NEWS LETTER No 5

GHRSST
Group for High Resolution Sea Surface Temperature

November 2011

VIIRS on NPP +++ AMSR-E +++ WindSat v7 +++ Pathfinder v5.2 +++ OSTIA updates +++ Salinity from SMOS and Aquarius +++ Large 2010 SST anomaly +++ Publications +++ CEOS SST-VC approved +++ IWWG +++ GDS2 revision4 +++ Meta-data review +++ User requirements review +++ NASA SST ST meeting +++ ESA CCI meeting+++ MyOcean ERNESST workshop +++ Dragon training course +++ GHRSST Workshop Melbourne +++ Events Calendar

---

VIIRS on NPP: The Visible Infrared Imaging Radiometer Suite (VIIRS) was launched on the NASA NPP (National Polar-orbiting Operational Environmental Satellite System Preparatory Project) satellite into a polar-obit on October 28. It is in an A-Train-like orbit with an ascending node at 13:30, an altitude of 824 km, and a 16-day repeat cycle. NPP carries five instruments designed to provide data for weather and ocean forecasting and for climate studies: the Advanced Technology Microwave Sounder (ATMS), the Cross-track Infrared Sounder (CrIS), the Ozone Mapping and Profiler Suite (OMPS), Clouds and the Earth's Radiant Energy System (CERES) instruments, and the Visible Infrared Imaging Radiometer Suite (VIIRS). VIIRS is the sensor of most interest to GHRSST, has 22 spectral channels in the visible and infrared. For the measurements of SST, VIIRS has two channels in the thermal infrared atmospheric transmission window for day and night use, and two in the mid-infrared window for night-time SST retrievals. VIIRS has a better spatial resolution at nadir than MODIS or AVHRR, and uses a new technique of "pixel aggregation" to reduce the effects of pixel size growth across the swath away from nadir. Like MODIS, VIIRS has multiple detectors per band (16 for VIIRS compared to 10 for MODIS), and uses a rotating telescope fore-optics design as was used for SeaWiFS. VIIRS has an internal blackbody calibration target built to the same design as that used in MODIS. More details at: ftp://ftp.rsmas.miami.edu/users/pminnett/GHRSST/Minnett%20SST%20from%20VIIRS%20on%20NPP.EUMETSAT_Oslo_2011.pdf. Daily updates of progress through the commissioning period can be found at http://www.star.nesdis.noaa.gov/jpss/StatusMMDD.php, where MMDD are the month and day.

AMSR-E: AMSR-E was shut down on Oct 4, 2011 due to an increase in the friction of the antenna rotation. JAXA plans to launch AMSR2 on GCOM-W1 within the current Japanese fiscal year (ending 31st March 2012). JAXA also leads an investigation into what occurred and has determined that it may be possible to turn the instrument back on at 4 rpm (normal is 40). an attempt to turn it back on within the year is likely. If this is successful, Remote Sensing Systems (RSS) will be able to retool their algorithms to begin producing AMSR-E data again. At 4 rpm there will be large gaps between successive scans.

For non-NRT users, AMSR-E version 7 will be released in November 2011 by RSS. The completely reprocessed dataset has significant improvements in the SST algorithm and RFI Radio Frequency Interference) flagging.

WindSAT v7: RSS has been working hard to release WindSAT v7 data and the release of WindSAT v7 is expected end of November 2011. The dataset will be from 2003 - present, with NRT data at ~3-5 hour delay. Their initial validation shows the SST data to be almost as good as those from AMSR-E, with errors ~0.5 K.

