



The COVERAGE Project & Thematic Demonstration Application: High Seas Tuna Fisheries In Relation to the Environment

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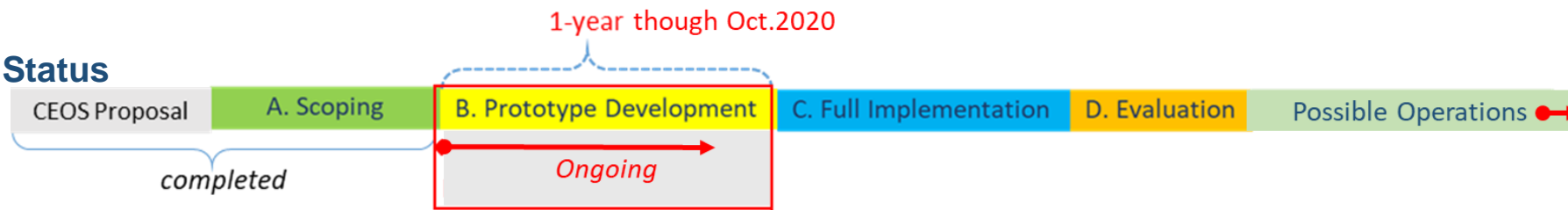
- **International initiative** led by NASA under the Committee on Earth Observation Satellites (CEOS) and endorsed as a 3 year pilot project, currently in its 2nd year of technical implementation
- **Cross-cutting, collaborative effort**
 - Enable more widespread use of ocean satellite products in support of science & applications for societal benefit
 - Improved access to a coherent set of global, interagency data products from the 4 Ocean VCs at common resolution
 - Implementation of an advanced technology platform providing access to complementary satellite & in-situ datasets via value-added data services
 - Demonstrate utility in the context of an example thematic application relating to:
“the environment and high seas biodiversity & pelagic fisheries”
 - Gap free L4 ocean color product development
- **Response to known needs of the ocean community** for improved, more integrated access to analysis ready data (ARD) in support also of the United Nations Sustainable Development Goals (UN-SDGs) (#14 in particular) relating to marine biodiversity & sustainable/ecosystem-based resource management



- **Advisory Board & Contributors**



- **Approach & Status**





“Satellite Data in Support of Ecosystem-based Fisheries Analyses”

Biological & Resource Management Communities:

- Increasing interest in use of Earth Observation data but limited expertise/capacity & currently under-served

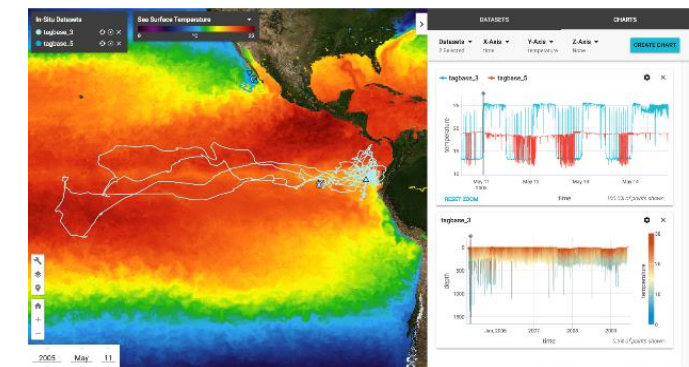
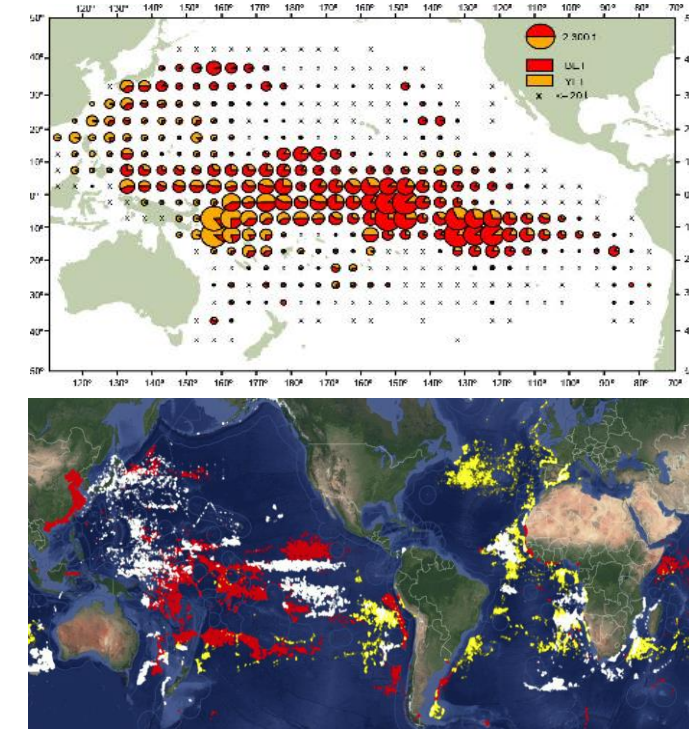
High Seas & Regional Fisheries Applications involving integration of ocean remote sensing, physical model and in-situ datasets enabling decision support and research investigations

