

## ASTER Science Team Meeting

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The 25<sup>th</sup> Joint Japan/U.S. Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Science Team Meeting was held at Aoyama Tepia in Tokyo, Japan, from June 14 to June 17, 2004. The meeting was attended by about 80 people including science team members from Japan and the U.S., as well as participants from other affiliated organizations.

At the opening plenary session, **H. Tsu** (Geological Survey of Japan) and **M. Abrams** (Jet Propulsion Laboratory [JPL]), the Japan and U.S. ASTER Science Team Leaders respectively, opened the meeting with greetings representing Japan and the U.S., followed by the introduction of new members of the U.S. Science Team. **M. Kato** (Earth Remote Sensing Data Analysis Center, ERSDAC), Japan ASTER Science Project Manager, described the schedule of the ASTER Science Team Meeting and other meeting logistics.

The NASA Headquarters representative, **W. Turner**, welcomed **M. Abrams**, the new U.S. Team Leader, and the new team members. He then talked about the structural reorganization taking place in NASA and how the transformation, and the fact that there is no follow-on mission for Landsat, might affect the ASTER project. He then described the Memorandum of Understanding (MOU) between the U.S. and Japan which will be in place when the current Diplomatic Note expires in October. The MOU will extend for 10

years. It will only change slightly, one change being that there will be an allowance of 10% usage time for a *general use* category, which is essentially for commercial users. It will be administered by the Japanese and will have lowest priority.

**N. Ohgi** (Japan Resources Observation System Organization [JAROS]) discussed the status of the ASTER instrument, reporting that it is generally in good health. There has been a gradual degradation of the radiometric response for the Very Near Infrared (VNIR) (10% per year) and Thermal Infrared (TIR) (7% per year) and a stabilization of the Shortwave Infrared (SWIR) following several adjustments. There is no indication that ASTER will not be working well for the proposed extension of the mission to 6 to 8 years. Extending the mission, however, raises the question of how to extend the life of the pointing capability. This discussion was deferred to later in this meeting. There is no indication that electrical or other mechanical parts are at risk at this time.

**K. Okada** (Japex Geoscience Institute) and **L. Maldonado** (JPL) reported on the land-surface-coverage status and the number of acquired scenes. The total global-coverage map consists of 801,239 scenes of which 0% to 20% cloud-cover-data amount to 331,323. However, some areas are better covered than others. For example Western Australia is poorly covered, an is-

sue which is being investigated. The impact of a new science team acquisition request (STAR), the TIR nighttime mapping STAR, is being investigated with simulation using two trial areas, and it seems there is no appreciable impact. The STAR Committee plans to review 74 STARs for possible change of status with the nominal mission lifetime approaching.

**Y. Kannari** and **H. Watanabe** (both from the Earth Remote-Sensing Data Analysis Center [ERSDAC]) reported on the Ground Data System (GDS). Approximately 798,000 scenes have been collected and categorized, by requestors and data types, etc. The daily acquisition of scenes has been reduced from an average of 500 to 400 as a result of the decision to reduce the pointings from 9 to 4 times daily to conserve pointing capability. Details of this decision were put off to the Operations and Mission Planning (OMP) session later in this meeting. An ongoing problem with damage to the data tapes sent from Ground Data System (GDS) to the Distributed Active Archive Center (DAAC) was solved with changes in the packing material. A widening of the registration between the SWIR and VNIR telescopes was noted and discussion deferred to the Level 1/Geographic/Digital Elevation Model (DEM) session. GDS has been considering replacement of their Product Generation Subsystem (PGS) processing machines and has various machines under consideration. Kannari

discussed the option of a dedicated network transfer to replace the courier now used to transport the Level 1B data, which may shorten the data transfer time by 4-5 days.

**Y. Maruyama** (ERSDAC) discussed the current status of the Japanese post-ASTER plan, which is to develop a small lightweight satellite instrument which will be similar to ASTER with some changes which will be developed jointly with countries from Asia and Oceania. The plan will favor industry, focusing on data applications for land and forest management, while addressing such issues as illegal deforestation and desertification. The first phase is planned for about 2010, second phase 2010-2015, and third phase 2015-2020, but this instrument is still in early phases of planning. Among the questions raised following this presentation was whether U.S. cooperation was excluded, to which the answer was "no."