Pathfinder v5.2: The AVHRR Pathfinder Version 5.2 (PFV52) was released in September by the NOAA National Oceanographic Data Center (NODC). It has been created in close partnership with Bob Evans and his team at the University of Miami, with partial support from the NOAA Climate Data Record Program. Changes in PFV52 include the use of an entirely new land mask, a modified grid, and the inclusion of sea ice and wind speed ancillary data to support the use of the SST data. Importantly, the new PFV52 data are provided in netCDF-4 (classic model, with internal compression and chunking) and are overall compliant with the GHRSST Data Specification Version 2.0 for L3C products. These data deviate from the standard in that the sses_bias, sses_standard_deviation, and sst_dtime variables are empty. Data for 1981-2010 are available through NODC:

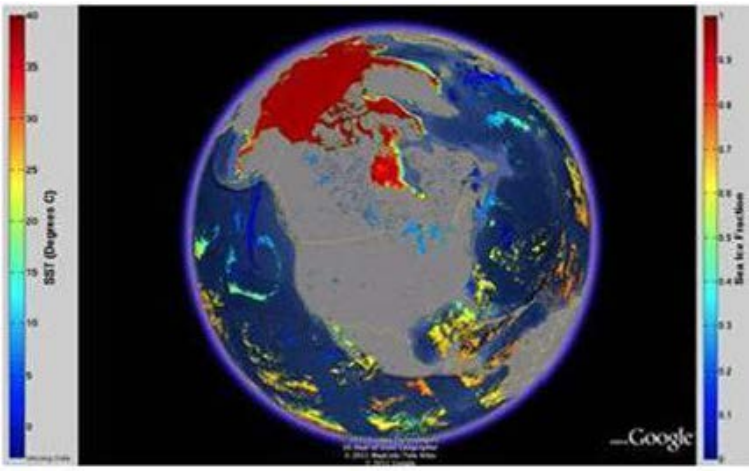

Fig 1: Pathfinder data v5.2 covers both SST and Sea Ice Fraction (note the two different colour scales)

HTTP: http://data.nodc.noaa.gov/pathfinder/Version5.2/
FTP: ftp://ftp.nodc.noaa.gov/pub/data.nodc/pathfinder/Version5.2/
OPeNDAP: http://data.nodc.noaa.gov/opendap/pathfinder/Version5.2/ (Hyrax server needs to be updated to most recent version before it can serve netCDF-4 data)
THREDDS: http://data.nodc.noaa.gov/thredds/catalog/pathfinder/Version5.2/catalog.html
Browse Images and KML: http://data.nodc.noaa.gov/pathfinder/Version5.2/browse_images

To keep abreast of all Pathfinder news, subscribe to the Pathfinder RSS feed.

OSTIA updates: will be operational at the UK Met Office from 22 November onwards. The main changes are: (1) inclusion of Lake Surface Water Temperatures (LWST), (2) inclusion of a number of new input data sources (GOES-E, IASI/MetOp, AVHRR/NOAA19) and a new version of the SEVIRI/MSG data, (3) use of a new climatology based on the OSTIA reanalysis and the ARCLake climatology.

The addition of LWST in OSTIA does not affect SSTs and therefore does not change their accuracy. The accuracy of LWSTs has been assessed using observation-minus-background comparisons. RMS (mean) errors calculated over the period 2nd September to 5th October 2011 over all lakes were 1.20 K (-0.18 K) compared to *in situ* data, and 0.79 K (0.08 K) compared to AATSR data. The lakes included in OSTIA are based on those defined by the ARCLake project (see http://www.geos.ed.ac.uk/arclake/ for more details).

The impact of new GOES-E and SEVIRI data is negligible in terms of RMS and mean errors calculated over ocean basins. Local changes are more significant and demonstrate improvements from these data types. The new NOAA 19 data undergoes equivalent processing to the current NOAA 18 data already used in OSTIA, so its accuracy is expected to be similar, and will provide improved coverage. MetOp IASI SST data is expected to complement the existing MetOp AVHRR data. Overall observation-minus-background statistics are unchanged for the new version of the system.

The new SST climatology is expected to have little impact on the accuracy of the SSTs, but ensures a more consistent analysis system overall.

Examples of the new data (in both the current and new formats) are available via ftp from ftp.metoffice.gov.uk. Please email ML-OSTIA@metoffice.gov.uk for username and password.

