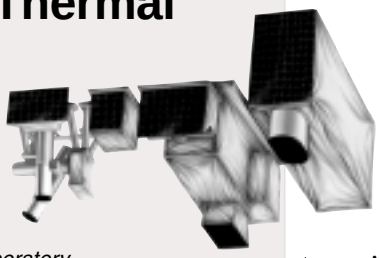
16th Advanced Spaceborne Thermal Emission and Reflectance Radiometer (ASTER) Science Team Meeting



— A. D. Morrison (andy@aster.jpl.nasa.gov), Jet Propulsion Laboratory

Summary

The 16th ASTER Science Team meeting was held Tuesday through Thursday, January 12 through 14, 1999, at the Pasadena Convention Center, Pasadena, California. There were approximately 100 participants, representing the ASTER Science Team, Jet Propulsion Laboratory (JPL), Goddard Space Flight Center (GSFC), Earth Remote Sensing Data Analysis Center (ERSDAC), Japan Resources Observation Systems Organization (JAROS), the ASTER Ground Data System (GDS) Project, the instrument vendors, and the Japanese algorithm-development contractors. The three-day meeting was composed of an Opening Plenary Session on January 12th, several individual Working Group meetings January 13th and the morning of January 14th, and a closing Plenary Session on the afternoon of the 14th.

During the meeting, reports were given on the instrument status, the spacecraft status, the new flight-operations system development schedule and status, and the EOSDIS readiness to support ASTER after launch. Progress was made in several areas including: 1) the participation of the Science Scheduling Support Group (SSSG) in the new flight-operations system end-to-end tests and exercises and 2), the responsibilities of the SSSG during the initial check-out-period (launch to launch+118 days). In addition, the Joint Review Panel for Science Team Acquisition Requests (STAR) met. The Panel reconfirmed its agreement on the criteria for selecting STARs and began reviewing and approving post-initial-check-out period STAR proposals. This panel reviews and approves requests for data acquisitions that are of interest to more than one investigator.

Plenary Session I
Tuesday, January 12

A. Kahle and H. Tsu opened the meeting and welcomed the attendees.

J. Ranson reviewed the Terra Project status —hardware, software, and EOSDIS interfaces. There is no official launch date at this time.

A. Unger addressed the Spacecraft and Instrument Status and reviewed changes since the last ASTER Science Team meeting. This included details and schedule of the integration and test program and a list of remaining activities at Valley Forge. He said that the platform is scheduled to be shipped to Vandenberg Air Force Base (VAFB) on April 15.

M. Kikuchi reviewed the progress of the testing of ASTER at Valley Forge during 1998. He was able to report that ASTER has had no trouble with the hardware and has required no rework and no removal from the platform.

D. Williams presented the Landsat 7 update. He said that Landsat will be shipped to VAFB on January 27, 1999. Although the official launch date is April 15, they are working towards a March 31 launch. Immediately after launch, Landsat 7 will underfly Landsat-5 for a couple of days for cross-calibration purposes. After the ASTER launch, coordinated Landsat 7/Terra same-day data takes will be performed with an expected separation of approximately 20 minutes.

D. Perkins reviewed the EOSDIS status and schedule. There is no padding in the schedules—the EOS Mission Operations System (EMOS) is the critical path for the Terra launch. She said that all instrument command and data-collection capabilities will be in place at launch.

M. Moore continued the EOSDIS status presentation by reviewing various EOSDIS Core System (ECS) options and limitations and specifically addressing impacts on ASTER products. He said that:

◊ Limitations under Option A+ will have no impact on ASTER products.

◊ Total Cloud Cover (TCC), derived from NOAA data will be used by the ASTER Ground Data System (GDS) for planning and scheduling the ASTER instrument.

◊ They are currently working on two problems with the L1 expedited data.

◊ On other fronts;
The first test of the ASTER Digital Elevation Model (DEM) was

successful and it is moving ahead well.

The first version of the Java DAR tool will be ready for test in early May. It should be operational by the end of May.