**B. Bailey** of the Earth Resources Observation Systems (EROS) Data Center began his presentation by thanking all the people who supported the proposal for a Landsat follow-on mission. He then gave an overview of the Landsat situation, the atmosphere at NASA Headquarters, and the status of the proposal and motivation for how the proposal was written. He explained that there is a mandate to have continual coverage of the Earth's surface with a Landsat-type instrument, and Landsat-7's degradation has caused considerable concern by NASA and the user community that there is nothing ready to fill that slot. It was proposed to replace both Landsat and ASTER in three years with an instrument jointly operated by the US, Japan, and nations that have ground receiving stations. At the same time, Japan has been considering op-

tions for an ASTER follow-on mission. Given these common goals, a joint mission seems to make a lot of sense, but this was only one of four U.S. options which also included a solely U.S. mission and the more international mission with the collaboration of many nations, namely Japan and countries that have ground receiving stations. This latter configuration was how the recent proposal was worded, and it was ready for presentation discussion at the Earth Observation Summit meeting, the GEO meeting, and the Ministry of Economy, Trade and Industry (METI) (Japan)/NASA/U.S. Geological Survey (USGS) meeting, all in Tokyo. The proposal failed to be addressed at the METI/NASA/USGS meeting, and it doesn't seem to be a favored approach by U.S. funders. This subject is still very much unsettled and under discussion.

Bailey then reported that Land Processes DAAC distribution of ASTER data is operating without any problem. The Landsat-7 Enhanced Thematic Mapper Plus (ETM+) data are now being distributed through the USGS Earth Explorer at a discount price. The DAAC has started processing ASTER L1B products to provide for what was not being produced at GDS and, so far, 250,000 scenes have been processed. The DAAC plans to coordinate with Japan for Level 1B production in the future (GDS would promote reprocessing on demand from the U.S. side). Traditionally, sales of Landsat products surpassed that of ASTER products; now, however, the trend has reversed. An increased number of orders for DEMs has generated a backlog of work equal to 900 scenes, a majority of which came from science users. Because of this heavy load, a system upgrade is being considered.

Abrams and Watanabe reported on re-

cent conference presentations and other outreach events as well as on progress in data processing and on the status of emergency observations. Watanabe reported a steady increase in user registration and use of data and strongly supported a follow-on mission.

**Y. Yamaguchi** (Nagoya University) raised three issues for working-group leaders to discuss in each splinter session. They were to: (1) review the existing data acquisition plan in view of the extended mission lifetime; (2) discuss planned publications for the journals *Remote Sensing of Environment* and *Transactions on Geoscience and Remote Sensing*; and (3) summarize the group's thoughts on post-ASTER.

### Working Group Reports

#### *Calibration Working Group*

Reports were made on the VNIR, SWIR and TIR onboard-calibration trends by NT Space MELCO and Fujitsu, respectively. **S. Tsuchida** (Geological Survey of Japan [GSJ]) and **F. Sakuma** (National Research Lab of Meteorology) did a study of contamination and radiation effects on the VNIR by applying two degradation curves, a single and a double exponential function to address different models, the single exponential for single layer of contamination and double exponential for multiple layers of contamination and radiation damage. These results were compared with JERS1/OPS degradation cases. They concluded that radiation contamination is not the main reason for sensor degradation. A smooth function (exponential or second-order polynomial) was recommended for the radiometric calibration coefficient for both the VNIR and the TIR.

It has been determined that there is a

scratch on the filter of the SWIR system and ERSDAC commissioned Mitsubishi to investigate it and develop a correction method. They performed a statistical analysis using uniform areas of desert scenes and did a frequency analysis. They found that after doing a radiometric correction there was still a need to find the location of the scratch by frequency analysis. It was found at slightly different locations and affected a different number of pixels in each band. **K. Arai** (Saga University) has suggested a procedure for correction, which Mitsubishi will implement and test.