Salinity data from SMOS and Aquarius:

Sea Surface Salinity (SSS) is the most recent oceanographic variable to be observed from space, now provided by the Soil Moisture and Ocean Salinity mission SMOS (launched November 2009) and the Aquarius mission (launched June 2011)

SMOS: At the CATDS (Centre Aval de Traitement des Données SMOS) hosted by Ifremer/Cersat, level 3 and level 4 algorithms for SSS are tested and compared with Argo sea surface salinity. SMOS salinity has been analyzed for consistency according to sea surface roughness, SST, and viewing geometry. One of the major error sources in the salinity products is associated with the frequent data contamination by Radio frequency interferences such as from radio links and radar. The salinity retrieval also depends on SST. Currently, OSTIA SST is ingested into the operational SMOS processing. To improve the quality of the salinity estimates, it is planned to account for the diurnal variability of SST in the near future, anticipating progress particularly in the Tropical seas. Currently, SMOS monthly Level 3 products at 1°x1° resolution are found to exhibit a global accuracy of ~0.3 pss. SMOS brightness temperatures data acquired 2010 have been recently reprocessed by ESA and then by CATDS to provide a consistent Level 3 SSS data set for the first year of mission operations (products available at http://www.catds.fr), see Fig. 2 for an example.

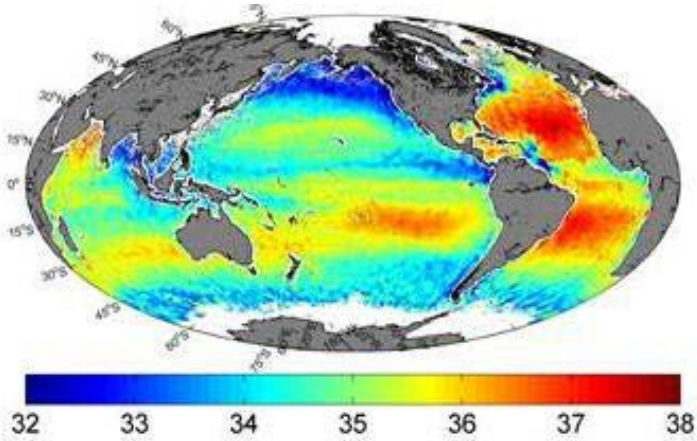

Fig 2: Composite SMOS L3 SSS field for the month of July 2010 at 0.25° resolution.

Aquarius: The Aquarius microwave radiometer was launched into a sun-synchronous orbit on June 10, 2011, aboard the US-Argentinean SAC-D satellite. The ascending node time is 06:00. Aquarius takes measurements at 1.4 GHz, where the oceanic emission is sensitive to the surface salinity. The first global image of surface salinity from Aquarius has already been released (Fig. 3) and while there are some instrumental or calibration artefacts apparent in the image, the main features of large-scale ocean surface salinity are clearly resolved. More details can be found at http://aquarius.nasa.gov/

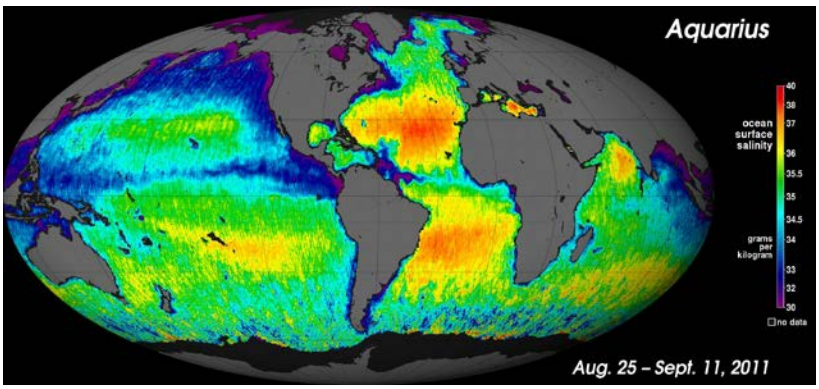

Fig 3: First map of global ocean Sea-surface Salinity from the Aquarius microwave radiometer.

