

Thoughts from the 5/22-26/95 ASTER Team Meeting

MEETING ARRANGEMENT

*~ 70 people*

Five (actually 4 1/2) day format worked well, once people travel to the meeting the extra time is not great. It enables more substantive discussions of technical things.

GENERAL COMMENTS

ASTER MOU status. Many meetings, another this weekend, then several more, then expects completion by end of year. The pricing policy has been one of the biggest issues so far. MITI does not plan to charge a lot BUT the pricing must be consistent with the Finance Ministry's policies which are not as clear.

ASTER is considering having one technical person describe his activities at each GSFC Project quarterly review (which they hope will be yearly or semi-annually rather than quarterly).

Hydrex and AVIRIS will be flying June 20-22 this year near Tahoe over various things. Biggar will be the Prince of ground measurements.

There is a MAS Hawaii campaign in 96 that ASTER would like to participate in both to study SST and to get MAS flown over some of their Hawaii sites.

Simon Hook gave a talk on the first ASTER preflight-inflight calibration experiment. <sup>Goal</sup> develop a methodology for assessing the inflight cal of ASTER Thermal bands. As a byproduct provides a satellite and an instrument with ground measurements for atmospheric correction and temp/emissivity correction. Tahoe because it was high and had a large body of water. included underflights with TIMS, goal was to have large enough area for low spatial resolution instruments as well as for ASTER. Included atmospheric profiles of temp, pres, rel humidity from a balloon, surface brightness, micro measurements of soil props. Included ATSR from ERS-1, three flightlines of Thermal Infrared Multispectral Scanner. There was a snow storm just before the experiment and there is some snow on the ground but much cleared up before end of experiment. Lake surface temp varied as much as 1.5 degrees, conditions were near perfect. However there was some concern that atmospheric conditions varied during the time and space of the experiment and that more measurements would have been good.

Paluconi discussed a validation data set experiment. His question was how could they provide a surface temperature data set. Thought it would be easier to do water surface temperature. Deployed buoys on a grid of ASTER pixels with a thermistor sensor about 1 cm. below surface. Also made radiometric measurements outside (just) the grid. They correct for emissivity of water and for sky reflection off of the water. Perhaps the water is being heated from the surface down, this is a non-trivial problem. An aircraft scanner flew over and showed that there was a lot of structure on the surface. Boat tracks seen in the scanner data showed the effect of stirring of the upper layer. Simon Hook

asked if there is vertical structure what about is the buoy just bobbing? Frank said that to first order the buoy follows the wave structure i.e. floats up and down with the waves. Frank says there were no real waves but there were some ripples and some little wind structure. The questions are what is the upper layer gradient and what is the buoy movement. There are other questions about the time constants of the buoy (how does it bob) and the time constant of the detector. The observed data sometimes had a 3 minute periodic effect. The basic message is that this is not an easy thing to do. There was a picture of a land surface temperature measuring rig which causes me to have real question about the precision of Slater's land measurements. It is hard to define what surface temperature means. The surface has many things rocks, chemical constituents, etc. Each has an emissivity and probably a different temperature. Thus there is probably a non-consistent radiation as a function of wavelength. I think this means that for a black body if you measure temperature at one wave length you know what it will be for all other wavelengths but that this is not the case for the surface.

Kurt Thome discussed optical depth measurements for the Lake Tahoe experiment and pointed out that there appeared to be a calibration error in the data but it was inside the system noise so who knows, It could also have been a microscale real effect but they only had one measurement source so who knows. They will be using Lake Tahoe as a SeaWiFS temperature test point. Given spectral optical depth and assuming a Junge size distribution (linear in log log space) they calculate an aerosol size distribution.

Simon Hook asked, water vapor measurements are accurate to perhaps 30%, how can we use 20% for the menzel profiles? Perhaps part of the answer is that instantaneous errors are high but, if random, total column water would average out some of this variation and perhaps have accuracy of 10%. ZZZ ask Paul Menzel?

#### VALIDATION SITES FOR ATMOSPHERIC CORRECTION

Too many sites have been submitted in the past, what does ASTER really want, how can there be coordination with MODIS, MISR etc. Paluconi wants two sites, Lake Tahoe high altitude cold water and Salton Sea, low altitude hot. Kurt Thome offers White Sands, Lunar Lake, vicarious cal sites  
Lake Tahoe is low reflectance, low optical depth, but it has sun glitter

Rogers dry lake is moderate reflectance and optical depth (Moderate for Arizona, low for east coast.)  
Maricopa Ag Center has more variance and vegetation.  
Questions what about fife and Boreas?