Reports on onboard calibration were followed by reports on science, or vicarious calibration. **H. Kieffer** (U.S. Geological Survey) reported on the lunar calibration results. Kieffer discussed the previously known crosstalk in the form of weak images in all of the SWIR bands, but most pronounced in bands 4 and 5. He also stated that there is a small amount of line noise in all bands except band 4, which may be correlated to the other crosstalk. In addition, there is a wide leak above and below all primary locations from an unknown source. Some of these leaks extend to the edge of the swath. When he investigated the TIR, he found that "ghosts" exist in each band and that they are different for the odd and even detectors.

**A. Iwasaki** (National Institute of Advanced Industrial Science and Technology) also discussed results of the lunar calibration experiment crosstalk in the SWIR and VNIR zero-offset results. **H. Tonooka** (Ibaraki University) presented a TIR stray light analysis and **S. Biggar** (University of Arizona) did an analysis of the SWIR crosstalk problem.

**S. Tsuchida, K. Thome** (University of Arizona) and **K. Arai** gave reports on field campaigns for vicarious calibration of the VNIR and SWIR bands. They concluded that smooth (first or second order polynomials) functions would work best for the radiometric calibration coefficients (RCC) for the VNIR. The crosstalk problem in the SWIR is an overriding problem. **F. Paluconi** (JPL), **H. Tonooka** and **S. Hook** (JPL) reported on vicarious calibration results for the TIR, and smooth function RCCs are recommended.

#### *STAR Committee Working Group*

**H. Sekine** from Mitsubishi Research Institute (MRI) reported on the progress of revisions to the STAR TOOL reflecting what was discussed during the previous OMP *ad hoc* meeting. Okada said that once the screening of select STAR proposals was over, the renewed STAR TOOL would be in operation within a week.

Kato introduced new STARs proposed in connection to business operations at ERSDAC and received approval. K. Okada clarified that all the candidate status proposals subjected to screening by the STAR TOOL were approved except for Thermal Global Map (TGM). **H. Muraoka** from Geotechnos proposed suspending some of the STARs targeting areas over Japan to ensure observations of west Australia (which is undercovered) by separately submitting a local STAR over the area. The proposal was approved. OMP WG in Japan will decide when to carry out the observation.

**T. Matsunaga** (National Institute for Environmental Studies) reported on the discussions to do nighttime coverage of the Earth in the TIR. A sub-working

group called the temperature-emissivity separation (TES) working group was created to work out details and submit a priority map to the Operations Working Group (OWG).

It was unanimously agreed to submit a STAR review plan to OMP by September 15.

#### *Geology Working Group*

It had been decided that existing STARs under the Geology Working Group be reviewed and perhaps removed, and the consensus was that each responsible requestor make that decision.

Several science members gave presentations as follows:

- **F. Kruse** (Horizon GeoImaging) presented *Mineral Mapping Using ASTER and HIS Data*. ASTER discriminates mineral groups but can't discriminate individual minerals.
- **T. Gubbels** (Science Systems and Applications, Inc.) presented *Examples of ASTER Rapid Response*. The EDS were very useful for monitoring disasters such as volcanic, seismic, and floods.
- **M. Ramsey** (University of Pittsburgh) presented *Kamchatkan Volcanology Results and Upcoming Field Campaigns*. ASTER data were found useful in volcanic observations, but it is necessary to develop a new emissivity-temperature-separation algorithm to observe very hot surfaces.
- **M. Urai** presented *ASTER Image Database for Volcanoes*. A web-based ASTER volcanic image database has been operational since March 2004.
- **B. Bailey** presented *Effects of the New 'Gap-Filled' Landsat ETM+ Data for Geo-*

*logic Mapping in Semiarid Terrains*. New ETM+ SLC off images might be used for geologic applications.

- **H. Kieffer** presented *Update on the GLIMS Science*. 100,000 ASTER Level 1A scenes have been acquired over glaciers.

Deadline dates for submission to ASTER special issues of *Remote Sensing of Environment and Trans. Geosci. and Remote Sensing* were confirmed.