Large 2010 SST anomaly investigated: From November 2009 to mid 2010, a large warming event occurred in the South Pacific with a spatial extent comparable to the size of Australia and a magnitude exceeding five times the standard deviation of local SST anomaly (*Lee et al. 2010*). The image below (Fig 4 left), derived from the ¼-degree Reynolds OI SST (*Reynolds et al. 2007*, one of the GHRSST products), illustrates the warming event near its peak. The warming was found to be confined to the top 50 m of the ocean, the approximate mixed-layer depth during the peak of the warming. The warming was caused by wind changes associated with an unusually strong and persistent anticyclone in

the South Pacific that reduced oceanic heat loss, decreased vertical mixing with subsurface cold waters, and inhibited northward advection of cold, high-latitude waters. The anticyclone (and thus the record warming) was linked to the 30-year record high SST anomaly in the central-equatorial Pacific associated with the 2009-10 central-Pacific El Niño (*Lee and McPhaden 2010*). In early 2010, SST anomaly in the Bellingshausen Sea and near the unstable Wilkins Ice Shelf, a region already hit hard by multi-decadal warming, also reached a 30-year high. Warming events in western Antarctica like this one and their teleconnection with the central-Pacific warming trend may have implication to the stability of western Antarctic ice shelf. The anticyclone and warming event were also associated with the largest multi-month anomaly of ocean bottom pressure as observed by the GRACE satellite (*Boening et al. 2011*).

References:

Reynolds, R. W., T.M. Smith, C. Liu, D.B. Chelton, K. Casey, M.G. Schlax (2007), Daily high-resolution-blended analyses for sea surface temperature. *J. Clim.*, 20, 5473–5496.

Lee, T., W. Hobbs, and J. Willis, et al., 2010: Record warming in the South Pacific and western Antarctica associated with the strong central-Pacific El Niño in 2009-10. *Geophys. Res. Lett.*, 37, L19704, doi:10.1029/2010GL044865/

Lee, T., and M. McPhaden, 2010: Increasing intensity of El Nino in the central-equatorial Pacific. *Geophys. Res. Lett.*, L14603, doi:10.1029/2010GL044007.

Boening, C., T. Lee, and V. Zlotnicki, 2011: A record-high ocean bottom pressure in the South Pacific observed by GRACE. Geophys. Res. Lett., 38, L04602, doi:10.1029/2010GL046013.

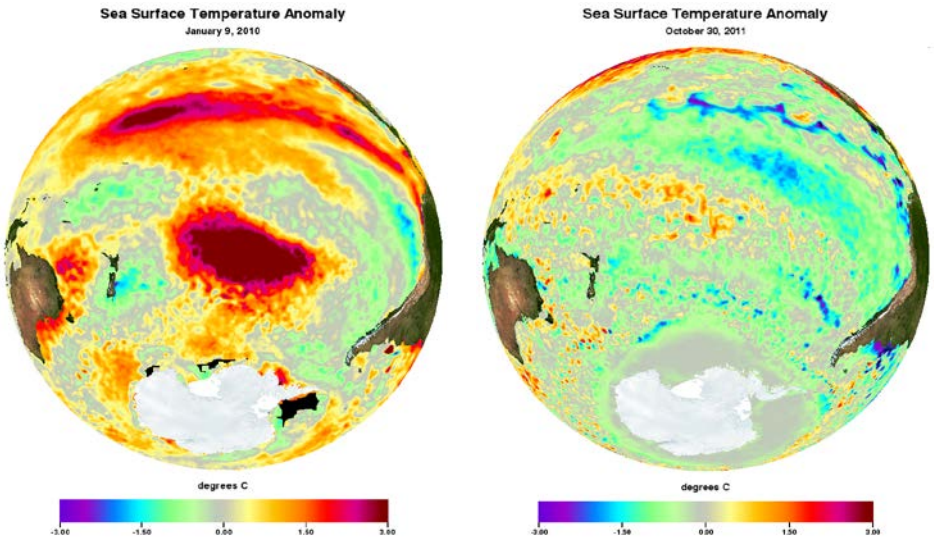

Fig. 4: SST monthly anomaly illustrating El Nino conditions and large warming in the South Pacific (left) and recent weak La Nina conditions (right) [Image credit: Charles Tompson, PO.DAAC]

A recent image of SST anomaly (Fig.4 right) shows that there is little large-scale SST anomaly in the South Pacific associated with the current weak La Niña.

