NASA Report to GHRSST Science Team

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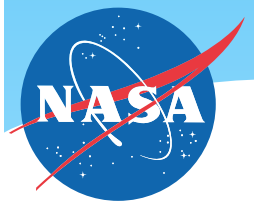
15th GHRSST Science Team Meeting

Cape Town, South Africa

2 June 2014



National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Topics

* Report from the MODIS Science Team Meeting
  * Status of MODIS L2P
* Report from the NASA Physical Oceanography Program
  * NASA SST Science Team Meeting
* CEOS COVERAGE program
* NASA funded GHRSST datasets
  * MUR
  * G1SST
  * WindSat
  * TMI
  * [VIIRS]
* ESDIS GIBS

MODIS Science Team meeting

* 29 Apr – 1 May, Columbia, Maryland
  * 5 Earth Science mission launches this year !!
* MODIS on Terra/Aqua continue to operate normally
* Projected lifetime for Terra until 2022 !! Similar or longer for Aqua.
* GHRSST MODIS datasets presented to community
* "Collection 6" reprocessing for both missions eminent. New SST and ocean color datasets
  * Peter Minnett: Col. 6 has mirror corrections, and improved coefficients and cloud masking
  * Col. 6 Terra and Aqua SD is around .3 to .4 degC vs drifters
* Collection 6 reprocessing will generate new GHRSST L2P datasets!
  * Data back to 2000 for Terra and 2002 for Aqua
  * GDAC currently preparing for reprocessing of native netCDF4. Lots of effort.

EOSDIS New Missions List

Missions	Launch Date	DAAC
Shizuku (GCOM-W1)	May 18, 2012	GHRC / NSIDC
GPM	Feb 27, 2014	GES DISC
SNPP	October 2012	multiple
OCO-2	Jul 2014	GES DISC
ISS-RapidSCAT	Jun 2014	PO.DAAC
ISS-CATS	Sept 2014	ASDC DAAC
SMAP	Nov 5, 2014	ASF / NSIDC
SAGE-III ON ISS	Dec 2014	ASDC
DSCOVR	Jan 2015	ASDC
CYGNSS (EV-M)	Oct 2016	PO.DAAC
OCO-3 on ISS	Dec 2016	GES DISC
ICESat-2	June 2017	NSIDC
GRACE FO	Aug 2017	PO.DAAC

Green - launch and in-orbit
Black – planned launches

Physical Oceanography Program Science Teams

(Organized around a **measurement/parameter** rather than around a mission.)

