Sea Surface Temperatures at STAR: The "O" in NOAA

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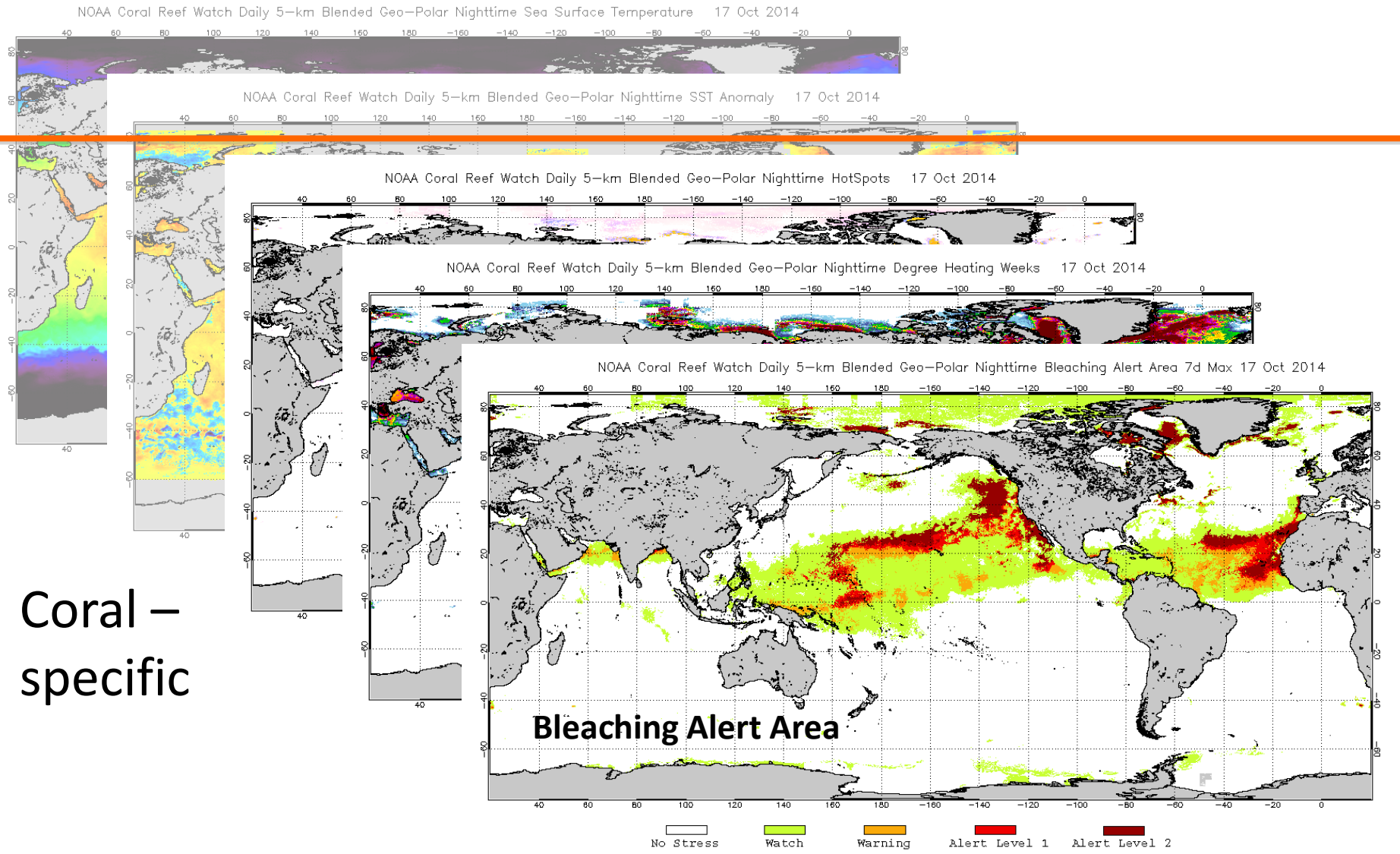
NESDIS Center for Satellite Applications and Research (STAR)

GHRSST
Group for High Resolution Sea Surface Temperature

17th Science Team Meeting,
Tysons Corner, VA, USA 6-10 June 2016

2014: Coral Reef Watch
Launched 5 km Global Products



Coral – specific

STAR Satellite Oceanography & Climatology Division (SOCD)

SOCD Organization

SOCD Chief: *Dr. Paul M. DiGiacomo*

Ocean Sensors Branch

Chief: *Dr. Alexander (Sasha) Ignatov*

- Sea Surface Temp, Ocean Winds, Ocean Optics & Water Quality (e.g. Chesapeake Bay)

Marine Ecosystems & Climate Branch

Chief: *Dr. Menghua Wang*

- Ocean Color, Coral Reefs, Sea Ice, Synthetic Aperture Radar, Blended SST

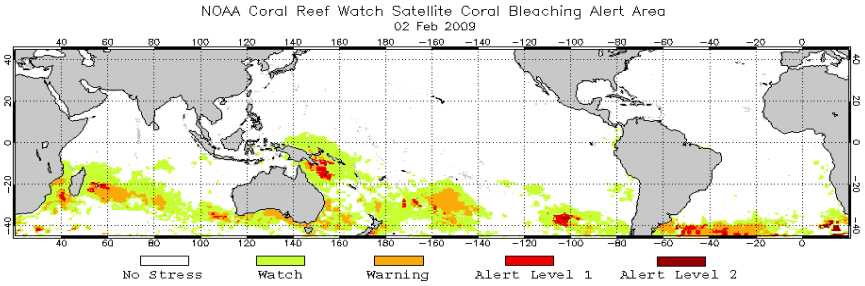
Laboratory for Satellite Altimetry

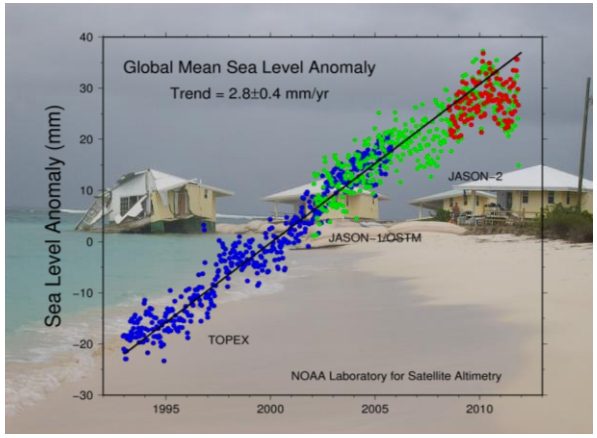
Chief: *Dr. Laury Miller*

- Sea Level, Bathymetry, Waves, Sea Ice/Climate

Science Teams: R&O

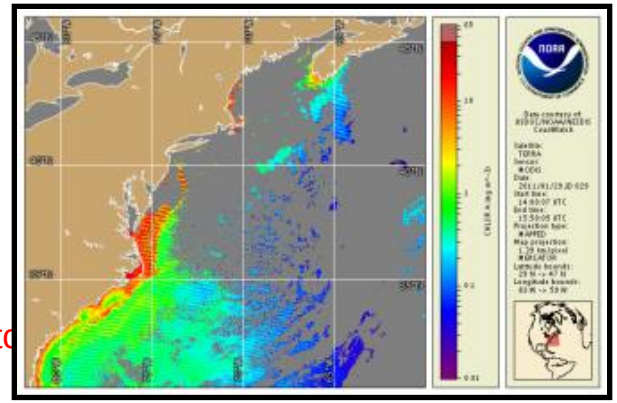
- Sea Surface Height
- Sea Surface Roughness
- Sea Surface Salinity
- Sea Surface Temperature
- Ocean Color Radiometry
- Ocean Surface Vector Winds
- CoastWatch/OceanWatch/PolarWatch
- Coral Reef Watch
- Sea Ice and Polar Dynamics





