

Tools, Services and Support of NASA Salinity Data at the PO.DAAC

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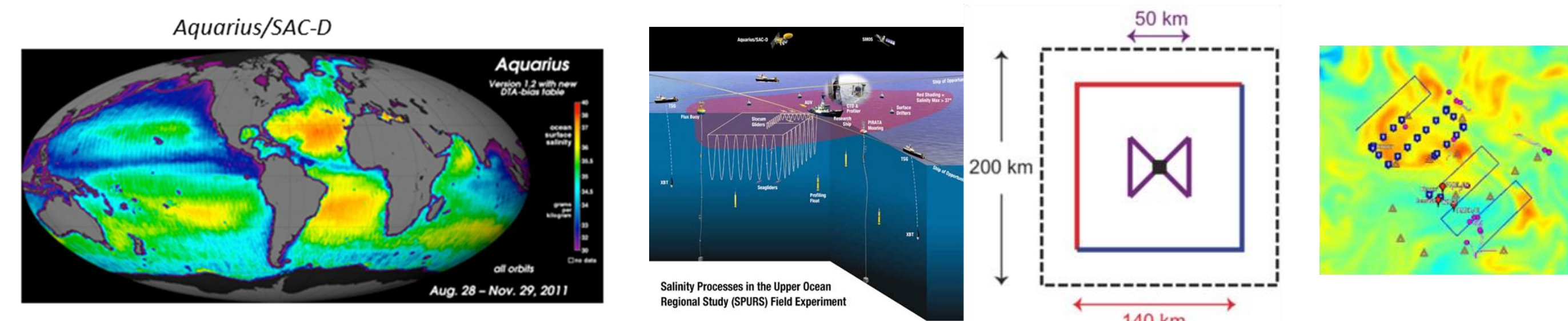
National Aeronautics and Space Administration

I. ABSTRACT

The Physical Oceanography Distributed Active Center (PO.DAAC) serves as the official NASA repository and distribution node for all Aquarius/SAC-D mission data products in close collaboration with the project. We additionally distribute the JPL Aquarius-CAP dataset and are also the designated archive for the SPURS field campaign data. Here we report on the status of NASA salinity data holdings at PO.DAAC, the range of data services and access tools that we provide in support of the Aquarius mission and SPURS in-situ salinity datasets. Data validation and quality assessment efforts in support of the Aquarius project are also described. Particular emphasis is placed on new tools and services that are available with the recent release of the Aquarius v4.0 dataset release. These range from OPeNDAP and THREDDS data access services, to web-based visualization via LAS, to PO.DAAC's advanced L2 subsetting tool called HITIDE (High-level Tool for Interactive Data Extraction). Dataset discovery via the PO.DAAC web-portal, and user support services are also reviewed.

II. AQUARIUS & SPURS

- **Aquarius-SAC/D NASA salinity mission:** <http://aquarius.nasa.gov>
 - Global salinity observations: improved understanding of water cycle
 - 3 years, 9 months of data archived & distributed by PO.DAAC
- **SPURS:** NASA-funded salinity oceanographic field campaigns <http://spurs.jpl.nasa.gov>
 - Salinity process study and synergies with Aquarius: sub-footprint SSS variability, water column structure & surface salinity field characterization
 - Inter-agency & International effort/support
 - SPURS 1: salinity max region N. Atlantic (5 cruises 2012-13)
 - SPURS 2: high rainfall ITCZ area E. Tropical Pacific (2016-17)
 - Range (novel) platforms & instruments: Multi-scale "Sensor-Web"
 - Diverse/Heterogeneous Data:
 - 15 core data sets (865mb): CTD, UCTD, Seasoar, ADCP, TSG, MET, Mooring (2), glider (4), drifter, float (3)
 - Initially in native "unstructured" file formats & metadata (*no requirements on PIs*)



III. SALINITY DATASETS @PO:DAAC

Aquarius Datasets (SMAP-SSS coming soon)

- Level 0, 1A
- **V4.0 Mission Products:**
 - Level 2
 - Level 3: Mapped Salinity, Density, Wind Speed, Ancillary SST (Daily, 7-day, Monthly, Seasonal, Annual x Asc/Desc/Comb, Climatologies)
- **CAP V4.0 Products**
 - Level 2
 - Level 3: Salinity, Salinity-rain corrected, Wind Speed (7-day, Monthly)
- Data Reader Software: Matlab, IDL
- V4.0 Documentation Package: (12 items) eg. User's Guide, ATBD
- CalVal Datasets: evaluation versions (24), MWR, Rain Rate, WWAV

SPURS1 In-Situ Data (SPURS2 & OMG coming soon)

- SPURS 1: 5 cruises Sep.2012–Nov.2013, N. Atlantic Salinity Max Region
- **Platforms/Datasets: (15):** Floats, Salinity Drifters, TSG, L/ADCP, U/CTD, Meteo, "Ecomapper" Microstructure profiles, Surface profiler, "Sea Snake", SeaSoar Wave Gliders, Sea Gliders, Tenuse Glider, Flux & PICO Moorings

