenes. **Denis Elliot** [JPL] gave a progress report on the effort to produce spatial response functions in-flight for the AIRS footprints. **Greg Leptoukh** [GSFC] showed how the *Giovanni* tool allows quick exploration and online analysis of remote sensing and model data. Presentations ended with **Vicky Meyers** [JPL] giving a demonstration of the new *Harvest* tool for submitting changes to the AIRS processing system.

The AIRS Science Team Meeting was a milestone in the lifecycle of AIRS. In the past, the group's primary focus was on product generation and validation, but now the focus is more on science investigations and operations. Product development continues, however, with improvements to retrievals over land and polar regions and with new research products for surface emissivity and atmospheric composition. The team is functioning well with members sharing their various techniques for deriving and improving product accuracies and comparing scientific results. All things considered, the AIRS Science Team Meeting was an unqualified success.

Tian, B., D. E. Waliser, E. Fetzer, B. Lambrigtsen, Y. Yung, and B. Wang. 2005. Vertical Moist Thermodynamic Structure and Spatial-temporal Evolution of the Madden-Julian Oscillation in Atmospheric Infrared Sounder Observations. *J. Atmos. Sci.*, In Print.

Xiouhua Fu, Bin Wang, Li Tao. 2006. Satellite data reveal the 3-D moisture structure of Tropical Intraseasonal Oscillation and its coupling with underlying ocean. *Geophys Res. Lett.* **33**, L03705, (doi:10.1029/2005GL025074).

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The group therefore strongly recommends continuing nighttime acquisitions. They also suggest changing the scheduler to allocate bits instead of scenes, which has severely limited data acquisition in the past, but apparently this change is not easy to make. They also recommend replacing the current project high/medium/low priority map with a land cover map, and that areas where scenes have already been obtained and snow-covered areas be excluded.

STAR Committee

The STAR committee approved three new STARS. Old STARS will expire in 2006 including the GLIMS STAR which has about 2500 glacier targets and the volcano STAR which also has a large number of targets.

After the working group meetings **Y. Yamaguchi** presented a summary of the teams decisions. **M. Kato** announced that the next meeting will be held in Japan, probably Tokyo, in June. **H. Tsu** and **M. Abrams** had a few final words and closed the final plenary session.