Major Programs/Activities

- JPSS: Ocean Color & SST EDRs
- GOES-R: SST (& Ocean Dynamics)
- JASON Satellite Radar Altimeter Program
- NOAA GCOM Program Scientist
- National Ice Center Chief Scientist
- Non-NOAA Sensors: Winds, SAR, SST etc
- Marine Optical BuoY (MOBY)
- Coast/Ocean/PolarWatch & Coral Reef Watch



NOAA STAR Sea Surface Temperature

- **NOAA STAR Measurement-Based Approach**: providing multi-sensor data sets and derived products to users that are of highest quality and fit for their applications

- **Advanced Clear-Sky Processor for Ocean (ACSPO):** The NOAA enterprise processing system for polar-orbiting and geostationary satellite SST data products; NRT and time-series

- **Analysis-level SST products for users:** GHRSST L2P geostationary; Geo-Polar SST analysis products; NRT and time series; ocean heat content product suite

NOAA STAR Measurement-Based SST

- **Operational:** Both near real time and long-term time series required for operational applications

- **Science:** Essential at every step, not only product development

- **Requirements:** Expected to evolve through iterative process of product development and user feedback

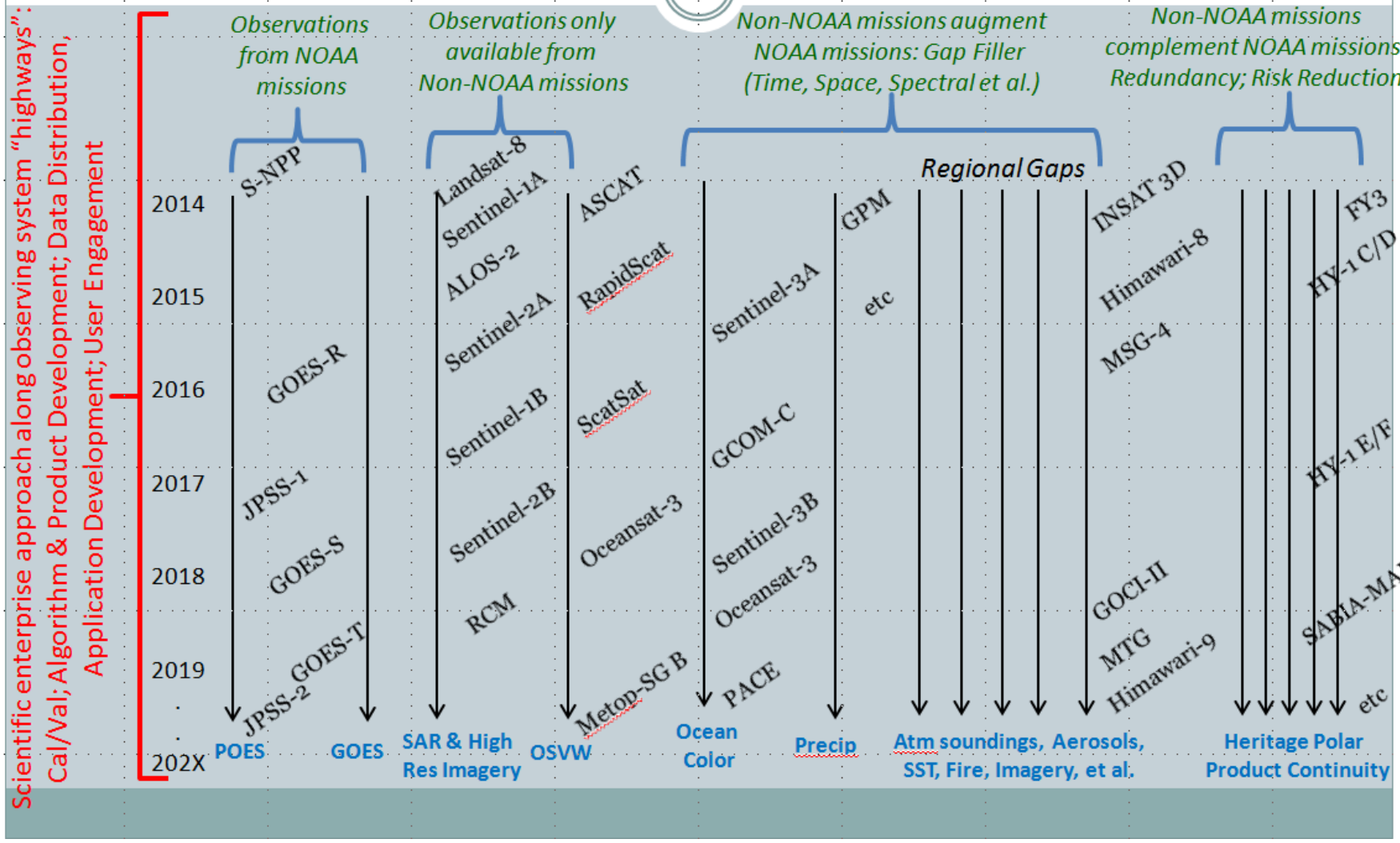
- **Measurement-Based:** Mission agnostic approach; users need fit-for-purpose observations and derived products for their applications

- **Integrated:** Fundamentally integrating non-NOAA observations, including enterprise algorithms and reprocessing

Measurement-based approach in support of users: Ensuring continuity & coverage

Observing System Highways: Utilize satellite data from NOAA & non-NOAA missions

Leverages existing science, technical, programmatic et al. infrastructure in NESDIS



Advanced Clear-Sky Processor for Ocean

ACSPO is the NOAA Enterprise SST system

Polar Products

- ✓ **S-NPP VIIRS**
- ✓ **NOAA/19 and Metop-A/B AVHRR/3**
- ✓ J1 (NOAA-20) will be launched in early 2017

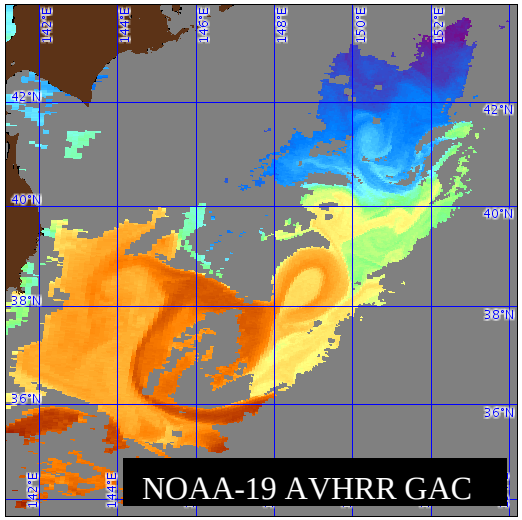
  Future JPSS satellites: J2 (2021), J3 (2016), J4 (2031)