Asked about ARM site in Oklahoma Paluconi said yes and it is good but it may not have a big body of water and it would be there anyhow so they did not list it.

It was suggested that one might organize the list by the characteristics it offered.

They wanted wide range of surface reflectance  
wide range of aerosol optical depth, size distribution  
sun angle

humidity  
temperature

Gillespie gave a talk about a student's model of the effect of surface roughness which even for something like a basically flat gravel surface could meaningfully change the radiative characteristics from that of a flat sheet of the same material. In fact shadowed parts seemed to behave as a black body rather than as a piece of gravel. This seems to enhance the importance of identifying shadow for MODIS.

Scott Lambros says that Lockheed coolers no longer input jitter beyond cooler spec! However the TIR pointing operation does and there are some operational constraints including slowing the speed of rotation down from 30 seconds to about 45 seconds and after a 90 degree slew it must wait 30 seconds to damp vibrations out. TIR pointing system is late. There is a contamination concern about cleanliness from ASTER not polluting other instruments. Quick look is gone, there is now a discussion of 2% expedited data test. There have been requests for a s/c jitter test but it is probably too expensive. Kudoh-San on same subject. Vibration tests at Ball caused the failure of the TIR scanner caused by fragility of points at the pointing mirror axis.

Browse is to produce only one browse, not L1A and L1B Japan thinks maybe all bands US said only fixed band combination. Japan thinks of perhaps 310 scenes per day processed to Level 1B.

Salisbury reports he is making measurements in the lab of soils, as is, sifted, wetted, etc. and asks if this will take the place of field experiments which he is not funded to do. Answer, no you disturb the surface when you collect it. Salisbury responds that for soil this is true but surely for rocks it is OK. Answer well yes but not if there is any rough structure.

Frank Paluconi discussed the effect of errors in MODIS parameters on derived radiance for ASTER. ZZZ are the MODIS numbers in the ATBD the average accuracy or the worst case or what? ZZZ Why do it this way instead of using MODIS derived corrections for atmosphere itself? What is the effect of scan angle? Not much TIR only scans about 8 degrees.

ASTER appears to be stuck if all the modis profiles are not present. Is this an at launch condition?

What about cloud adjacency? Conclusion that this will be significant (and not because of instrument effects) especially in the case of small surface emissivity and high atmos temp. with a hot cumulus temp 281.7 and a surface of 288.2 and a surface  $e$  of .8 and a semi-infinite cloud then comes times radiance errors of 1.17 to 3.69 for 1 pixel away clouds and less for 15 (90 meter pixels) away clouds. Concludes that correction is impossible and that cloud adjacent pixels must be rejected.

Shmugge is doing a standalone, starting with assume an  $r$  (and thus an  $e$ , calculate an  $e$ , correct the  $r$  do over perhaps 5-6 iterations until convergence. Question ZZZ how can  $e=1-r$  and  $r$  is angle dependent and  $e$  is not? ZZZ There might be some value in getting Wan, Paluconi, Menzel, Vermote, Schmugge, Gillespie together for a day or discussing things on e-mail.

Gillespie comments on the problem of mixing differing surface types and points out that linear mixing even of isothermal things introduces an error. He says that if the surface is not relatively uniform and all one thing there is a big problem. He gave as an example "If you have snow at -10 degrees and hot lava flowing thru it "what is the surface temperature of that pixel" It is undefined!" By extension a mixed pixel of varying temperature (e.g. visible dirt and trees) is also undefined.

He did something interesting by plotting an effect for representative samples of inherent variation of materials and then did a scatter according to measurement error. The point was that the size of the two scatters was similar so the measurement capability is no more limited by measurement error than it is by natural variability.

Tom Schugge may be a good contact for discussing land test sites. In particular he has a grass land test site.

Level 1B validation sites discussed. Anne in issues for discussion

1 Real selection of test sites for validation and development

2 Validation Planning wants to interact with MODIS and others before launch.

To see if both instruments will get same answer for instance on temperature.

Gillespie feels that if you validate an algorithm once in a few places it becomes someone else's problem to look at long term changes introduced by instrument changes or atmosphere changes. This is not valid in my opinion.

Discussion of MIVIS instrument and of an aircraft instrument extravaganza in June somewhere in U.S. This would be the second one, last year there were many 20-30 planes measuring at the same place and time. MIVIS seems to be a Daedalus instrument operated by the Italians. Discussed by Mike ? One concern is that TIMS may be down for one or two years because of the change in C-130s.