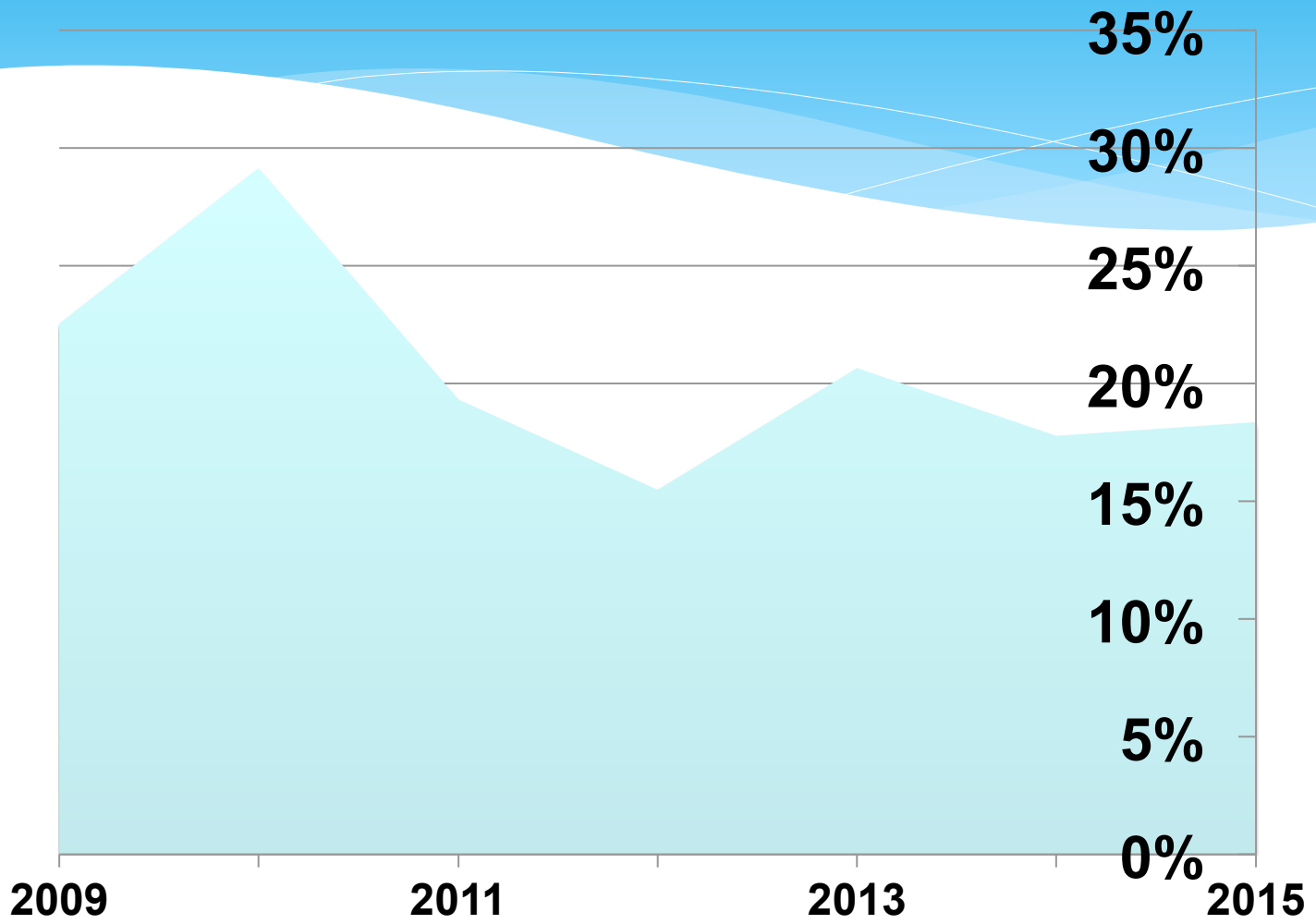
- Ocean Surface Topography (ROSES 11)
  - Joint/CNES
  - Project Scientists (Josh Willis/Juliette Lambin)
- Ocean Vector Winds (2013)
  - International (2009)
  - NASA Project Scientist (Ernesto Rodriguez)
  - NASA Team Leader (Mark Bourassa, FSU)
- Ocean Salinity (2013, Phase 2- 2011)
  - Part of Joint NASA/CONAE Aquarius/SAC-D ScienceTeam
  - Project Scientists (Gary Lagerloef/Sandra Torrusio)
- Sea Surface Temperature (2010-2012)
  - First SST ST Meeting 11/2010
  - Team Leader (Andy Jessup, UW)