H. Watanabe presented the ASTER GDS development status. He reviewed the communications between the U.S. and Japan regarding the Flight Operations Segment (FOS) problems and the launch date slip. Regarding the ECS-Instrument Support Toolkit (ECS-IST), he said that of the three subsystems, only the Mission Management System will be delivered before launch. The Real Time System and the Analysis System will be delivered at Launch plus 30 days. GDS is now moving from the Development to the Operational Phase. Finally, he said that GDS is waiting for MITI to decide how the Japanese data products will be priced.

S. Hook reported that the MODIS-ASTER Simulator (MASTER) is working. The instrument was switched to operational on a KingAir Beachcraft B200 in January 1999. Data were presented that favorably compared MASTER data with TIMS data. MASTER will be deployed on the ER-2 and DC-8 this summer.

T. Schmugge presented early MASTER data for New Mexico. The results ranged from generally poor quality, to good quality but with some clouds, to good quality. Good agreement with Landsat data was obtained for the southern part of the reservoir.

H. Fujisada summarized the status and schedule of the ASTER Level 1 Products. He reviewed the Level 1 radiometric and geometric parameters and summarized the anticipated Level 1 product accuracies vs. requirements. In every case, the anticipated accuracies meet or exceed the required accuracies.

K. Matsumoto presented an overview of the Initial Check-out (ICO) Geometric Validation activities including their planned procedures, ICO and post-ICO targets, and ICO and post-ICO schedule. Their objective is to have 300 Ground Control Point (GCP) points prepared for the calibration activity.

H. Kieffer reported that the U.S. Geometric Working Group is "on track and we're working away." They have 23 STARs submitted to support Geometric Calibration.

I. Sato showed examples of parts of the Japanese Users Guide which is being prepared and presented the schedule for its completion. He invited anyone who is interested to visit their web site at http://astweb.ersdac.or.jp/guide and return any comments to hozuma@mri.co.jp or isao@gsj.go.jp.

Y. Yamaguchi reviewed the results of the October 1998 Operations and Mission Planning Working Group (OMPWG). The topics discussed at that meeting included

- ◊ Impact of the FOS development problem—no major impacts were forecast
- ◊ Operations documents—the Mission Guidelines document is awaiting GDS approval and sign-off; the Operations Procedure Document v2 will be delivered in March 1999.
- ◊ Development status reports and demo—Instrument Support Terminal (IST), ASTER Mission Simulator (AMS), and Mission Analysis Tool (MAT) were reviewed, and the IST was demonstrated.

A. Morrison summarized the status of the U.S. STARs. He noted that there are approximately 190 U.S. ICO STARs totaling approximately 422 scene equivalents, 79 U.S. non-ICO STAR proposals, comprising over 2700 individual STARs totaling an estimated 100,000 scene equivalents, and another few STARs that will be considered for scheduling once the non-ICO STARs have been put to bed. In the future, STARs will have to be submitted to the STAR Review Committee, an ASTER Science Working Group, the ASTER Science Project (Japan), the U.S. ASTER Science Team, or the SSSG, as required by the Guidelines Document.

H. Sekine summarized the status of the Japanese STARs. He said that there are approximately 33 Japanese non-ICO STAR proposals, comprising over 2553 individual STARs totaling an estimated 515,900 scene equivalents. Sekine reported that U.S. and Japanese ICO STARs and Japanese non-ICO STARs had been transmitted to R. Molloy for the testing of the AMS.

Working Group Summaries:

K. Thome, U.S. Atmospheric Correction Working Group (ACWG), reviewed details and status of thirteen U.S. ACWG STARs, which included STARs for validation of ASTER, MISR, MODIS, and CERES instrument data and validation of International Satellite Cloud Climatology Project (ISCCP) cloud-droplet-particle-size products. M. Moriyama, Japanese Atmospheric Correction Working Group, presented details of the fifteen Japanese atmospheric-correction-related non-ICO STAR sites in Japan.

F. Palluconi and K. Arai, TIR Atmospheric Correction Working Group, presented a list of their Working Group's Calibration/Validation STARs and reviewed their purposes.

