DRAFT, send comments to Curt Davis (cdavis@coas.oregonstate.edu)
MERIS and OCM Data Workshop Report

Executive Summary

A Workshop on the use of MERIS and OCM by NASA, NOAA, Navy and university scientists was held at NRLSSC January 29-31, 2008. Current US ocean color sensors are past their design life and we need to assure continuity of data and products for ocean applications. Additionally MERIS and OCM are the only sensors designed for ocean color measurements at higher resolution that meet coastal requirements. The workshop focused on identifying issues that needed to be addressed to make use of MERIS and OCM by US scientists for coastal waters with a goal of transitioning to operations. The group considered that work with OCM-1 was essential as a pathfinder for OCM-2. The workshop goal was to develop a real working plan on how we can address the issues identified including issues of data collection for US sites, data access and cross calibration so that the data can be used in combination with SeaWiFS and MODIS to extend coverage and produce a consistent time series of ocean color data. The workshop specifically addressed approaches for cross-validating MERIS and OCM-1 with coincident SeaWiFS and MODIS data and in-situ measurements. In situ data could include MOBY, Martha's Vineyard Coastal Observatory, the Ligurian Sea and other sites if they are available. The workshop also addressed the specifics of MERIS and OCM data and algorithms.

The primary result was a plan to assemble a comparison data set for four representative US coastal regions including MERIS, OCM, SeaWiFS and MODIS satellite data and in situ data for the sites for clear days in 2005 and 2006. A plan was developed to process the data to a standard level for the comparisons at the remote sensing reflectance level and to compare a standard chlorophyll product and a standard product that estimates particulate scattering (Rrs 490 nm/ Rrs 560 nm). The data would be analyzed at full resolution for comparisons to in-situ data, and it would be binned to a 4 km average for comparisons of large scale averages and temporal changes. The data and analysis results would be hosted on an FTP site at Oregon State University for ready access by the team.

The workshop participants were enthusiastic about the use of MERIS and OCM data for a host of science and operational applications. The 620 nm and 709 nm channels on MERIS have proven especially useful to address issues of bathymetry of optically shallow waters and of harmful algal blooms in the Laurentian Great Lakes and coastal waters. Also the higher resolution of the MERIS 300 m data and the OCM data should be particularly valuable in many coastal regions. For MERIS we need to demonstrate the utility of 300 m for operational coastal applications and the group plans to prepare a Cat 1 proposal to ESA for that work. We recognize that there is no mechanism in place for operational use of MERIS data at this time but the goal is to demonstrate the utility of the data and develop products that can be used by US and other scientists and resource managers. The group also discussed the fact that OCM-1 may not be operating much longer, but that OCM-2 is due to be launched in 2008 and that it should provide better coverage and higher quality data. The group concluded that it was important to continue to work with OCM-1 to better understand the issues with this type of data and prepare for OCM-2 when it becomes available.

Therefore we have two specific recommendations. First, US agencies (NASA, NOAA and Navy) should work with ESA for improved access to 1.2 km and 300 m MERIS data. For MERIS we should request routine near-real time access to 1.2 km data for the Great Lakes, US coastal water and other areas of interest. The ideal would be to upgrade this to 300 m data for near coastal regions. Access by requesting data collections and retrieving the data from ESA can be useful, but the shear volume of data suggests that this may need to be accomplished using receiving stations in the US. The University of Miami has a station already licensed for this use, but the data collection, and the ability to distribute that data to users may need to be expanded to meet this need for the East Coast and Gulf Coast. The Great Lakes could be imaged using an existing station in Halifax Canada. On the west coast an X-band station at Oregon State University could be upgraded and licensed to receive and distribute this data. The US agencies should negotiate the appropriate agreements with ESA to make this happen.

Second, the group also expressed great interest in receiving and working with OCM-1 data and OCM-2 data when it becomes available. We look to NOAA and NASA to make an agreement with the Indian Space Agency (ISRO) for access to that data. In return the US team can share results and help with issues of calibration and data product validation that can help the Indian scientists make the best use of the data.