Physical Oceanography Program Support

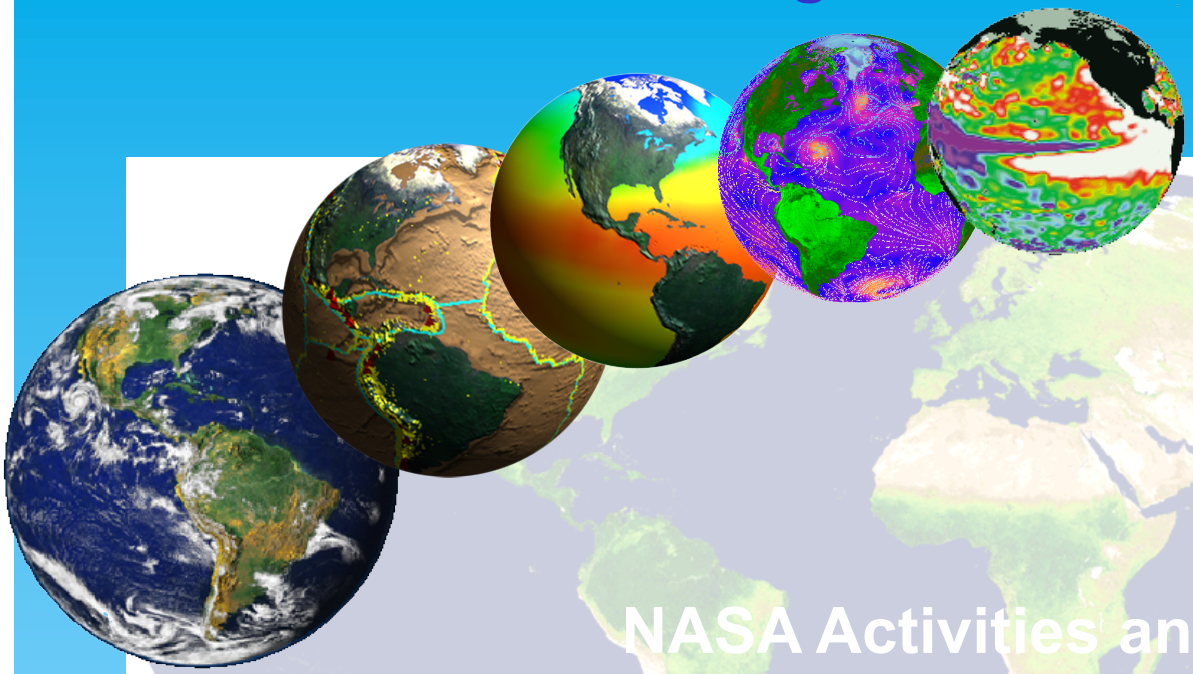
- Physical Oceanography R&A (incl. SST) [~$10M]
  - Proposals due end of June each year
  - Guidance mainly by US CLIVAR
- Ocean Surface Topography Science Team [~$6.5M]
  - Ongoing (next opportunity ~2015)
  - SWOT Science Definition Team new dimension [~$2M]
- Ocean Vector Winds Science Team [~$4.5M]
  - Proposals for new team due mid-November 2013.
- Sea Surface Salinity Science Team [~$2M→~$5M]
  - Proposals presently under review
  - Beginning synthesis of SPURS field program
  - Planning begins for SPURS-2 field program in 2015-16.
- Division Pools (IDS, EOS, USPI) (SST) [~$2-5M]
  - Ocean-Ice Shelf interaction, Sea Level Rise, Terra and Aqua (incl SST), Suomi-NPP Science Team

Total annual support ~$28M/yr for ~160 Projects

SST as % of PO Program



Sea Surface Temperature Science Team Meeting
Seattle, Washington 28-31 October 2013



NASA Activities and Sea Surface Temperature

Eric Lindstrom
NASA Science Mission Directorate
Earth Science Division

NASA SST-Science Team

Many funding routes to membership.
Scientists contributing to the previous activities are SST-ST members.

One basis for recent activity has been the WHITE PAPER,
produced by the Interim Sea Surface Temperature Science Team (ISSTST)
In June 2010.

The white paper addressed three areas:

- ***requirements placed on satellite derived SST products;***
- ***a framework for the characterization of the error budget for satellite-derived SST products; and***
- ***recommendations for tasks that need to be undertaken to improve satellite-derived SST products.***

Many projects follow the role of the ocean (particularly SST) within the climate system.

What has NASA folded into the SST-ST

- Supporting new missions: planning, preparation, implementation (example- NPP/VIIRS);
- Ongoing missions: calibration, validation, bias removal, optimization, noise characterization >>>(examples- MODIS on T&oA, WindSAT, etc.);
- Product generation and improvement;
- Product management and delivery: PODAAC, GDAC;
- NOPP interagency support of MISST;
- PO funding for research and applications: significant use of SST data/products.

All the above are part of current NASA SST Science Team activities.

PO and NOPP current NASA funding-:
~22 projects, $2.5m/year (funding is comparable to other Science Teams).

Perspectives, Issues, Discussion

How to interface with Ocean Salinity Science Team/Aquarius, especially with regard to surface layer dynamics (requiring density and SSS info, not just SST)?

How to interface with the Ocean Vector Winds Science Team, especially with regard to air-sea interaction?

Recognition that many multi-sensor activities are ongoing to optimize the utility of individual parameters (a broader arena of Climate Data Records).

It is time to define the NASA/Science Team relationship to GHRSST. How best to make the most of the commonalities/complementarity?