R. Welch, Digital Elevation Model (DEM) Working Group, summarized the activities of the Working Group. He said that over the last three years of testing, three DEM software packages have consistently provided DEMs with residual 2-coordinate errors of less than ±10 m. Typically, the root-mean-square equivalent for the vertical direction ranged from ±4 to ±9 m. He reported that there was no appreciable difference in Z-coordinates determined from Level 1A and Level 1B data. The cost of these software packages ranged from less than $5 K to more than $30 K. He added that the joint Working Group has agreed to a total of eleven prioritized validation sites, seven in Japan, three in the U.S., and one in Mexico.

L. Rowan, U.S. Geology Working Group, presented a list of twenty-one U.S. Geology WG Cal/Val STARs. Eleven of those came from ASTER Science Team members, one from an ASTER Science Team Associate, one from an EOS IDS member, and eight were from other submitters. M. Urai, Japanese Geology Working Group, said that they have eight STARs, all from ASTER Science Team members. He said that Japan is developing a new higher-level volcano map product.

T. Schmugge, Ecology Working Group, discussed the twenty-nine U.S. Ecology STARs. Of the twenty-nine, fourteen were submitted by ASTER Science Team members. Three are for MODIS parameter validation.

M. Abrams, Oceanography and Limnology Working Group, summarized the status of the six-to-eight joint Working Group lake and ocean sites.

A. Gillespie, Temperature-Emissivity (T-E) Separation Working Group, pointed out that the T-E algorithm needs real data to fine tune it, and, therefore, they will need as much data as early as possible and their need will taper off after that.

Field Campaign Results:

F. Palluconi presented the plan for the upcoming field campaign at the Salton Sea and Ivanpah Playa. He said that three groups will participate: JPL (Salton Sea), the University of Arizona (Ivanpah Playa), and several Japanese investigators (both sites). He also reported on the results of the June 1998 field trip to June Lake, the calibration at UC Davis of the JPL temperature-sensing buoys, and a comparison of various sun photometers and their ability to obtain water-column figures.

N. Bower from the University of Wisconsin gave a brief overview of the AeriBago. The Aeribago is a high-resolution (<1 wavenumber) interferometer mounted in a Winnebago. The instrument was used to make surface and atmospheric measurements coincident with the MASTER overpass at the Salton Sea.

K. Thome summarized three past campaigns:

◊ A joint campaign to Railroad Valley, June 1998, that acquired a cloud-free Landsat image and enjoyed a successful overflight of MAS/AVIRIS

◊ MASTER evaluation flights in August and December 1998 to acquire data at Ivanpah Playa for calibration/validation of VNIR and SWIR bands.

He said that the planned January campaign at Ivanpah Playa was expected to acquire same-day Landsat-5, MASTER, and ground data. He also expects numerous field campaigns after the launch of Landsat 7 that will provide useful lessons for the evaluation phase of ASTER. He said that the planning for a large joint field campaign after the ASTER launch will be delayed until a launch date is set.

H. Tonooka described a field campaign at Lake Kasumigaura in September 1998.

Participants included Tonooka and two assistants from Ibaraki University, S. Machida and N. Doi of ERSDAC and F. Palluconi of JPL. Objectives of the campaign included comparison of U.S. and Japanese buoys, comparison of three sources of precipitable water vapor measurements, and preliminary validation of the Global Data Assimilation System (GDAS)-based atmospheric correction technique under wet humid conditions using NOAA/AVHRR data.

M. Abrams summarized ASTER education and outreach activities. These included:

◊ articles in IJRS, IEEE, and the ERSDAC newsletter;

◊ exhibits at the LA County Fair, California in Space, JPL Open House, IWG, and ERSDAC;

◊ preparation and printing of the ASTER brochure;

◊ posters at ERIM Oceanography and Geology sessions;

◊ preparation/distribution of ASTER pins;

◊ development of the ASTER web site;

◊ participation in the JPL/Cal State ALERT Project to incorporate NASA information and data into Earth science curricula;

◊ coordination with Regional Earth Science Applications Centers; and

◊ Support for Yoram Kaufman's Executive Committee on Science Outreach.