Workshop Goals:
1. Determine US current capabilities with MERIS and OCM
2. Identify calibration strategy for OCM
3. Identify MERIS evaluation strategy using either MSL12 L2 data or ESA level 2 data
4. Assemble a comparison data set for four representative US coastal regions
5. Identify product validation strategies
6. Recommend US needs for MERIS for the ESA
7. Recommend US needs for OCM 1 and 2 for ISRO

PARTICIPANTS

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Location: NRLSSC, Bob Arnone local host.
Schedule: 2.5 day Workshop January 29-31, 2008

Agenda and meeting summary:

Day 1:
Introductions and meeting overview presentations by Bob Arnone and Rick Stumpf

MERIS: Presentations on current MERIS processing issues, current results

Navy; Paul Martinolich
Processing both level 1 and level 2 data
Issue of smile correction and one camera gives different results than the others
This is for 1.2 km data
Major question for ESA is how we get the 300 m data – will need a direct downlink station in NA to get this real time. Can also get stored 300 m data, but you still need to request that it be collected.

Navy; Ping Lee
Preliminary results of using MERIS in US coastal waters (Sept 11, 2006 for COAST and some off Florida for the Hyperion experiment)
[Rick, 620 and 709 nm channels are of value in the coastal ocean, so even the 1.2 km data is of unique value in the coastal waters, spectral products]
[Chuck Trees NASA-ONR-ESA cruise in October]

NOAA; Phil Keegstra
Use MERIS 1.2 km files convert to Coast Watch HDF (CWHDF)
Primarily users looking at change detection (e.g. Rick Stumpf looking at HABs)
Not sure OCM will work for this, looking at OCM 2
US coastal waters
Near-real time no archiving after 2 weeks
Dave Foley – local node maintains long-term archive of the merged data
Data access from Kiruna, Sweden data rate is bimodal 400 KBs and 16KBs
[suggestion is that the data we sent to North America and then redistributed from there at a higher data rate.]
Data access is from Joaquin Trinanes as PI on ESA Category 1 proposal; all other users are as co-investigators on this proposal
Can distribute your products if you include the ESA logo (e.g. Coast Watch distributions)
Collecting and processing MERIS since June 2006
Have dome some comparisons with SeaWiFS data and MODIS Aqua (60 day averages are close)

[Rick; suggestion we put together a reference set of images and run it through all of the systems and see if we get comparable answers]
[Chuck; we must all agree and use the same version of MSL12 to make this work – there are upgrades to each version. Make the comparison at the nLw or Rrs level first.]

NOAA; Rick Stumpf
NOAA using MERIS monitoring the bluegreen algae blooms (post zebra mussels, the Phosphorous is being resuspended in the shallow part of Lake Erie, Saginaw Bay and Lake St Clair). This is primarily Microcystis, strong scattering from gas vacuoles. Use MERIS 709 channel to identify strong blooms. Also using 620 nm may see phycoerytherin absorption? Coupled with models of the circulation (GNOME) includes surface circulation and wind drift.

NASA; Sean Bailey NASA GSFC not working with MERIS

Universities; Although there was great interest in MERIS data there are currently no researchers from the represented universities working with MERIS data.

General Discussion of MERIS processing issues

Lunch

OCM: Presentations on current OCM processing issues and current results.

Navy; Paul Lyon
OCM destriping, detector corrections, correction for each image is dependent on the scene; if you have many clouds you cannot do a good destriping correction. Destripe the data at L1 and then produce products. But the detectors are not stable between the data collections. The detector is turned off between collections, and on for various times before collection.
[Rick For consistency we need to then link this to SeaWiFS]
[Curt; we need to collect all of the papers and put them on the web site along with the presentations]

NOAA; not currently using OCM data.
NASA; not currently using OCM data.

Universities; Nan Walker
LSU has a receiving station for OCM for 4 years now. Originally purchased data through SeaSpace. They are now buying data directly from the Indians. Looking at nLw after running through a filter from TerraScan. Looking at cyanobacteria blooms in a freshwater lake. Used OCM matched with SeaWiFS to do a calibration at Rrs.
[Rick; compare the Rrs output of the Terrascan processing (Nan) and the NRL processing using MSL12 for the same scenes]
[Rick; Is the Terrascan filter a median filter? Pepper?]
[Announcement is out for getting and using OCM 2, need to check the announcement and results of the trip to India, record the 1 km and direct downlink of the 300m? OCM2 to launch this year]

[Lisa at Rutgers is getting data though a deal with the Indians, also U. Texas is collecting and archiving the data from both sites, they will post the data for users. Not clear that anyone is working on the ocean data.]