COVERAGE -- Technical Description

- **CEOS Ocean Variables Enabling Research and Applications for GEO (COVERAGE)**
- **What is COVERAGE?**
  - **Seeks to build a Near-Real-Time (~24 hr) a gridded (~25km) global data set including Sea Surface Height, Temperature, Salinity, Color, Vector Winds, and Salinity (and potentially Ocean Currents)**
  - **It's a way to unite the Ocean Virtual Constellations around a common project for CEOS and Blue Planet**
  - **Preliminary analysis shows that THIS IS FEASIBLE.**
  - **Preliminary analysis shows that THIS WOULD BE USEFUL.**
  - **Potential distinctive features may also be feasible:**
    - **Include a trend analysis in the product**
    - **Include a climatology in the product**
    - **Build a web service for additional product context and examples**

COVERAGE -- Technical Description

- **Why produce such a multi-variable ocean product?**
  - **Recent research developments show significant interest in multi-variable analyses (e.g. Chelton "eddy" data set w/ height, wind, color for ~16,000 eddies tracks)**
  - **Individual applications using a single variable may be enhanced by availability of other ocean data (e.g. fish trackers, harmful algal bloom forecasts)**
  - **Recent application poll from an GHRSST Webninar**

    Near real-time: 43.2%
    Coastal applications: 45.9 %
    Climate Studies: 40.5%
    Interdisciplinary: 48.6 %
    Numerical Weather Prediction(NWP) 10.8%
    Modeling- Ocean 37.8%
    Climate Modeling: 5.41%
    Other: 21.6%

Activities on MUR L4 Product

* **Near Real Time Delivery**

➔ Users have been requesting "near real time" delivery.

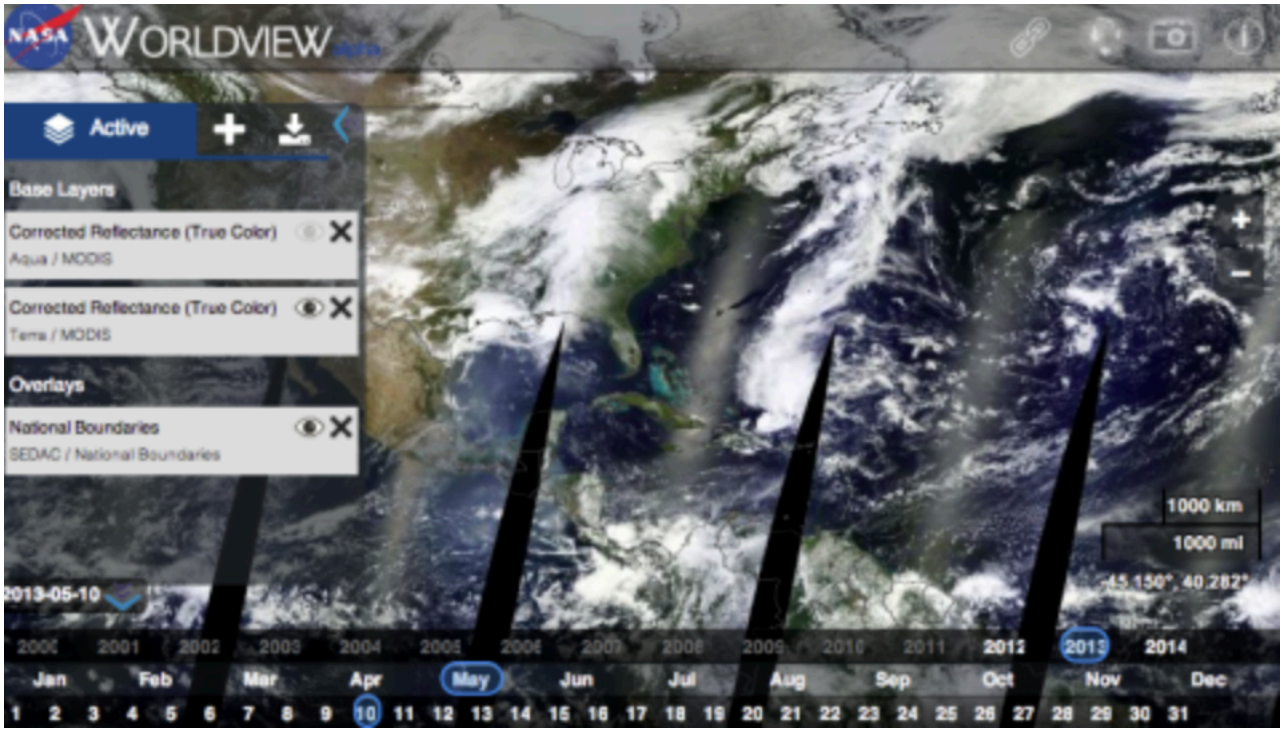
➔ May 2014, MUR started "interim" productions at 3-, 2- & 1-day latency periods.

➔ "Interim" products are ***updated daily*** (until reaching 4-day latency = "Final" MUR product).