Current plans for MODIS validation/quality control/calibration/long term test sites include collecting periodic TM data at these sites. ZZZ do we want periodic ASTER data at these scenes? If so we have what amounts to a standard order for ASTER data which we ought to share with the mission planning people for ASTER! We should discuss this and our other plans with both Anne and Andy Morrison. zzz send them any working papers, draft copies, etc. Share the IGBP sites with Andy and Anne. ZZZ ask for copies of all Andy's collection. Send them what I turned in to Starr. Note that we may want to identify individual investigator science investigation sites as a second form of validation data test site and collect this information into a data base and include the various levels of ASTER individual test sites. Perhaps we should press Starr into developing this?

Note, and bug Project Scientist, that there is no requirement for a validation plan for ASTER beyond whatever was discussed in the ATBDs.

THOME on Test Data (from U Arizona) developing test data set to test the code.

Goals:

Test the code for operation, time the code, error analysis, and preflight validation.

Compute at sensor radiance for given inputs of surface reflectance and atmospheric characteristics. Using Gauss-Seidel iteration which is the same as the one used for their atmospheric correction. Note that this produces "errorless" results i.e. is incestuous. There are things such as adjacency effects not included. If they use the same sort of input parameters than they get further incestuous, can still do code and timing tests is less work, but weak error analysis.

Current status, have coded up Gauss Seidel, accepts input reflectance image, computes at satellite radiances. Test Images of two types Model imagery developed to test anticipated problems with a wide range of reflectance and with adjacency effect problems. The second type is to use real images. They do things like %change in TOA radiance for various optical depths of aerosol for various surface reflectance. Currently use Junge aerosol size distribution and Mie. Want to try non Junge and more realistic size.

What is the status of adding GSFC to EDC's request for DEM data from DMA. —

ASTER Ecosystem group is starting an e-mail news letter. Does MODIS Land team want to be on the distribution list? Do we already have too much? Do we have anything to trade? Professor Honda from Japan is setting up distribution. They may just put it on the ASTER homepage.

Watch out for ETOPO5 since it includes bathymetry data i.e. it shows the bottom of the ocean and of the lakes. UN enviro something has interpolated all of Africa to a substantially better resolution than etopo5.

What are we doing about flagging bad pixels in Level 1B. Whn the engineering data casts doubt on a given scan line what do we do?

Also the need to decide how to specify both for scan lines and individual pixels whether each individual pixel is good or bad and what should go into metadata.

Might want to involve ASTER's Mike Abrahms in future discussions (reviews) of SST

Question asked by Keiffer as to whether MODIS Level 1B structure would easily support single wavelength data set orders. Hugh intended to pursue this with Dorthy Hall.

## LANDSAT 7

Jim Irons spoke on the Landsat 7 Image Assessment System (IAS) to allow assessing and assuring data quality and calibration of radiance and location. ETM+ instrument adds a panchromatic band with spatial resolution of 15 meters and the thermal band (6) goes from 120 meters to 60 meters. Still 8 bit but now with independent switchable high and low gain. 5% radiometric accuracy 400 meter (90%) without ground control geodetic accuracy. two 75 mbit/sec per antenna, three x band antennas. when near EDC they will use two antennas, one real time one playback. Landsat Processing system will be built, implemented and operated at EDC by NOAA(?) it will not - at level 0R apply radiometric or geometric cal. This is the data that will be archived and distributed. Landsat 7 will NOT provide level 1 data. The user gets level 0R and goes to a value added vendor or does it themselves. IAS will provide the

processing parameters that are required to produce the Level 1 data and that will be provided with the data. Cost will be about \$400-500 per scene. An obvious question is what will the copyright distribution policy be??? They expect to receive about 250 scenes per day and distribute about 100 per day. He expects that when the users actually see the level 0 versus current level 1 data they will not be too happy. IAS will be able to process to level 1, perform radiometric cal, perform geometric cal, and assess performance. IAS will be offline, not in production flow, will operate by product sampling. Will not interface directly with users, will not provide information directly to users (they get info from DAAC.) Will not do processing for users. Processing is only for quality assessment. Data will be copyright free and copies can be distributed. The time lag on coefficients (i.e. once per day, orbit, etc) was not clear they hope to make software available as freeware but they have no budget for this. Portability, maintenance, user support, documentation, are all unfunded.

Bad Pixels

MCST detected

Info transferred how

what to do

missing line

Interpolate space, spectral

Engineering data per scan

MCST

Info Format

OK

Clearly No

Other, (what to do)  
(meta data)

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Validation  
sites

campaigns

Instruments

Quality Control

comparative measurements

tools - display, data base

products -

staff / costs

~~Purpose / Goal / Schedule for SRS review~~