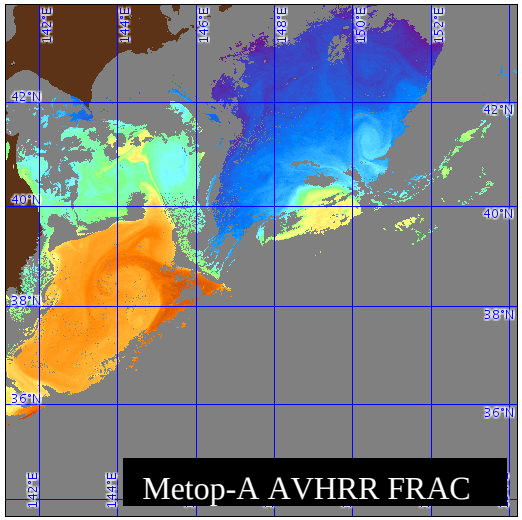
Geostationary Products

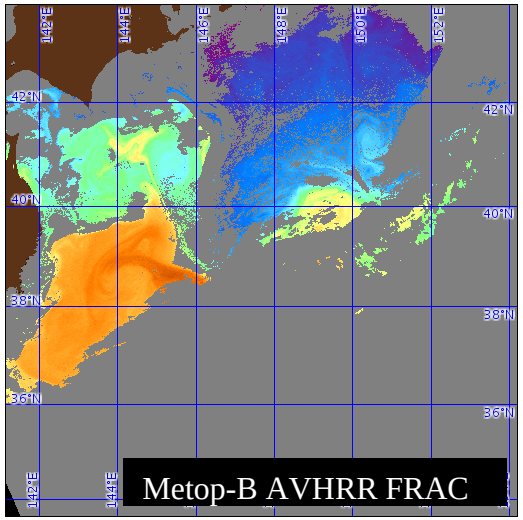
- ✓ **Himawari-8 AHI**
- ✓ GOES-R will be launched in Oct'2016

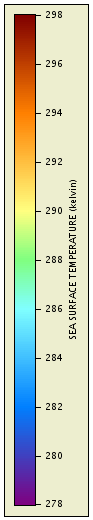
  Future GOES satellites R series: GOES-S, -T, -U (launch schedule TBD)

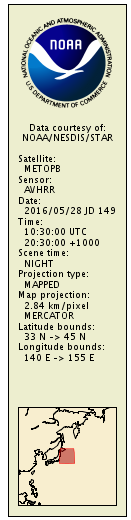
ACSPO SST, Kuroshio Current (28 May 2016)

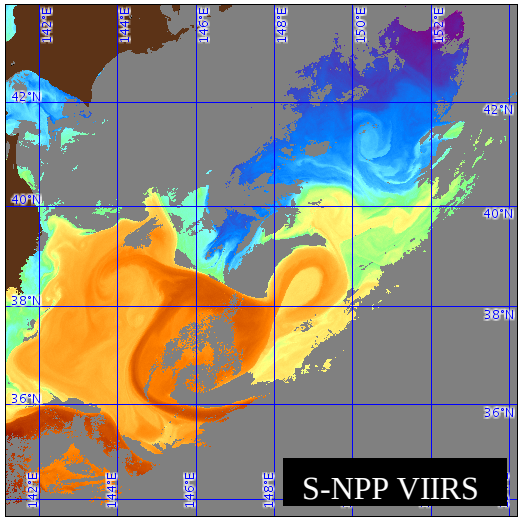


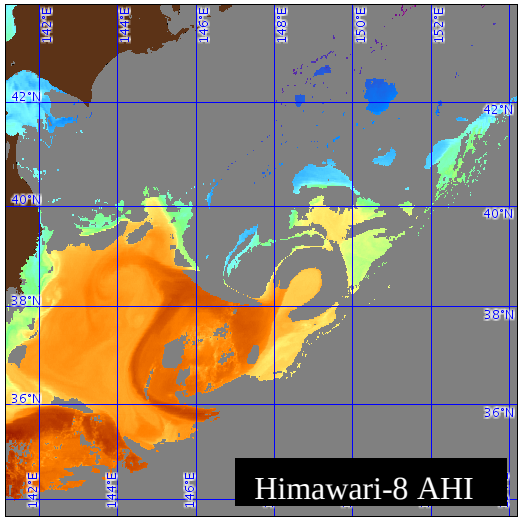












- ACSPO SSTs produced from AVHRRs (NOAA/GAC, Metop/FRAC), VIIRS (S-NPP), AHI (Himawari-8). L4 producers are encouraged to use those
- There are users' requests for various flavors of hi-res L3s – Un-Collated, Collated, Super-Collated. We are working to produce a uniform L3 line

www.star.nesdis.noaa.gov/sod/sst/arms/

ACSPO Reanalysis (RAN)

Several ACSPO Reanalyses (RAN) are currently underway and several planned in near-future

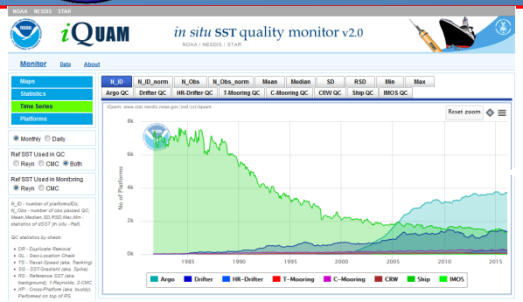
Advanced/Completed RANs (under evaluation and archival)

- ✓ S-NPP VIIRS RAN1 (Mar'2012 – Dec'2015)
- ✓ AVHRR GAC RAN1 (Jul'2002 – Dec'2015)

RANs Planned/Underway

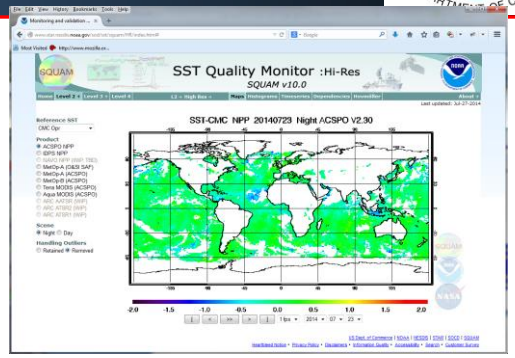
- ✓ AVHRR GAC RAN2 (1994 – pr)
- ✓ Himawari-8 AHI (Mar'2015 – pr) planned