He added that the ground rules for release of information are now being debated at GSFC. GSFC is aware that ASTER is not just a GSFC / NASA instrument, but that Japan is part of the Project and that Japan has its own rules and requirements that must be considered.

T. Kawakami gave examples of education and outreach activities by ERSDAC. He showed a timetable of active and passive Public Relations (PR) activities and showed the expected science data content of PR materials as a function of mission phase.

J. Ranson summarized the EOS Terra. A Terra web page is ready for review at http: / / terra.nasa.gov / terra.html (the / terra.html will drop off at publication).

Y. Yamaguchi presented five topics that he urged the Science Team to address in their discussions during this meeting. The first was the participation of the ASTER Science Team in EOS-planned operations exercises and rehearsals. The second was the need for an algorithm validation plan for the mission—both ICO and post-ICO phases. Third was the topic of STAR collection, including the need to establish and agree on consistent STAR criteria. The fourth was publication / presentation of early science results. And finally, the fifth was about a Public Relations / Outreach plan including ASTER PR / Outreach activities, cooperation with NASA / GSFC activities, and collaboration with other instrument activities.

Over the next day and a half, the ASTER Working Groups and the STAR Review Committee each met. Summaries of their meetings were presented in the Second Plenary Session.

Plenary II
Thursday, January 14, 1999

Working Group Meeting Summaries:

Geology Working Group: The meeting discussion topics were reviewed—these included frustrations with the STAR submission policy and a request for clarification of the process. The status of the Working Group's STARs was presented

Radiometric Calibration Working Group meeting: Topics covered included possible procedures for getting updated calibration coefficients into the GDS, lunar calibration procedures, past and future field campaigns, Radiometric Calibration Working Group participation in operations tests, and a review of the Working Group's STARs

Operations and Mission Planning Working Group (OMPWG): The Group reviewed the xAR development schedule put together by G. Geller. This includes STAR development, IST, ECS DAR tool, Data Product Request tool, xAR submissions, and the Scheduling schedule. They also reviewed the status of the Mission Procedures Document (v2.1 will be available in May 1999), listened to a report of the SSSG meeting held earlier, discussed SSSG participation in GDS-GSFC day-in-the-life (DITL) tests and discussed the status of the ASTER mission simulators (development of the U.S. AMS is scheduled to end on April 30, 1999) and the Mission Analysis Tool (due to be operational before Launch+118).

DEM Working Group: U.S. co-Chair Harold Lang invited anyone who was interested to make contributions to the DEM ATBD update being prepared for submission February 1, 1999. He especially asked for any publications / citations that might be appropriate. Because the U.S. will produce only one absolute DEM daily, an effort was initiated to come up with a plan for prioritizing DEM requests. The Working Group reviewed its STAR status, which remains unchanged—eleven STARs for the ICO period, the same sites annually thereafter.

Atmospheric Working Group: Among other topics, the Working Group reviewed the status of its algorithms (ATBDs are being revised) and code development (v2.1 has been delivered; v2.2 will be the at-launch version). The latest version of the adjacency-effect code will be incorporated in v2.4 of the atmospheric-correction algorithm (the second delivery after launch). They also reviewed ACWG STAR requests and will ask investigators with large requests to prioritize their data needs to meet the STAR Guidelines. Other WG discussion topics included QA plans, comparison of column-water-vapor test results for three different instruments, field campaign plans and results, and the results of TIR correction using GDAS data (GDAS has some trouble with cirrus clouds—inclusion of GPS data improved the GDAS-based correction).

Temperature-Emissivity Separation (TES) Working Group: Discussion topics included the status of the TE algorithm and of the TE STARs. The TE software has been tested on both sides of the ocean, and its performance is well within specification. In addition, the algorithm seems to be robust and useful for other instruments as well. The Working Group members are working to overcome discrepancies between the U.S. and Japanese versions of the TES QA plan. After launch, using early data, the algorithm parameters will be fine tuned for the ASTER instrument. The Working Group has 13 validation STARs. Three of them will be coordinated with field campaigns.