* **Ongoing and future activites**
  * Quality-control/adjustment of Arctic SST values, e.g., estimates based on ice concentration data.
  * Preparing for ingestion of VIIRS data (presently NAVO VIIRS is used only for validation of high resolution features).
  * Anticipation for new Pathfinder AVHRR data (mainly for pre-GHRSST era before 2006).

ESDIS Browse Enhancements

* Global Image Browse Service
  * “Parameter Visualizations” for all EOSDIS Imagery
  * Standardized access via OGC WMTS / TWMS / WMS / KML
  * Source code for the GIBS OnEarth server and sample code available at the GIBS GitHub site



Backup

Carton	Evaluation of Mixed Layer Temperature
Chelton	Atmospheric Response to Small-Scale Sea-Surface Temperature Variability
Clayson	Physical Processes Associated with Sea Surface Temperature Gradients and the Coupled Atmospheric Boundary Layer
Gentemann	Multi-Sensor SST
Gentemann	Storm induced wakes: upper ocean variability
Jessup	SST Science Team
Kaplan	Error and Variability in SST Analyses
Kelly	The Contribution of Ocean Circulation to North Atlantic SST
Kwon	Coupling Between the Atmospheric Intra-Seasonal Variability and Ocean Circulation in the Northern Hemisphere
Li	Global Multi-Scale Blended Sea Surface Temperature for Research and Applications
Matsumoto/Holt	Seasonal evolution of the coastal thermal front and small eddies in the Great Lakes as characterized by satellite SST and SAR imagery and numerical modeling
Menemenlis	Mixed layer heat budget from GHRSST and ECCO2
Minnett	Diurnal heating in shallow water with irregular bathymetry and tidal flows
Minnett	MODIS Sea Surface Temperature algorithm refinement and validation through ship-based infrared spectroradiometry
Ray	Tidal mixing signatures in sea-surface temperature
Steele	Linking surface and subsurface temperature and salinity in the Arctic Ocean's Canadian Basin
Thompson	Understanding the influence of large gradients in the extratropical sea-surface temperature field on the tropospheric circulation.
Vandemark	Amazon river discharge and its influence on tropical Atlantic SST and mixed layer dynamics
Vazquez	Multi-Sensor SST (Gentemann is PI)
Whitney	Sea Breezes and Estuary-Shelf Response in Areas with Spatial Sea Surface Temperature Variability and Complex Coastal Geometry
Wick	Characterizing Diurnal Warming in Satellite Sea Surface Temperature Products and Their Impact on Air-Sea Interactions

COVERAGE -- Technical Description

- **How will COVERAGE be done?**
  - **Conduct this as a "badgeless" CEOS R&D enterprise**
  - **Build on experience from individual variables (e.g. GHRSST Global Data Assembly Center at JPL)**
  - **Build a "pilot" product to:**
    - **Test with user groups in Sargasso Sea**
    - **Assess impact through Observing System Simulation Experiments (research)**
    - **Refine best "new features" for branding the product**
- **What is the timeline?**
  - **Finish assembling a proposal for CEOS Plenary**
  - **Work via a 3-year R&D commitment toward an "operational" capability NLT end 2016.**

How Science Team Members can help NASA (and GHRSST)

- Deliver scientific breakthroughs and well-cited publications.
- Keep NASA and the rest of the Science Team informed of scientific breakthroughs and publications.
- Actively attend and support Science Team meetings.
- Respond as needed to requests from the Team Leader for scientific and technical input.
- Enhance Interagency and international coordination.

On-going and Future MUR Activities

* Quality-control/adjustment of Arctic SST values, e.g., estimates based on ice concentration data.
* Preparing for ingestion of VIIRS data (presently NAVO VIIRS is used only for validation of high resolution features).
* Anticipation for new Pathfinder AVHRR data (mainly for pre-GHRSST era before 2006).

History and What's New

- ISST-ST meeting in November 2009, URI, RI;
- Follow-on work produced a WHITE PAPER on 18 June 2010;
- First SST-ST meeting was held in November 2010, Seattle, WA;
- Aquarius Launch, 10 June 2011 (provides new opportunities);
- NPP-VIIRS Launch, 28 October 2011 (provides new opportunities);
- 25th CEOS Plenary, 8-9 November 2011, Lucca, Italy (Freilich assumes SIT Chair & GHRSST becomes Virtual Constellation in CEOS).
- Second SST-ST meeting held in November 2011, Miami, FL:
- Third SST-ST meeting held in October 2013, Seattle, WA.