Topics to be discussed by each group:
Present Calibration used in OCM – level 0 an level 1
Present level 2 processing of OCM
Existing data products generated
Data archive and storage
Problems and issues

Break

General Discussion of OCM processing issues

OCM-2:
Plans and discussion about meeting with Indians (expect feedback later)
Group agrees it is worth our while to solve these questions to be ready for OCM-2. We can provide them with vicarious calibration in exchange for the OCM-2 data. Brian Franz and Stan Hooker went on the trip to India with Stan and Paula.
Dave Foley (Coast Watch) getting data from Seaspace no longer paying, getting only So. Cal bight at this time.

Discussion on directions of OCM and MERIS:
Test data sets (e.g. a time series over a month, and a set of 5 or so from different seasons, etc. that might have ground truth. Also want to match with SeaWiFS , MODIS and MERIS if possible)
NOAA Coast Watch (Dave Foley), LSU and Rutgers are running the SeaSpace software, can test that software. NRL will do the processing using their software based on MSL12. Each to bring a few data sets. Foley to look at Monterey Bay, Sept 2006 to match with MERIS and COAST data.
Tomorrow set up plans for data set, selection, processing, set up an FTP and website. Could be one site
Hans Graber (U. Miami) runs the receive site for east coast MERIS 300 m data and they are also getting ASAR (OSU to follow their lead?) But the SAR is very expensive. May need to write a CAT 1 proposal, but that is not real time only research. Can we get the 300 m data from the site in 3 hrs (Dave gets the 1.2 km data this fast) but the link is slow from Europe. Also, if we pull down the data can we distribute the data.

Day 2:
Discussion of MERIS and OCM issues (listed in the issues document)

NASA; Sean Bailey use of OCM and MERIS
MERIS global coverage is not as complete as SeaWiFS and MODIS (about half the rate)
Compared level 3 water leaving radiances binned good comparison for oligotrophic regions

There is a seasonal oscillation when compared to SeaWiFS which has no polarization sensitivity and has a BRDF correction. MERIS could use the same BRDF collection as it was developed for MERIS, but we do not know if it is being used. They see the same pattern when comparing MODIS Aqua to SeaWiFS.

Sean reviewed the NASA vicarious calibration procedure
Use fixed NIR gains
In situ sources
> MOBY
> NOMAD/BOUSOLE
> Clear water model

Comparisons are at the sensor Lt
Cross calibration also at Lt mapped to the same coverage.
e.g. to fix Terra MODIS using SeaWiFS

Discussion of the selection of data sets (see issues paper)

Lunch

Discussions on satellite calibration and product validation:

Chuck Trees lead a Discussion of joint NASA, ESA, and ONR supported calibration and validation cruise in the Legurian Sea. Two week cruise in October 2008 and 2 months of glider data. Discussion of satellite data sets that can be collected for the experiment.

> Calibration Sites – data flow. (MOBY, Martha's Vineyard OOS)
> Spatial and temporal calibration
> Vicarious methods
> Cross satellite calibration issues

Rick Stumpf presentation on the comparison of SeaWiFS and NOMAD data, also comparisons with MOBY. He looks at the spectral shape from 490 to 443 to 412 nm and sees that the shape is off and he looks at adjusting the gain at 412 to get the correct shape. It works well if the shape is basically correct to begin with. The results indicate that the calibration at 412 nm may be off by .003 giving low values for SeaWiFS 412 nm data. Note that this error is within the calibration limits. If this is the case then we could have a huge over estimate of the CDOM in the ocean. Alternatively there may be other issues with the SeaWiFS data? But this could provide a quick fix for the data and could fix the negative 412 nm radiances problem for many coastal scenes.

Day 3:
Review of initial draft of report
Review and refine issues for MERIS
Review and refine issues for OCM
Plans for future work

The meeting was concluded at noon.