IV. SALINITY RESOURCES

- **Mission Pages:**
 - Mission overview
 - Platform/instrument description
 - Data links
 - Documentation

- **User services/support**

<http://podaac.jpl.nasa.gov/aquarius/>

VI. DATA VISUALIZATION & SUBSETTING:

HITIDE (High-level Tool for Interactive Data Extraction) Web-based Level 2 subsetter

- Intuitive Interface: Filter specification, Mapping (zoom, pan etc.)
- Filtering: Dataset-type, Temporal, Spatial (bounding box)
- Returns: list of data files matching filter criteria with mapped swaths
- Imaging of select variables
- Export subsetting granule data (NetCDF, HDF)
- Powered by Web-services: CWS, OPeNDAP

VII. WEBSERVICES: for data Discovery, Access & Subsetting

OPeNDAP (<http://opendap.jpl.nasa.gov/opendap/>)

- Data transport architecture and HTTP-based protocol widely used to serve & subset earth science data
- All SPURS & Aquarius L1A - L3 data accessible OPeNDAP: eg. <http://podaac-opendap.jpl.nasa.gov/opendap/allData/spurs/>

Granule subsetting via extended OPeNDAP URL with parameters

HTTP request: [http://podaac-opendap.jpl.nasa.gov:80/opendap/allData/aquarius/L3/mapped/V3/7day/SCI/2014/015/Q20140152014021.L3m_7D_SCI_V3.0_SSS_1deg.bz2/13m_data\[30:190\]\[105:1:185\]](http://podaac-opendap.jpl.nasa.gov:80/opendap/allData/aquarius/L3/mapped/V3/7day/SCI/2014/015/Q20140152014021.L3m_7D_SCI_V3.0_SSS_1deg.bz2/13m_data[30:190][105:1:185])

Variable list: 30-190
Subset Array index range & step: 105:1:185

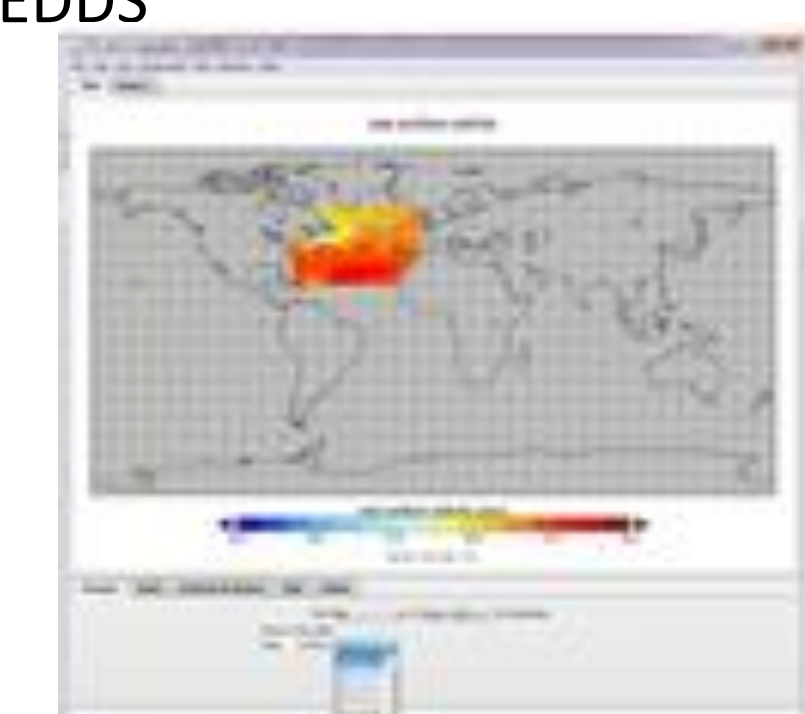
THREDDS (http://podaac.jpl.nasa.gov/podaac_thredds)

- HTTP-based Webservice protocol widely used to aggregate, serve and subset earth science data
- Subsetting by-value (*Lat/Lon/Time*) via NCSS service
- Supports OGC standards: WMS & WCS services
- All Aquarius L3 (Daily, 7d, Monthly) data in THREDDS

Spatio-Temporal subsetting via structured THREDDS URL with parameters

HTTP request: http://thredds.jpl.nasa.gov/thredds/ncss/grid/ncml_aggregation/SalinityDensity/aquarius/aggregate_AQUARIUS_L3_SSS_SMI_7DAY_V3.ncml?var=13m_data&north=60&south=20&east=5&west=75&time_start=2013-12-20T00:00:00&time_end=2014-09-24T00:00:00

Catalog reference: 13m_data
Variable list: north=60, south=20, east=5, west=75
Spatial bounding box: north=60, south=20, east=5, west=75
Time range filters: time_start=2013-12-20T00:00:00, time_end=2014-09-24T00:00:00