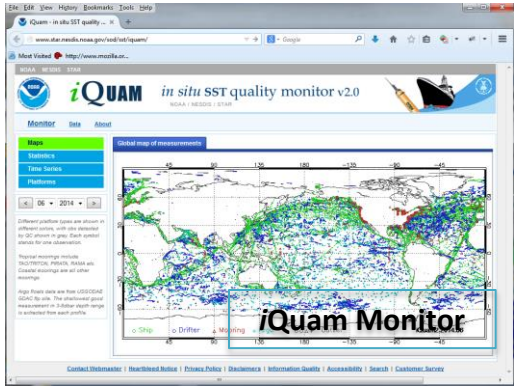
iQuam – Match-ups – Validation in SQUAM

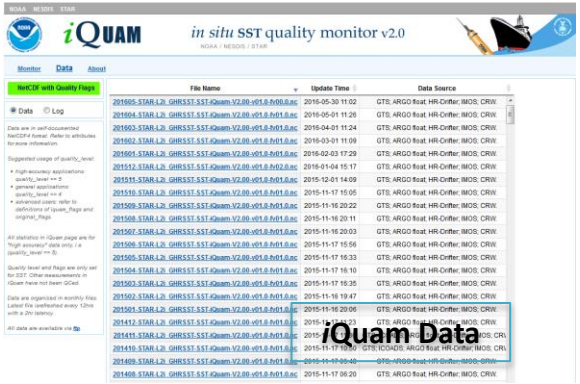


NOAA ACSPO

NOAA ACSPO RAN

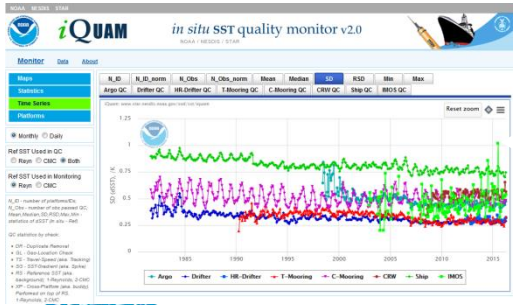






Satellite-*i*Quam-L4 Match-Ups

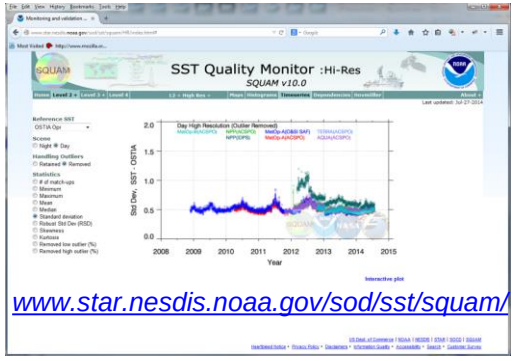
www.star.nesdis.noaa.gov/sod/sst/iquam/



EUMETSAT AVHRR ..

A(A)TSR / SLSTR ..

IDPS, NAVO VIIRS ..



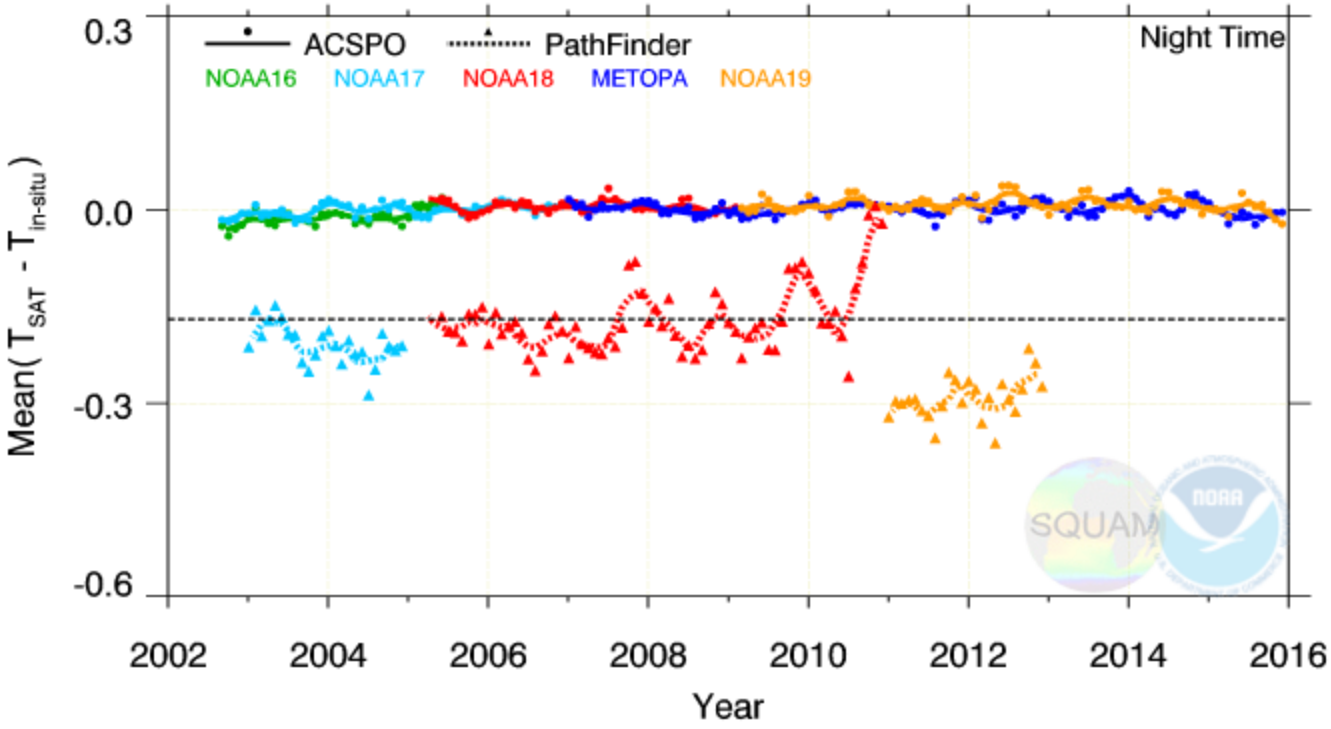
www.star.nesdis.noaa.gov/sod/sst/squam/

Monitoring in iQuam

Monitoring in SQUAM

AVHRR GAC RAN1 Validation: BIAS

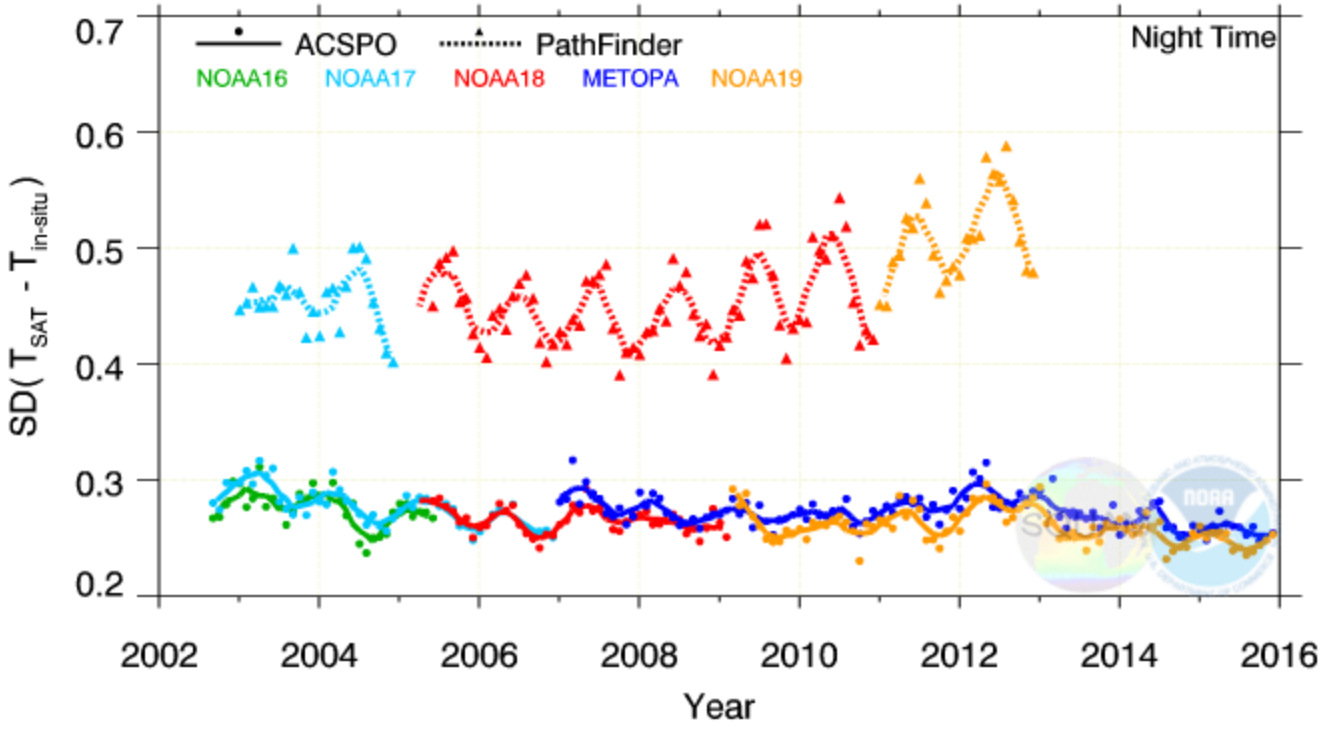
ACSPO v2.41 0.02º L3U



- RAN1 is produced from 2 satellites (whereas PFV5.2 from only one)
- RAN1 SST are more stable & cross-platform consistent than PFV5.2
- Note that PFV5.2 is a “skin product” and a -0.17 K bias is expected