*Level 1/Geometric/DEM Working Group*

- **Fujitsu** reported on the renewal of ASTER Level 1 data-processing parameters.

- **MSS** reported on the evaluation of parallax correction processing.

- **Hitachi** reported on registration between telescopes.

- **H. Fujisada** (Sensor Information Laboratory Corp., SILC) remarked that the inconsistency between V and S was attributable to SWIR.

- **SILC** reported on the accuracy of Level 1 geometry.

- **Abrams** introduced an ASTER geometric correction tool that will allow users to have geometric correction done to their data at JPL by request through the ASTER web site.

- **CCS** reported on the validation result of product accuracy. Fujisada hinted at the possibility that the accuracy of the information on Terra's degraded orbit was causing the degradation of geolocation accuracy.

- **Bailey** reported on the provisional validation results of the DEM product

at LPDAAC, which was being tested using two sites.

- **Abrams** asked to carry out a comparison between DEMs produced at NED-USGS and U.S.-ASTER.

- **Kieffer** reported on SWIR crosstalk at lunar calibration and said that higher gain setting for SWIR would be desirable if there was a chance for a second lunar calibration.

- **Fujisada** explained how to use the DEM/Ortho software developed by SILC.

The Working Group has assigned members to review the STARs under the group's name.

*Science Scheduling Support Group/ Operations and Missions Planning (SSSG/OMP) Working Group*

A review of the action items from the last meeting was conducted by **Y. Yamaguchi** followed by reports on some high priority items by **L. Maldonado**. The experiment conducted April through June to lower the number of pointings showed a significant impact on data acquisition. Two important observations in the U.S.: 26 observations in April, mostly field campaigns, and 10 of 36 observations in May were missed. This was judged to be unacceptable, and it was agreed to return to the original pointing function. Furthermore, pointing control may not be the only limiting factor for the life of ASTER. At this time, there is no indication of degradation of the hardware. It is possible that there may be a problem with the simulator. On the U.S. side, the mission simulator is being reactivated to examine the problem in greater detail and study the long-term effects. The

current scheduling simulator did not show the effects of reduced pointing.

The second round of global mapping was evaluated and it was found that western Australia remained undercovered due to priority observations in Japan and southeast Asia. It was agreed that some STARs in Japan would be suspended and a new STAR proposed for intensive observation of western Australia.

**Matsunaga** described an experiment done in February through March to do nighttime TIR global mapping. There was some impact to daytime observations but it was felt to be overridden by the advantage of having a nighttime global map, particularly if a priority map is developed. Advantages to nighttime observations include better emissivity values due to less temperature contrast and more useful information for such applications as heat-island analysis.

The SSSG report was given by **Okada**, who showed by use of maps the total observed scenes and scenes with less than 20% cloud cover, globally and by local area (Japan and U.S.). He addressed the status of the Global Mapping STAR round two (GM2) and TIR Nighttime Global Map (TGM). He suggested for the TGM that two large areas be used to test the impact. The GM2 STAR suspends the GM1 high-priority STARs and submits high-priority STARs with modified parameters such as permitted wider scan angles. This STAR started August 20, 2003, and many may have already been satisfied. The OMP WG agreed in an *ad hoc* meeting February 2004 on a plan to analyze 74 STARs whose *lifetime end* is set around 2006 to be reevaluated by the relevant working group by the next team meeting.

*Temperature Emissivity Separation (TES) Working Group*

**S. Rokugawa** (Tokyo University) reviewed the status of the existing STARS for this group. A presentation was then given by **H. Tonooka** on Level 1B and the atmospheric-correction product reprocessing for temperature-emissivity separation. **T. Matsunaga** then led a discussion on the nighttime TIR STAR proposal. **D. Sabol** (University of Washington) reported on the status and future plans for the U.S. TES Product. **M. Ramsey** then gave a report on the "hot target" study. Discussions followed on post-ASTER scenarios, ASTER operations beyond 2005, publication plans, and the four TES STARS. It was decided to maintain the STARS as they are.