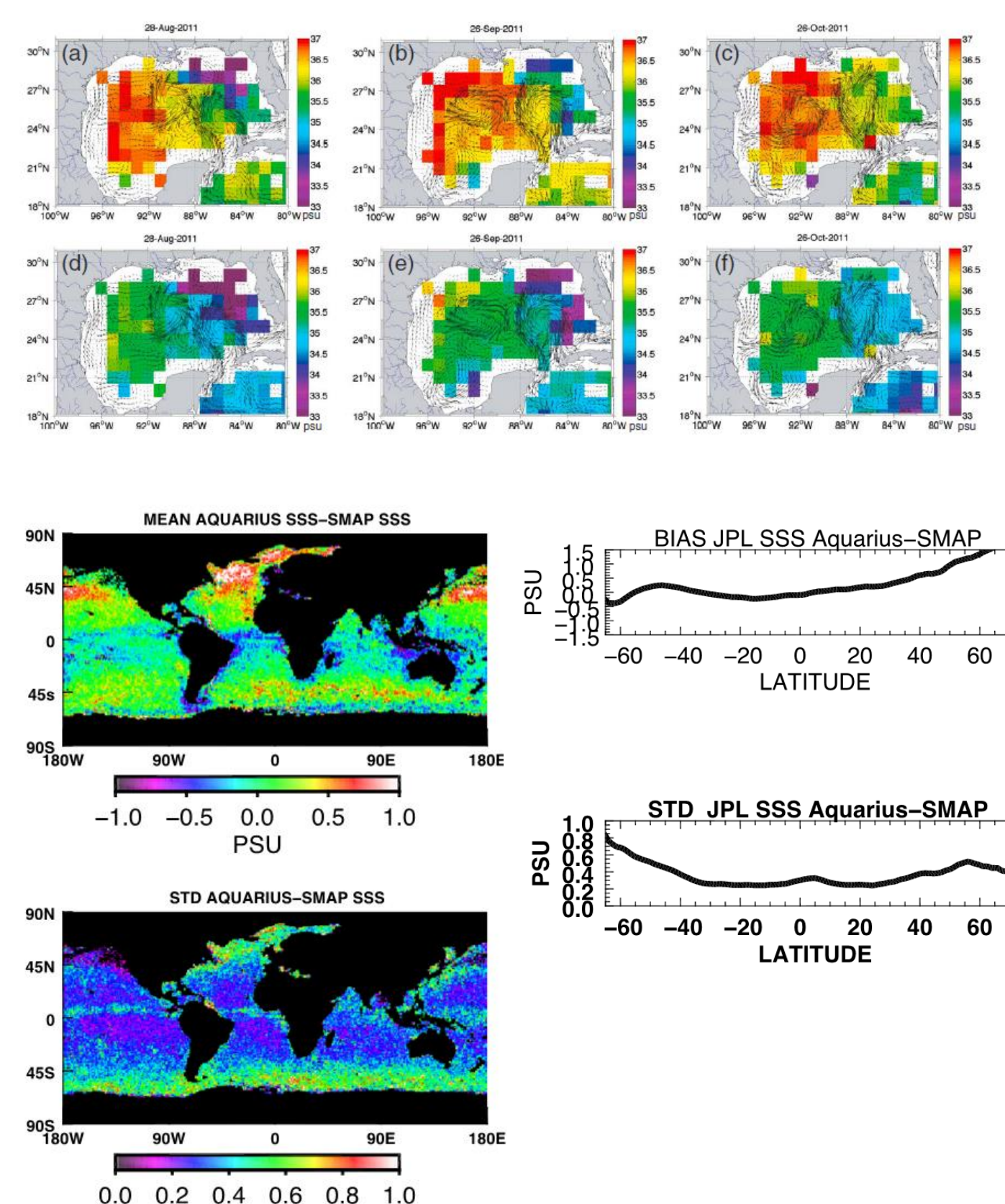


V. SALINITY SCIENCE & Cal/Val Support

GEOPHYSICAL RESEARCH LETTERS, VOL. 40, 1-6, doi:10.1002/gl.50995, 2013

Aquarius and SMOS detect effects of an extreme Mississippi River flooding event in the Gulf of Mexico

Michelle M. Gierach¹, Jorge Vazquez-Cuervo¹, Tong Lee¹, and Vardis M. Tsontos¹



LAS (Live Access Server) by NOAA

- Visualize L3/L4 datasets: (eg. Aquarius L3 SSS Daily, 7d & Monthly data)
- Spatio-temporal subsetting
- Plotting: Maps, Hovmoller, Line-plots (Transect & Point Time series)
- Analysis: visual comparisons, data transformations, layer differencing
- Export: various formats (eg. ASCII, CSV, NetCDF)

<http://podaac.jpl.nasa.gov/>

CWS (Consolidated Web-Services)

- Integrated set of PO.DAAC Web-services for dataset and granule search & subsetting
- General Form: <http://podaac.jpl.nasa.gov/ws/service?parameters>
- Returns: response as XML structure or in JSON format