AVHRR GAC RAN1 Validation: Std Dev

ACSPO v2.41 0.02º L3U



- RAN1 SDs are smaller than PFV5.2
- RAN1 SDs are more stable in time & cross-platform consistent

Analysis-level SST products for users

GOES SST Products

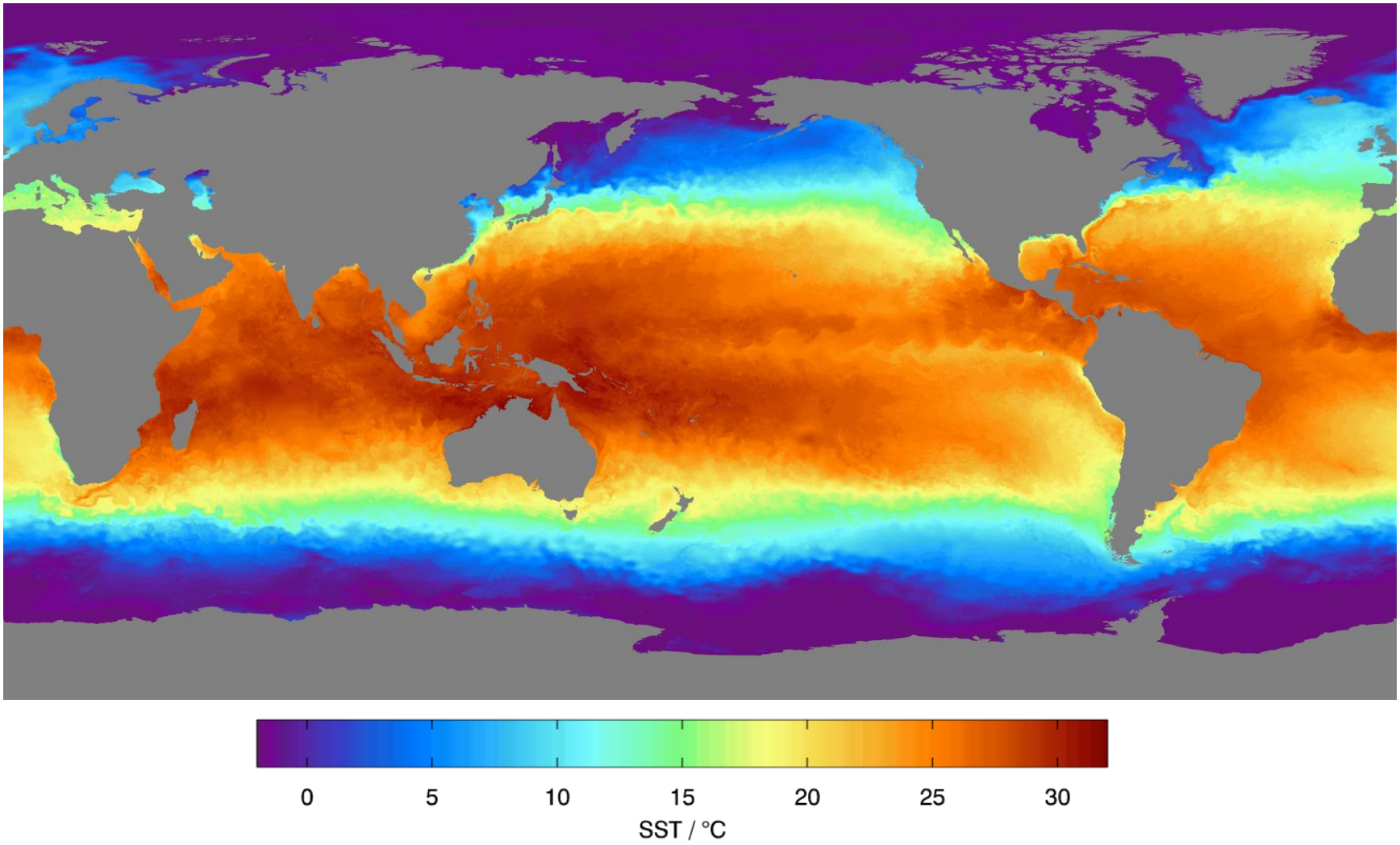
- *GOES-East; GOES-West; Meteosat-10*

- **AMSR-2 SST**
- **Blended SST Products**
  - *5-km Global SST Analysis*
  - *5-km Global Nighttime*
  - *5-km Global Diurnally Corrected SST Analysis*
- **Reprocessing (2002-2015):**
  - *Geostationary data (GOES, MSG, MTSAT)*
  - *Geo-Polar SST Nighttime Analysis*

- *All in GHRSST L2P & L4*

- **Oceanic Heat Content Products**
  - *North Atlantic; North Pacific; South Pacific*

