34th ASTER Science Team Meeting Report

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The 34th Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Science Team Meeting was held December 8-11, 2008 in Pasadena, CA. ***M. Abrams*** *[Jet Propulsion Lab (JPL)—U.S. Aster Science Team Lead] and* ***H. Tsu*** *[Earth Remote Sensing Data Analysis Center (ERSDAC)—Japan Aster Science Team Lead] welcomed approximately 55 U.S. and international team members and guests.*

Opening Plenary Session

M. Abrams updated the audience on U.S. ASTER and related activities including planned budget cuts, the upcoming Senior Review of Terra, an ASTER publication summary, and reports on the Hyperspectral Imager (HypsIRI) proposed as part of the recent Earth Science Decadal Survey, the Landsat Data Continuity Mission moving toward a planned launch in 2011, and other highly visible ASTER milestones.

T. Sato [Japan Resources Observation System Organization (JAROS)] reported on instrument status, noting that ASTER is now nine years old, and has outlived its nominal lifetime by four years. Only the Shortwave Infrared (SWIR) detector is showing its age. (The SWIR is currently unavailable due to its detector temperature rising—see discussions below.) Sato made note of the design lifetimes of various components of the other telescopes and the gradual decline in radiometric responses of the Visible–Near Infrared (VNIR) and Thermal Infrared (TIR) detectors.

M. Hato [ERSDAC] reported on the status of ASTER observations and data processing, reporting that since launch 1,593,045 scenes (an average of 440 granules per day) have been acquired. Hato also reported on the status of Level 1A (L1A) reprocessing—all motivated by SWIR-related-issues, the status of ASTER Global Digital Elevation Model (GDEM) production, and SWIR status. Validation is taking place at ERSDAC and the Land Processes Distributed Active Archive Center (LPDAAC) with release due in the first quarter of Japan's fiscal year. After a number of *on-off* cycles and *stroke length* changes, the temperature of SWIR continued to rise. At this time the cooler remains off and discussions continue for possible solutions.

T. Tachikawa [ERSDAC] made a detailed report on the SWIR history and status and consequences of losing SWIR data, including cloud assessment limitations and inter-telescope registration concerns. He also gave a detailed discussion of the GDEM production.

M. Fujita [ERSDAC] reported on the general status of data acquisition including a discussion of the difficulty of not being able to assess cloud cover data due to loss of SWIR. He reported on the status of the third round of global mapping, the second round of nighttime global mapping, the missing GDEM data observations, and the attempt to fill in data gaps at high latitude. Fujita also reported on the observation status of urgent data requests and acquisition requests associated with ground campaigns. The consumption rate for TIR pointing resources has been monitored and the rate was confirmed to be reasonable.

B. Bailey [U.S. Geological Survey (USGS)] gave a report on the LPDAAC including their new website, switch to the Warehouse Inventory Search Tool (WIST), global DEM validation activities and plans for distribution. He showed statistics on the ingest and distribution of ASTER data products and covered several miscellaneous items including upgrade to *Version 3.2* processing, a back-up strategy for L1A data, and the discontinuation of hard media option for data distribution.

Y. Yamaguchi [Nagoya University] reminded the audience of issues to be addressed in the splinter groups: 1) what to do about a SWIR retry plan; 2) how to improve the cloud assessment without SWIR; and 3) whether to stop or renew global mapping.

Operations and Mission Planning Working Group

T. Sato presented recommendations from the instrument operations team to do another recycle of the SWIR, which prompted a long discussion of the possible outcomes and risks. In the end, the group recommended only one recycle be performed using predetermined parameters and schedule.

T. Tachikawa discussed the impact of cloud assessment error due to problems with SWIR from July–September 2008. All Science Team Acquisition Requests (STARs) during this period were affected, but the problem has been addressed and data acquired during this period have been reprocessed. He also presented an analysis of cloudy scene statistics based on metadata contained in the global DEM data set with maps showing areas of poor coverage. The committee recommended that a new STAR be submitted to fill in these gaps.