Recent publications based on GHRSST data:

1. Information regarding obtaining validation-quality *in situ* SST observations from hull-contact temperature sensors on ships of opportunity is contained in: Beggs H., R. Verein, G. Paltoglou, H. Kippo and M. Underwood (2011) Enhancing ship of opportunity sea surface temperature observations in the Australian region, *Journal of Operational Oceanography, (submitted) - Contact h.beggs@bom.gov.au for a PDF of the paper.*
2. Recent paper published on Arctic diurnal warming that demonstrates the combined use of several GHRSST L2P data sources: Eastwood Steinar, Pierre Le Borgne, Sonia Péré, David Poulter (2011) Diurnal variability in sea surface temperature in the Arctic, *Remote Sensing of Environment*, **115**, Issue 10, 2594-2602, doi:10.1016/j.rse.2011.05.015.
3. A new eddy detection scheme from high-resolution SST data is developed, which is published on IEEE -Geoscience, see http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=05898391.

CEOS SST VC approved: The CEOS SST-Virtual Constellation (VC), proposed by GHRSST as its formal connection with CEOS, has been officially approved. The SST-VC received very strong support from numerous agencies during the CEOS Plenary discussion on 8th November. ROSHYDROMET, JAXA, ESA, NOAA, UK Space Agency, ISRO, GCOS, and NASA all stated strong support for the SST-VC and the Full Proposal was accepted unanimously. The SST-VC team, co-chaired by Kenneth Casey and Craig Donlon, will now draft the SST-VC Implementation Plan in consultation with interested GHRSST members and submit it to CEOS within the next few months.

IWWG: Note the former GHRSST working group on Lakes (LSWT) has re-named itself to Inland Waters Working Group (IWWG). The new Chair of the group is Simon Hook. The current focus of the group is to agree on a common land mask for GHRSST products, and to discuss the issues of retrieving temperatures of waters higher than sea level and enclosed by land, see https://www.ghrsst.org/documents/q/category/gds-documents/operational/.

GDS2 revision4: The GHRSST Data Specification (GDS) has been reviewed by the Data Assembly and Systems Technical Advisory Group resulting in GDS 2.0 revision 4. This document is stored together with the GDS2.0 Amendment tracker under https://www.ghrsst.org/documents/q/category/gds-documents/operational/.

Call for meta-data review: GHRSST data providers please review your metadata contents https://www.ghrsst.org/news/q/date/2011/10/19/post-ghrsst-12-metadata-review/ and acknowledge through the GHRSST forum, also if all metadata was found correct.

Call for user requirements review: GHRSST data users - please let Andrea at the GHRSST Project Office (ghrsst-po@nceo.ac.uk) know whether https://www.ghrsst.org/users-partners/user-requirements/ are still applicable for your purposes or which changes are required. A more detailed user requirement document (URD) is in preparation by the GHRSST Project Office, you are invited to contribute or to review.

NASA SST ST meeting: The second annual meeting of the NASA SST Science Team (SST ST) was held in Coconut Grove in Florida on 2-4 November 2011. The Science Team was formed to be responsible for the quality and integrity of NASA's measurements of global SST, and replaces former instrument science teams, specifically the SST components of the MODIS, NPP, ASTER, and AMSR-E Science Teams. Prior to the formation of the SST ST, an interim team produced a White Paper on the SST Error Budget (available at http://www.ssterrorbudget.org/ISSTST/White_Paper.html), which is being used as the framework of the SST ST research activities. The format of the meeting was a mixture of plenary presentations, poster sessions and break-out groups. On the final day there was some discussion on how the NASA SST ST and GRHSST should best interact, as while there are clearly similarities in the objectives, the two are different in the international nature of GHRSST and the involvement of the operational community. The web site for the SST Science Team is available at http://sstscienceteam.org where details of the meeting, including abstracts and presentations can be found. At the end of the meeting, Andy Jessup (University of Washington Applied Physics Laboratory) took over the Chair's duties from Peter Cornillon (University of Rhode Island Graduate School of Oceanography).