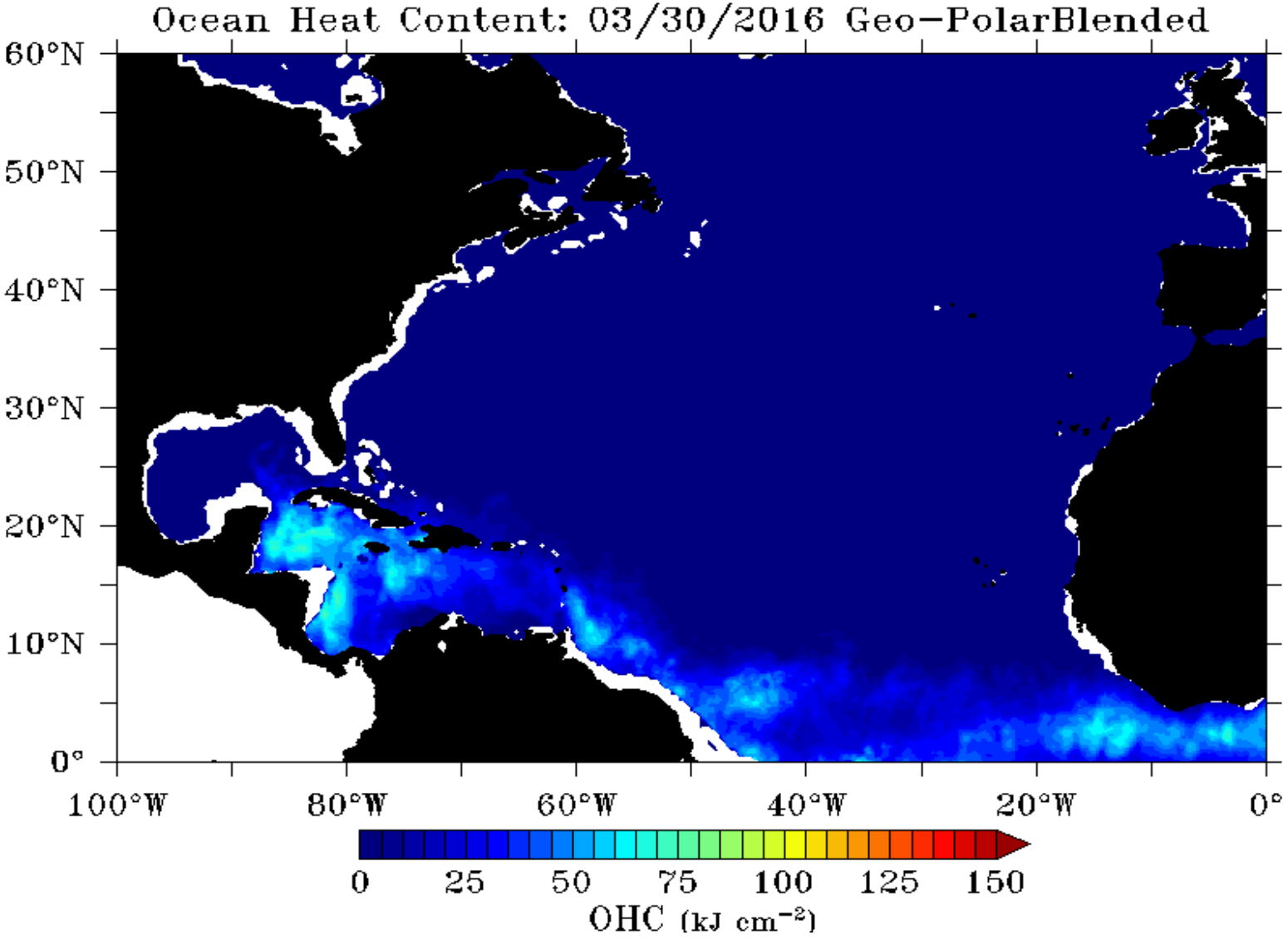
5-km Global Blended SST Analysis



Ocean Basins

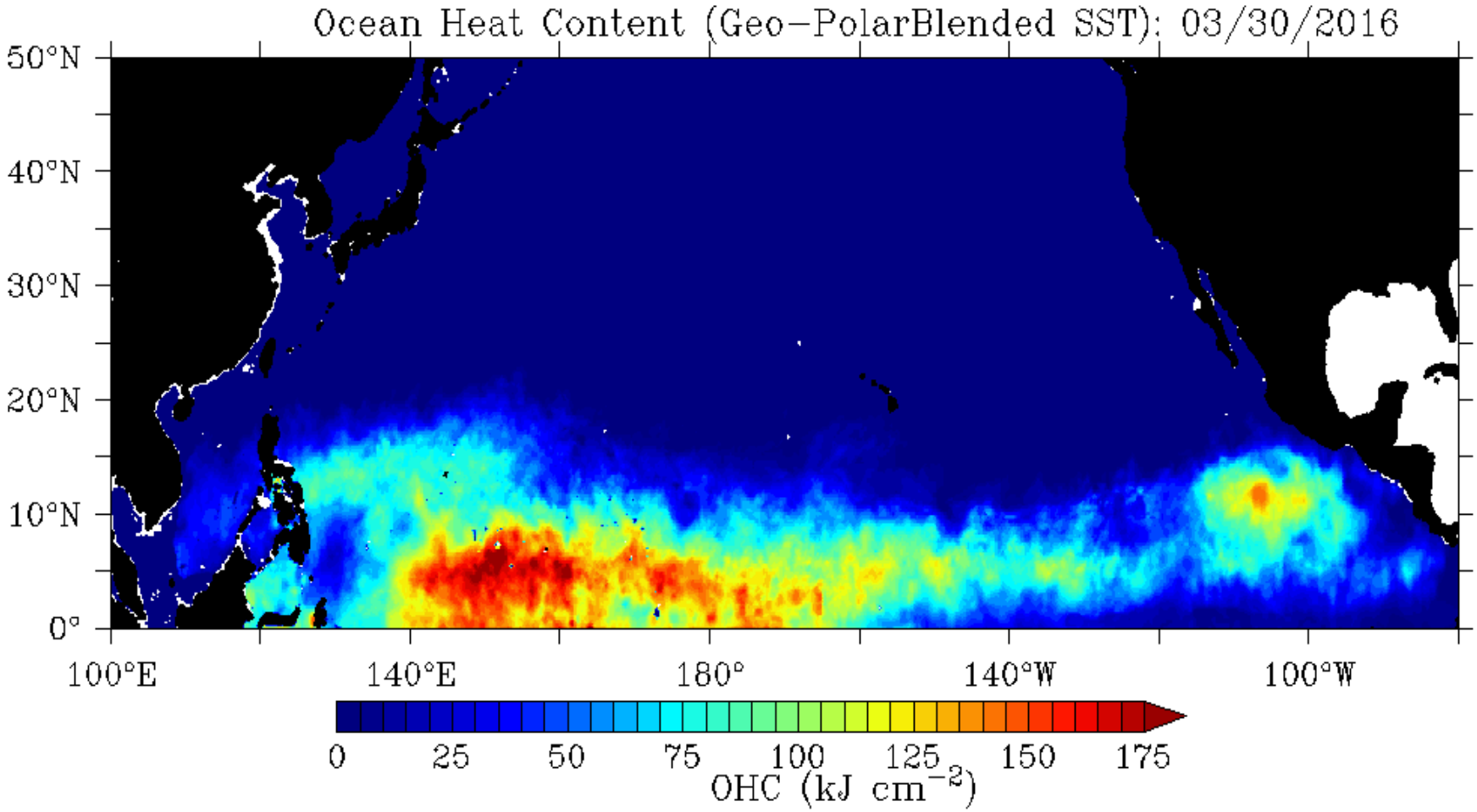
1. Atlantic basin (North Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea)
2. Northeast Pacific basin (Mexico to the dateline)
3. Northwest Pacific basin (the dateline to Asia including the South China Sea)
4. North Indian basin (including the Bay of Bengal and the Arabian Sea)
5. Southwest Indian basin (from Africa to about 100E)
6. Southeast Indian/Australian basin (100E to 142E)
7. Australian/Southwest Pacific basin (142E to about 120W)