M. Fujita reported on the status of the nighttime TIR STAR and announced that they are waiting for a report from the Temperature Emissivity Separation group for recommendations on possible changes. He also reported on the status of the recently completed global DEM STAR, where 14,000 cloud-free scenes were added to the archive. It is now about 80% complete, but the Gap Filler STAR still remains quite incomplete due in

part to the cloud assessment problem, and will be re-submitted.

Level 1/ DEM Working Group

H. Fujisada [Sensor Information Laboratory Corporation (SILC)] reported on, among other things, the status of the Level 1 software that was modified to correct radiometric calibration to account for the unusable SWIR data. Nighttime TIR geolocation accuracy has decreased to 300–500 m in longitude (reduced from 100–200 m earlier), and the error is always in the same sense. The inter-telescope and intra-telescope registration are fine. Fujisada also described in detail the procedure he used to fill voids and replace anomalous DEM values in the global DEM with data from existing DEMS—e.g., the Shuttle Radar Topography Mission (SRTM), the Canadian Digital Terrain Elevation Data (DTED), and USGS Alaska data. He showed examples of data before and after anomaly correction. The metadata plane of the GDEM shows which data set has been used. Fujisada reported that SILC had completed and delivered the *beta* version of GDEM to both ERSDAC and JPL for the LPDAAC. The new version has 22,600 tiles and has been corrected for anomalies.

M. Hato is designing the distribution system for the GDEM; the suggested release date is June 1, 2009. He went over the status of agreements between the Japanese Ministry of Economy, Trade, and Industry (METI) and NASA on conditions for public release of the GDEM.

T. Tachikawa and **A. Iwasaki** [Tokyo University] reported on the GDEM validation over Japan. The plan is for the Ground Data System (GDS) to use a combination of precision ground control points and high resolution DEMS for this validation.

T. **Sohre** [LPDAAC] reported on GDEM distribution plans by the LPDAAC. The first phase will be to use the Warehouse Inventory Search Tool (WIST) system, and possibly the USGS Global Visualization Viewer (GLOVIS) to meet the planned June 1 release date. Future tools may be implemented via a seamless system.

B. Bailey described the Earth Resources Observation Systems (EROS) Data Center (EDC) plan to validate the GDEM over the conterminous U.S., using a combination of high resolution DEMs and ground control points. EDC released a Request for Proposals (RFP) for international participation in the validation and he described the terms and conditions of this RFP.

R. Crippen [JPL] reported on preliminary observations based on analysis of ASTER data over South America, and presented qualitative comparisons with SRTM data. Both sets had strengths and weaknesses that generally complemented one another.

Temperature-Emissivity Separation Working Group

H. Tonooka [Ibaraki University] reported on an updated method of optimizing temperature–emissivity separation by *Bayesian inference*. He also reported on the status of the East Asia Emissivity Mosaic and on a method for cloud assessment for nighttime scenes using cloud masks generated from the Moderate Resolution Imaging Spectroradiometer (MODIS) *MOD35* cloud mask product.

M. Fujita gave an update on the nighttime TIR global map, which is an ongoing activity.

A. Gillespie [University of Washington] reported on new findings on emissivity spectra accuracy addressing why the emissivity spectra of water can be too low and distorted. The spectra may be too low due to the temperature–emissivity separation (TES) algorithm, in particular the regression. However, the distortion is not due to TES since model spectra from the *AST09T* (surface radiance) product (not run through the TES algorithm) are also distorted. This effect is most likely due to calibration inaccuracy or atmospheric correction errors or both.

S. Hook [JPL] showed results of in-flight validation of ASTER TIR bands using the Lake Tahoe CA/NV automated validation site. The site now uses an automated processing system that extracts field data from the Level 2 database and automatically does forward calculations. Validation results indicate a problem over high emissivity targets due to a recent change in the ASTER TES algorithm. Therefore, over water targets Hook recommends using a split window approach for the time being. He also announced that the Salton Sea, CA validation site is now fully operational. Additionally, Hook announced a new version (*v2.0*) of the ASTER spectral library.

A. French [U.S. Department of Agriculture (USDA)] reported on a study using ASTER and MODIS to detect temporal changes in thermal infrared emissivities. He said that the emissivity data is used in hydrological modeling for measuring surface temperature, net longwave radiation, surface roughness, and land cover type and condition. Emissivity temporal variations over vegetation/soil systems were observed at three scales including: daily observations from rainfall, seasonal observations from cropping types and phenology, and inter-annual observations from changing densities of perennial vegetation.