Speaking for the Level 1 and Geometric Working Groups, G. Geller said that the Level 1 and Geometric Working Groups currently have no role in the planned EOS exercises, but will participate at GDS or elsewhere if requested to do so. He said that their algorithm validation plan has been submitted to S. Hook. Algorithm parameter tuning and update plans and procedures were presented to the ASST in June of 1998, and they will be documented in the GDS-EROS Data Center (EDC) Operations Agreement as appropriate.

A. Kahle reviewed the discussions that took place in the STAR Review Committee meeting. She reported that the proposed Japanese and U.S. non-ICO STARs were reviewed by the Committee. Many were approved (31 of 33 Japanese proposals and 66 of 81 U.S. proposals), some will need additional work, and some were changed to DARs. At Y. Yamaguchi's request, the criteria for Local STARs and Regional STARs were discussed, and the Committee concurred with him that the originally agreed to criteria should be firmly adhered to. These are that Local STARs (less that ten scene equivalents) should be restricted to Cal/Val, Emergency, PR, field-campaign support, and special Science Team and Program-level requests and that Regional STARs should be restricted either to observations that require large resources exceeding the DAR allocation limit or observations authorized by an ASTER Working Group and the STAR Review Committee. Yamaguchi also reviewed the submittal path for small Area of Interest (AOI) requests that will be used to determine whether some proposals will be categorized as Local STAR candidates, DAR candidates, or Regional STAR candidates.

M. Pniel presented the ASTER calendar and solicited additions and then adjourned the meeting.

Tropical Clouds and Associated Sea Surface Temperatures

[From the Goddard Earth Sciences Update; Earth Sciences Directorate weekly bulletin]

Several scientists have noted the emergence of towering clouds (also called convective clouds) over tropical oceans at sea surface temperatures (SST) above 28° C. They also offered plausible explanations for the observed upper limit of SST at about 30° C. Sud et al. (1999) of the Climate and Radiation Branch at NASA Goddard have shown that the previous explanations for the upper limit of SST were incomplete because they did not include the dynamical influences of clouds on oceanic cooling. With good agreement between theory and observations, Sud et al. (1999) have offered a more-complete explanation for the coupled behavior of tropical SST and its overlying clouds.

First, the new calculations performed with the observed atmospheric data yield a SST of 28-29° C for providing the necessary humidity and temperature (called moist-energy) for generating towering clouds in the tropics. Second, for cloud-free conditions, the intense solar radiation continually warms the SST and evaporates the sea water, thereby increasing the moist-energy of the overlying air. This energy build-up initially causes shallow clouds that moisten the lower atmosphere. Eventually, the ambient atmosphere (for SST at or above 28° C) gathers sufficient moist-energy for towering clouds to emerge. These clouds use up the moist air accumulated by the shallow clouds and produce intense rain. The resulting cloud cover effectively shields the sea surface from solar radiation. In addition, these clouds are accompanied by cool and dry air, streaming down from aloft (commonly called convective downdrafts), that spreads near the surface.

This produces the well-known cooling that follows an intense convective event. The downdrafts make the tropical oceans evaporate and cool significantly. In this way the ongoing rise of SST is abruptly reversed by the convective event.

In summary, the authors show how tall clouds emerge at 28-29° C and how the subsequent oceanic cooling is jointly caused by reduced solar radiation and downdrafts. Both processes have a pivotal role in containment of SST at or below 30° C. It is fascinating to note that convective cloud and ocean processes work together to maintain the observed SST limit.

Reference: Sud, Y. C., G. K. Walker, and K. M. Lau, 1999: Mechanisms Regulating Deep Moist Convection and Sea-Surface Temperatures in the Tropics. *Geophys. Res. Lett.*, **26**, 1019-1022.

For further information contact:
Dr. Yogesh C. Sud, Code 913
Yogesh.C.Sud.1@gsfc.nasa.gov
301 614-6240