Northern Atlantic Ocean Domain for OHC Product



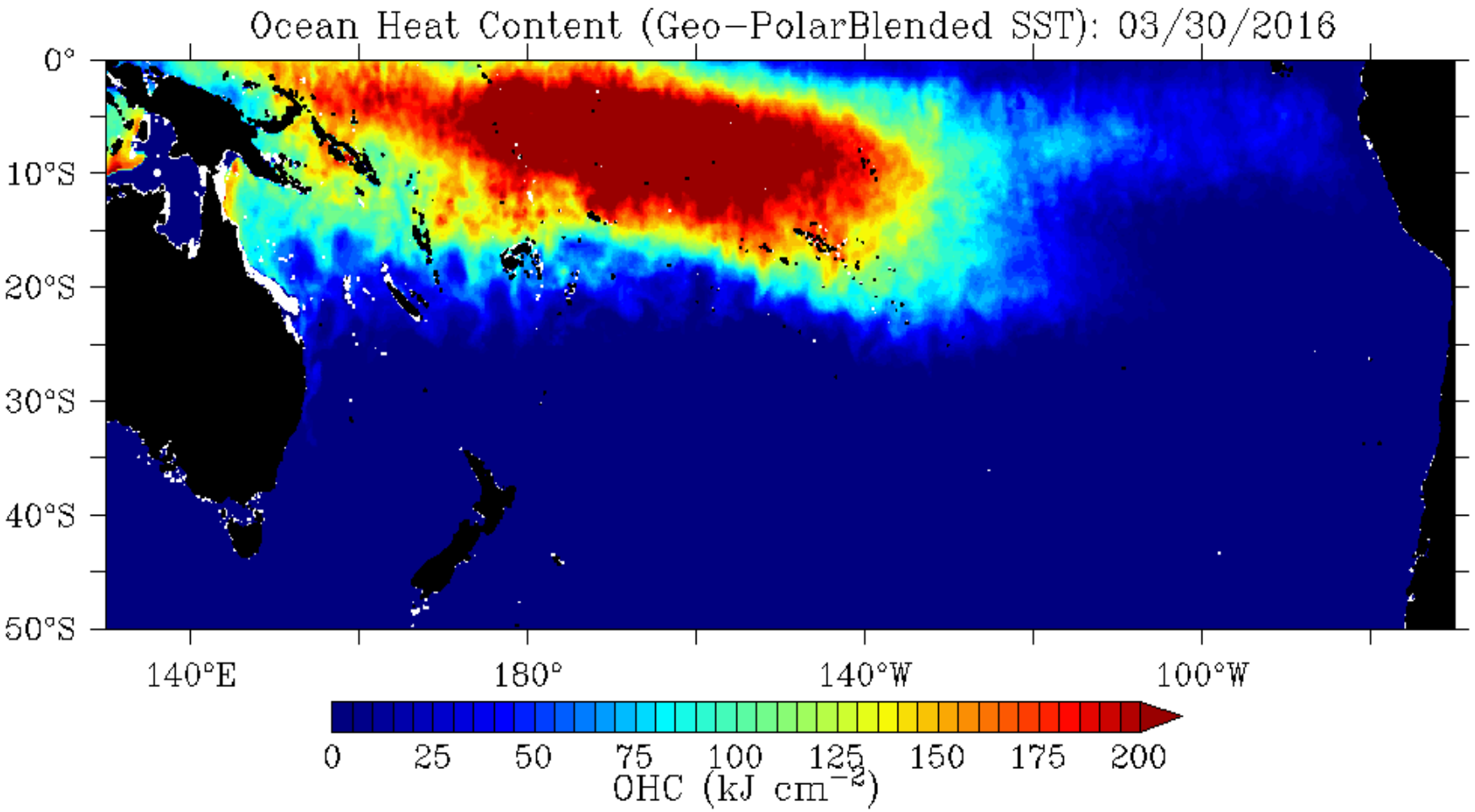
V14.1 July 2009

Northern Pacific Ocean Domain for OHC Product



V14.1 July 2009

Southern Pacific Ocean Domain for OHC Product



V14.1 July 2009

GHRSST L2P Geostationary SST

- Powerful data sets for studying SST
  - Diurnal warming of the ocean surface
  - Evolution of mesoscale features such as fronts and eddies

Geo-Polar SST Analysis products

- Temporal and increased data coverage for studying the
  - Oceanography – Fisheries
  - Meteorology – Ocean Heat Content for Hurricane Intensity
  - Climate – Coral Reef Watch Improved Bleaching Products
- Reprocessing a very powerful tool for climatic studies

NOAA CoastWatch Program

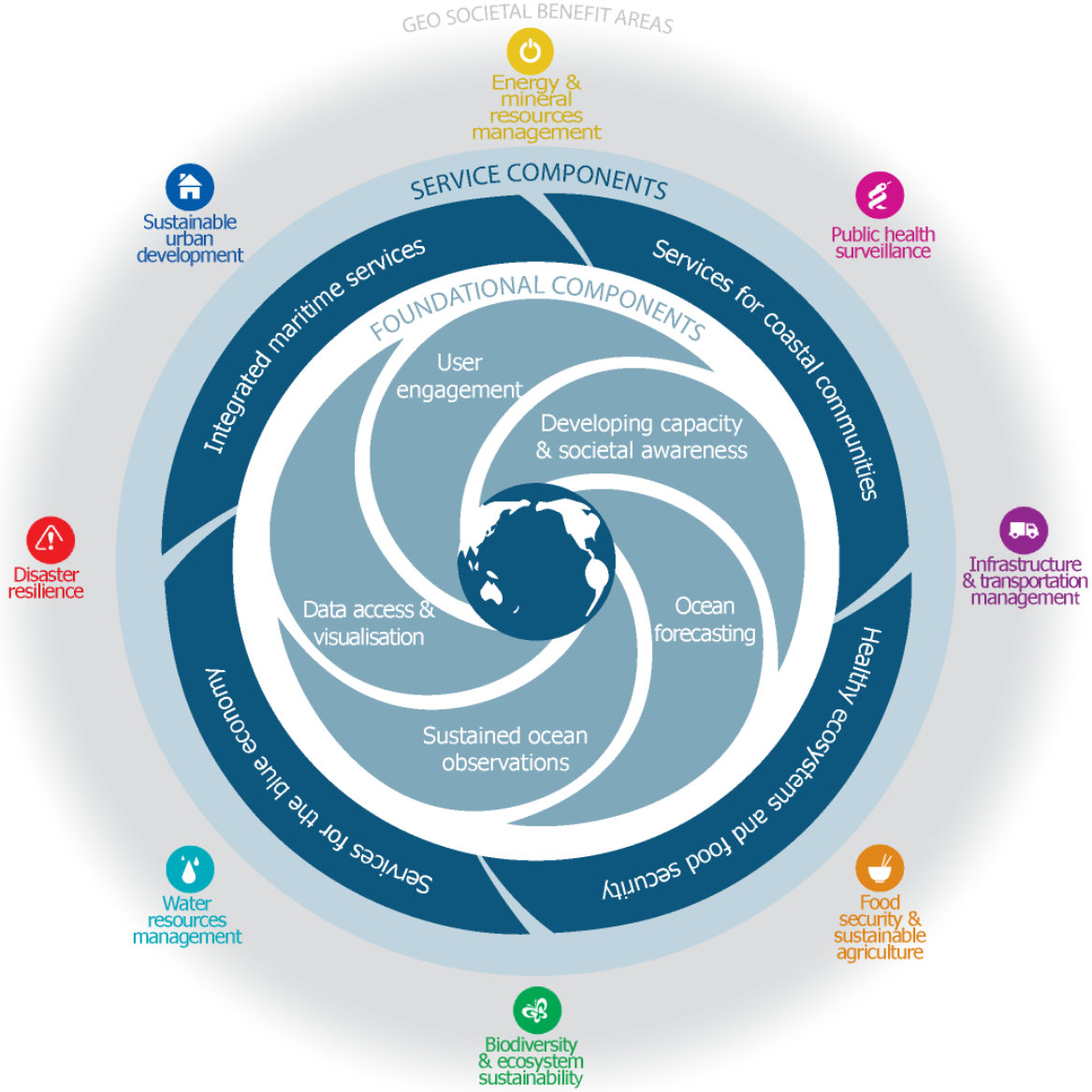
- Provides multi-sensor satellite data and products to users
- Covers regional (e.g., coastal U.S., Med Sea, Australia) and global
- Dedicated PolarWatch data portal forthcoming
- http://coastwatch.noaa.gov/

NOAA STAR Sea Surface Temperature

- **ALL NOAA Line Offices** have the need for consistent, fit-for-purpose quality, multi-sensor ocean satellite observations including SST in support of the NOAA Mission.