G. Hulley [JPL] showed the current version of his North American ASTER land surface emissivity database, which is a mean-seasonal emissivity product with an improved ASTER cloud mask. The products used are land surface emissivity and temperature for

mean summer months (July–August–September) and mean winter months (January–February–March) for 2000–2008. He described the major new algorithm developments which are the aggregation algorithm and the cloud mask algorithm. He selected 10 sand dunes to use as validation sites.

M. Ramsey [University of Pittsburgh] presented a compositional analysis by laboratory thermal infrared spectroscopic methods of synthesized *quartzofeldspathic* glasses of a type common on the Earth and other planetary surfaces. These glasses can have immediate importance because they occur at volcanic sites which are intrinsically hazardous. He described the synthesization and microprobe analysis of the glasses and the spectroscopic methods used. Observations are consistent with other glass compositional studies.

Ecosystems/Oceans Working Group

G. Geller [JPL] reported that one new STAR was submitted since the last meeting and that it comprised about 25% of the total STARs.

H. Shimazaki [National Institute for Environmental Studies] reported on a new research project to study the Mekong River basin. Land use and land cover maps will be generated and a database for the watershed will be developed using ASTER data to generate the maps.

J. Masek [Goddard Space Flight Center (GSFC)] gave an update on the Recent North America Forest Dynamics Project (NAFD), which is a project to map forest disturbance from 2000–2005 using ASTER and Landsat data. Initial work indicates discrepancies between ASTER calibration for the visible bands with MODIS and Landsat.

T. Gubbels [Science Systems and Applications, Inc.] reported on a study focused on comparison of ASTER and MODIS cloud cover estimates as part of the next Landsat Ecosystem Disturbance Adaptive Processing System (LEDAPS) survey. Significant differences were found with the ASTER cloud cover estimate showing errors of omission (missed clouds) more than 10% of the time.

T. Ishiyama [Chiba University] used multi-temporal MODIS and ASTER images to investigate changes of vegetation in the Tarim River basin from 2001–2005. MODIS NDVI data showed that maximum vegetation coverage occurred earlier in the west than in the east and ASTER images showed changes in vegetation near farmlands in the western part of the basin.

L. Prashad [Arizona State University] gave an update on the *100 cities project*, which will use a set of analytical tools based on tools developed for Mars image analysis for viewing and processing images from a variety of sensors.

T. Matsunaga [National Institute for Environmental Studies] presented a paper for **Y. Sakuno** [Hiroshima University] and **K. Kawasaki** validating ASTER Sea Surface Temperature (SST) maps using SST data from buoys in Mikawa Bay, Japan.

M. Ramsey showed an ASTER–MODIS comparison of albedo and thermal inertia of the White Sands, NM aeolian system. He used day/night pairs of ASTER data from 2002–2008 and found that the average values compared fairly well.

T. Matsunaga prepared a talk with **Y. Sakuno** and **T. Kozu** on image characteristics off the San-in District coast under a red tide condition in 2007 using the Panchromatic Remote-sensing Instrument of Stereo Mapping (PRISM) and Advanced Visible and Near Infrared Radiometer type-2 (AVNIR-2) sensors on the Japanese Advanced Land Observing Satellite (ALOS) and ASTER data.

J. Kargel [University of Arizona] reported on field validation efforts and science assessment of ASTER classification and time series of glaciers and postglacial vegetation change in the Copper River Basin, AK.

G. Geller gave an update on *TerraLook*, which makes ASTER and historical Landsat data available as georeferenced *jpegs*, for free, to novice users.

Radiometric Calibration/Atmospheric Correction Working Group

B. Eng [JPL] gave an update on software status.

F. Sakuma [National Institute of Advanced Industrial Science and Technology] reported on instrument calibration issues. The VNIR radiometer outputs are slowly decreasing but manageable with everything else on the system stable. The SWIR system was restarted with an 83 K set point on August 27 and October 22, 2008, but the temperature was not controlled so the cooler has been kept off. New coefficients were applied to TIR on July 5, 2008.