ESA CCI meeting: The second ESA Climate Change Initiative collocation meeting was held 12-14th October at ESA ESRIN. The objective of the SST CCI is to independently quantify SST to a quality suitable for climate research. This includes a thorough error characterisation of the SST Essential Climate Variable (ECV). The project team is particularly focusing on algorithm development and product validation.

MyOcean ERNESST workshop: A joint MyOcean – ERNESST meeting, dedicated to small scale (in time and space) SST variability, was held at Météo-France Centre de Météorologie Spatiale (CMS) in Lannion on 3 November 2011. The meeting gathered about 30 European participants, and was organized in 3 sessions: diurnal warming in ocean models (validation), diurnal warming in observations (satellite and in-situ), ocean dynamics. The meeting agenda, with links to the presentations, can be found at: https://www.ghrsst.org/ghrsst-science/Meetings-and-workshops/myocean-ernesst-lannion-2011/ and the summary is available at: https://www.ghrsst.org/ghrsst-science/Meetings-and-workshops/.

Dragon training course: The Dragon Programme is a cooperation between ESA and the Ministry of Science and Technology (MOST) of the P.R. China (http://dragon2.esa.int/). Dragon 2 focuses on exploitation of ESA, TPM and Chinese EO data for science and applications development in land, ocean and atmospheric applications. An advanced ocean remote sensing training course was held at the State Key Laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai, P.R. China (http://earth.eo.esa.int/trainingcourses/OceanTrainingCourse2011/). The course included an overview of **AATSR principles**, atmospheric correction algorithms, comparison of microwave and infrared techniques for SST measurements, and AATSR applications for oceanography.

GHRSST Workshop Melbourne: Note that registration for the GHRSST workshop on Tropical and High Latitudes in Melbourne https://www.ghrsst.org/ghrsst-science/Meetings-and-workshops/workshop-on-tropical-warm-pool-and-high-latitude-issues/ **closes 1st February 2012**. For the TWP+ data set go to: https://www.ghrsst.org/ghrsst-science/science-team-groups /dv-wg/twp/.

Events Calendar:
See https://www.ghrsst.org/calendar/q/date/2011/ and https://www.ghrsst.org/calendar/q/date/2012/ for upcoming conferences, workshops and meetings. Agenda, Presentations and Summaries of GHRSST related meetings are available from: https://www.ghrsst.org/ghrsst-science/Meetings-and-workshops/.

2011		
29 Nov -02 Dec 11	EO for Ocean–Atmosphere Interactions Science	Frascati, Italy
05-09 Dec 11	AGU Fall Meeting San Francisco	San Francisco, USA
2012		
19-24 Feb 12	Ocean Science Meeting - 2012	Salt Lake City, USA
05-09 Mar 12	Workshop on Tropical Warm Pool and high latitude issues	Melbourne, Australia
07-11 May 12	44th Int. Liège Colloquium on Ocean Dynamics	Liège, Belgium
21-22 May 12	Workshop on Polar Lows in	Oslo, Norway
04-08 Jun 12	**GHRSST XIII**	**Tokyo, Japan**
25-28 Jun 12	Research Network on Surface Temperature	Edinburgh, UK
09-13 Jul 12	Satellite Remote Sensing of Reef Environments	Cairns, Australia
25 Aug - 01 Sep 12	XXII Int. Soc. of Photogrammetry and Remote Sensing	Melbourne, Australia

Acknowledgements: Andrea Kaiser-Weiss (ed.) would like to thank Peter Minnett, Craig Donlon, Chelle Gentemann, Kenneth Casey, Jonah Roberts-Jones, Nicolas Reul, Tong Lee, Simon Hook, Misako Kachi, Hervé Roquet., Steinar Eastwood, Ed Armstrong, Pascal Lecomte and Helen Beggs for their contributions to this Newsletter.