- **STAR is committed** to the development and production of measurement-based, fit-for-purpose, near real time and time series satellite SST data and derived products required by user communities:
  - R&D and Operational: Underpinned by best science
  - Domestic: Within and external to NOAA
  - International partners and users
  - Downstream users and stakeholders (i.e., Blue Planet Initiative)

Group on Earth Observations (GEO)
Blue Planet Initiative: Oceans and Society

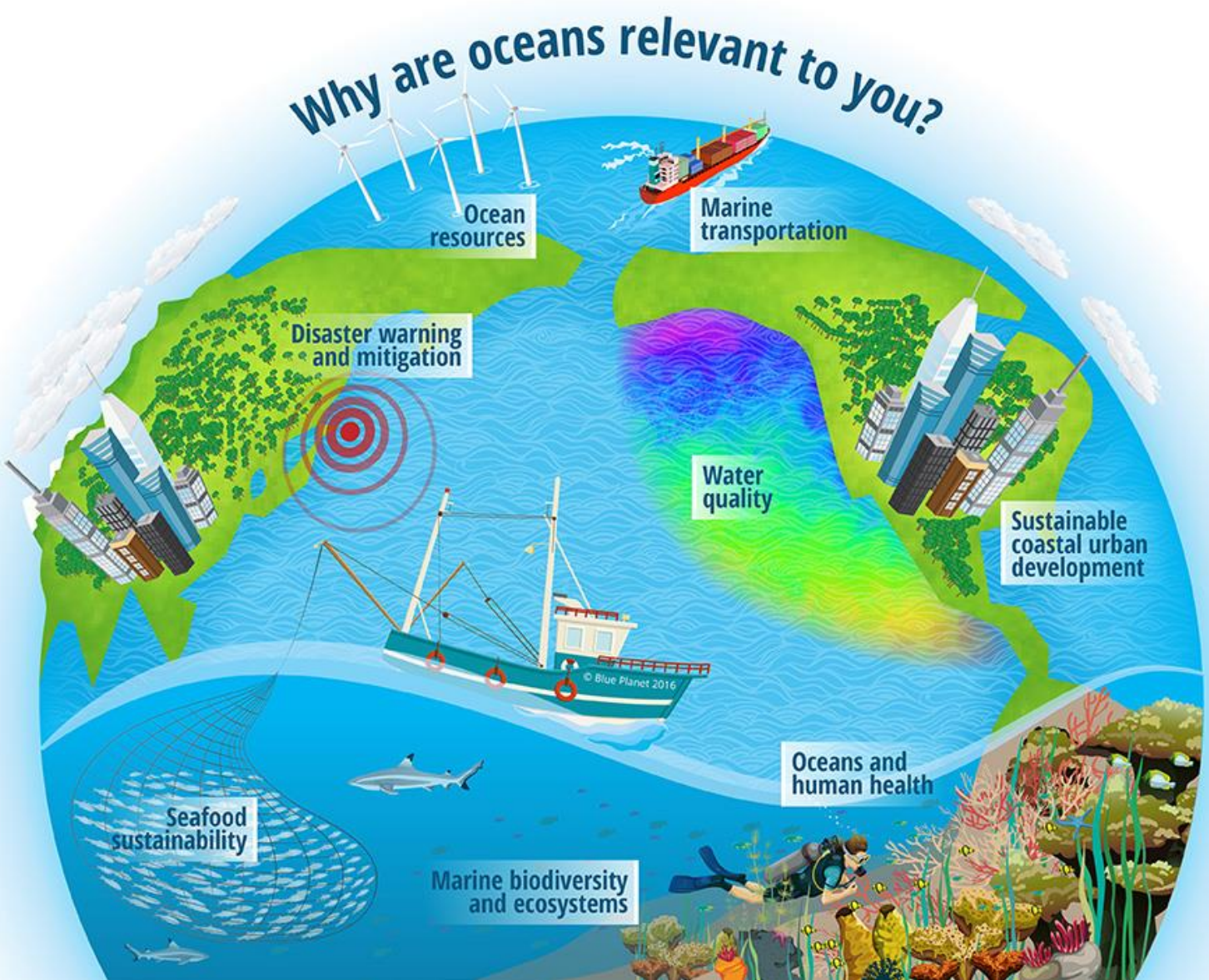



THE NIPPON FOUNDATION
PAP
Porcupine Abyssal Plain Observatory
pogo
GODAE
GLOBAL OCEAN DATA ASSIMILATION EXPERIMENT
The Global Ocean Observing System
GOOS
SOOS
SOUTHERN OCEAN OBSERVING SYSTEM
GO-SHIP
KIOST
KOREA INSTITUTE OF OCEAN SCIENCE & TECHNOLOGY
GACS
GLOBAL ALLIANCE of CONTINUOUS PLANKTON RECORDER SURVEYS
CEOS
Argo
Atlantic Meridional Transect
FIO
green seas
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE
nano
NF-POGO Alumni Network for Oceans
AWI
UNESCO
United Nations Educational, Scientific and Cultural Organization
Intergovernmental Oceanographic Commission
RESOURCES, MEETINGS, DOCUMENTS, PEOPLE
SCOTTISH ASSOCIATION for MARINE SCIENCE
NIOZ
Royal Netherlands Institute for Sea Research
UNIVERSIDADE DE SÃO PAULO
IO
Instituto Oceanográfico
cnrs
INSU
Observer & comprendre
GHRSST
Group for High Resolution Sea Surface Temperature
OceanSITES
INTERNATIONAL OCEAN CARBON COORDINATION PROJECT
IOCCP
GEOMAR
Helmholtz Centre for Ocean Research Kiel
Questions…
BLUE PLANET
Oceans and Society
Emily.Smail@noaa.gov
INSTITUTO ESPAÑOL DE OCEANOGRAFÍA 1914
CENSUS OF MARINE LIFE
University of Cape Town
Marine Research Institute
BIGELOW LABORATORY FOR OCEAN SCIENCES
Ifremer
International Council for Science
SCOR
Scientific Committee on Oceanic Research
CSIRO
BIOS
BERMUDA INSTITUTE OF OCEAN SCIENCES
King Abdullah University of Science and Technology
access
CONTINUOUS PLANKTON RECORDER SURVEY
SAHFOS
WOODS HOLE OCEANOGRAPHIC INSTITUTION
1930
SCRIPPS INSTITUTION OF OCEANOGRAPHY
UCSD
INSTITUTE OF MARINE RESEARCH
HAVFORSKNINGSINSTITUTTET
IODP
INTEGRATED OCEAN DRILLING PROGRAM
Lamont-Doherty Earth Observatory
COLUMBIA UNIVERSITY | EARTH INSTITUTE
INCOIS
Flanders Marine Institute
British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL
IOCAS
1950
National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL
University of Rhode Island
GSO
Graduate School of Oceanography
NRF
National Research Foundation
SAEON
South African Environmental Observation Network
JAMSTEC
独立行政法人
海洋研究開発機構
JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY
COPAS
CENTER FOR OCEANOGRAPHIC RESEARCH in the eastern South Pacific
IMAS
INSTITUTE FOR MARINE AND ANTARCTIC STUDIES
NIO
understanding the seas
SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY
OGS
ISTITUTO NAZIONALE DI OCEANOGRAFIA E DI GEOFISICA SPERIMENTALE
PML
Plymouth Marine Laboratory

GROUP ON EARTH OBSERVATIONS

BLUE PLANET Oceans and Society

New website - http://geoblueplanet.com/



Thank you - Questions?