T. Tachikawa reported on SWIR product issues and gave several scenarios for recovery of cloud assessment capability in the event that SWIR capability is lost.

H. Tonooka reported on TIR field campaigns in 2008 at Alkali Lake, CA; Railroad Valley, NV; Coyote Lake, NV; and Lake Kasumigaura, Japan.

K. Thome [University of Arizona] reported on VNIR field campaigns in 2008 at Railroad Valley, NV;

Ivanpah Playa, NV; and Alkali Lake, CA. He also announced that he will be leaving University of Arizona for GSFC in December 2008 and announced the changes taking place at Arizona.

K. Arai [Saga University] reported on his team's 2008 field campaigns. Sites included Ivanpah Playa, NV; Alkali Lake, NV; Railroad Valley, NV; and Roach Lake and Coyote Lake, CA. He included comparisons with different calibration teams.

S. Biggar [University of Arizona] announced a request by M. Abrams to include a choice of solar spectrum in reflectance processing and request for a comparison of ASTER with MODIS and Landsat by J. Masek.

Geology Working Group

R. Wessels [USGS] reported on satellite imaging of the summer 2008 eruptions at Okmok, Cleveland, and Kasatochi volcanoes in Alaska with a total of 17 ASTER images.

A. Carter [University of Pittsburgh] gave a talk on ASTER-derived and field-based thermal studies in the North Pacific using Bezymianny as an example. The ASTER Emergency Scheduling Interface and Control System (AESICS) automatically schedules ASTER acquisitions.

M. Ramsey showed some unique thermal infrared observations of active dome and pyroclastic flow deposits of Sheveluch volcano, Kamchatka, fusing Forward-looking Infrared (FLIR) imaging and ASTER data to allow validation of observations of small-scale flow feature morphology.

J. Mars [USGS] demonstrated mapping hydrothermal silica using ASTER SWIR and TIR data with examples from Cuprite and Goldfield, NV and Balqash, Kazakhstan, where he has successfully separated hydrothermal from non-hydrothermal quartz.

M. Urai [Geological Survey of Japan] showed a statistical analysis of 964 active volcanic *hotspots* using nighttime ASTER SWIR. ASTER is able to detect more *hotspots* than MODIS because it has a smaller spot size.

D. Pieri [JPL] gave an update on the ASTER Volcano Archive and reported on planned improvements to the website. A bilateral stretch will be implemented to improve the quality of the *jpgw* files and a low temperature hotspot detection algorithm is also being tested.

T. Gubbels reported on his study of volcano change detection using ASTER DEMs: methodology and validation at Mt. St. Helens. Differencing ASTER DEMs documents the 2004–2005 dome growth with a precision of at least 10 m.

T. Rhodes [University of California, Santa Cruz] is using ASTER DEMs to assess mass-loss from Greenland's perimeter. The goal is to compare ASTER DEMs from February 2001–July 2006 and assess glacial mass balance by calculating ice-volume flux from the elevations derived from the DEMs.

J. Kargel reported on a classification of glaciers, lakes, rocks, and vegetation in the Copper River Basin, AK with a goal to document the movement of glacial fronts since 1010. They documented the spectral signatures of affected vegetation and a variety of sediment types and used a fuzzy *c-mean unsupervised clustering technique* to discriminate spectral domains.

D. Pieri showed the extent of paleo ice-cap surfaces in Siberia by studying river network patterns and drainage basin slope characteristics, ridge morphologies and dimensions, and large scale glacial scour to delineate the extent and nature of the glaciated area.

A. Gillespie talked about the loss of spectral contrast in rocks due to microscale (less than 1 mm) roughness, which may be hard to quantify remotely and may limit the use of TIR for compositional mapping.

Closing Plenary Session

Each working group chairperson presented a summary of the discussions and talks that were given during the working group sessions. They each gave reports on suggestions made by the group for further actions by the whole team, particularly how to address the possible loss of SWIR and how to allocate resources to complete the various global map data acquisitions.

At the close of the meeting, **H. Tsu** invited the ASTER Science Team to attend the 35th team meeting in Japan.