*Ecosystems/Oceans Working Group*

The new members of the working group were introduced by Matsunaga followed by a review of the status of the STARS. Then six scientific presentations followed:

- **A. French** (Goddard Space Flight Center), *Optimal Land Surface Temperature Estimation and Assimilation for Global Hydrological Applications*
- **T. Miura** (University of Hawaii), *A Continuity/Compatibility Investigation of EOS Reflectance and Vegetation Index Products*
- **M. Kishino** (retired, Institute of Physical and Chemical Research), *Retrieval of Chlorophyll A, Suspended Solids, and Colored Dissolved Organic Matter in Tokyo Bay Using ASTER Data*
- **S. Tsuchida**, *Phenological Eyes Network-Ground-based Measurement for ASTER Data*

- **Y. Sakuno** (Hiroshima University), *Study for Monitoring Water Quality, SST, and Coral Reef Using ASTER Data-Our Activities, 1995-2004*

- **M. Netzband** (University of Arizona), *Urban Land Cover and Spatial Variation Observation Using ASTER and MODIS Satellite Image Data*

Discussions followed on the operational scenario beyond 2005 and the pointing-control issue, whose negative impact on field-campaign observations is especially disturbing. Five papers are expected to be submitted by members of the group to Remote Sensing of Environment.

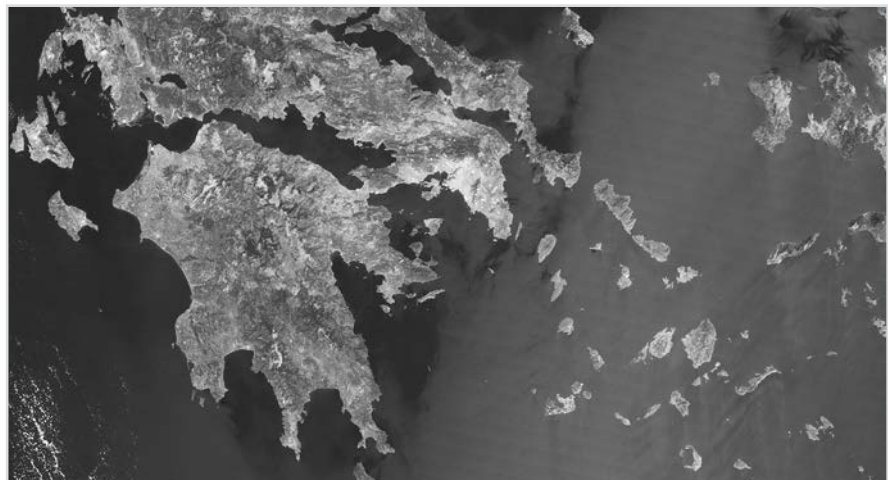
*Atmospheric Correction Working Group*

The action items were reviewed and the STARS. **B. Eng** (JPL) gave a presentation on the current status of atmospheric-correction software. **K. Thome** then discussed the current status of the VNIR/SWIR correction and proposed that exclusive dependence on MODIS will lead to instability of the ASTER data. He then described the validation

results on the playas. On the subject of validation of atmospheric correction for the TIR, **H. Tonooka** explained that the validation results for water-surface emissivity were greatly affected by water vapor. He introduced a new algorithm called Water Vapor Scaling for the purpose of removing the major effect. **S. Tsuchida** then reported on the difference of Thuillier irradiance from World Radiation Center (WRC) irradiance for ASTER bands.

The action items will remain open, and no new action items were generated.

The second plenary session was brought to a close with remarks by **H. Tsu**, **Y. Yamaguchi**, and **M. Abrams** with a promise to meet next in the U.S. in late 2004 or early 2005.



Forming the southern tip of the Balkan Peninsula, Greece is made up of a series of mountains that run into the sea, extending into scattered islands through the Aegean Sea in the east. The texture of mountain and valley makes the country appear marbled in this image, captured by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite on August 19, 2004. NASA image courtesy of Jeff Schmaltz, MODIS Land Rapid Response Team at NASA GSFC