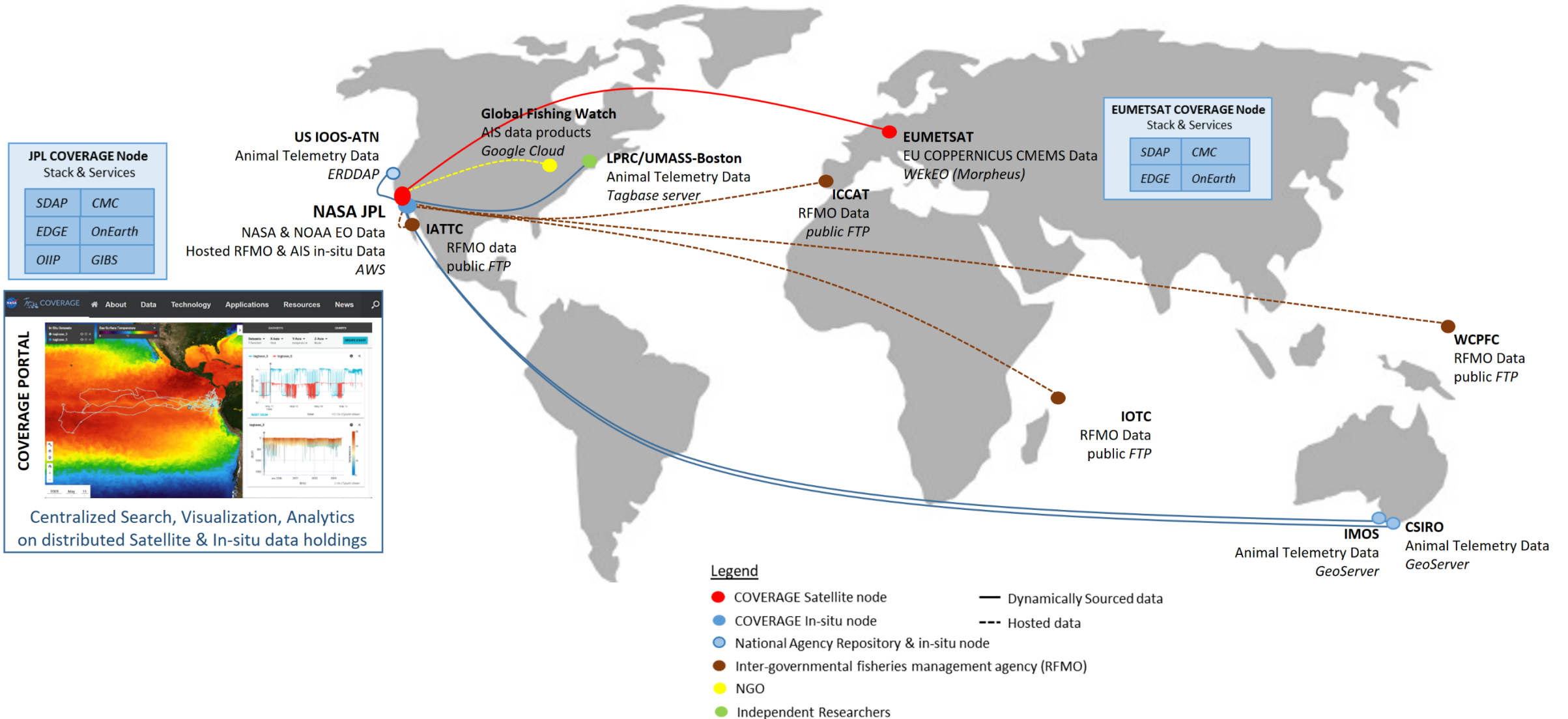
- Habitat analysis for Highly Migratory Species (HMS)
- Tuna Spatial catch forecasting
- By-catch mitigation

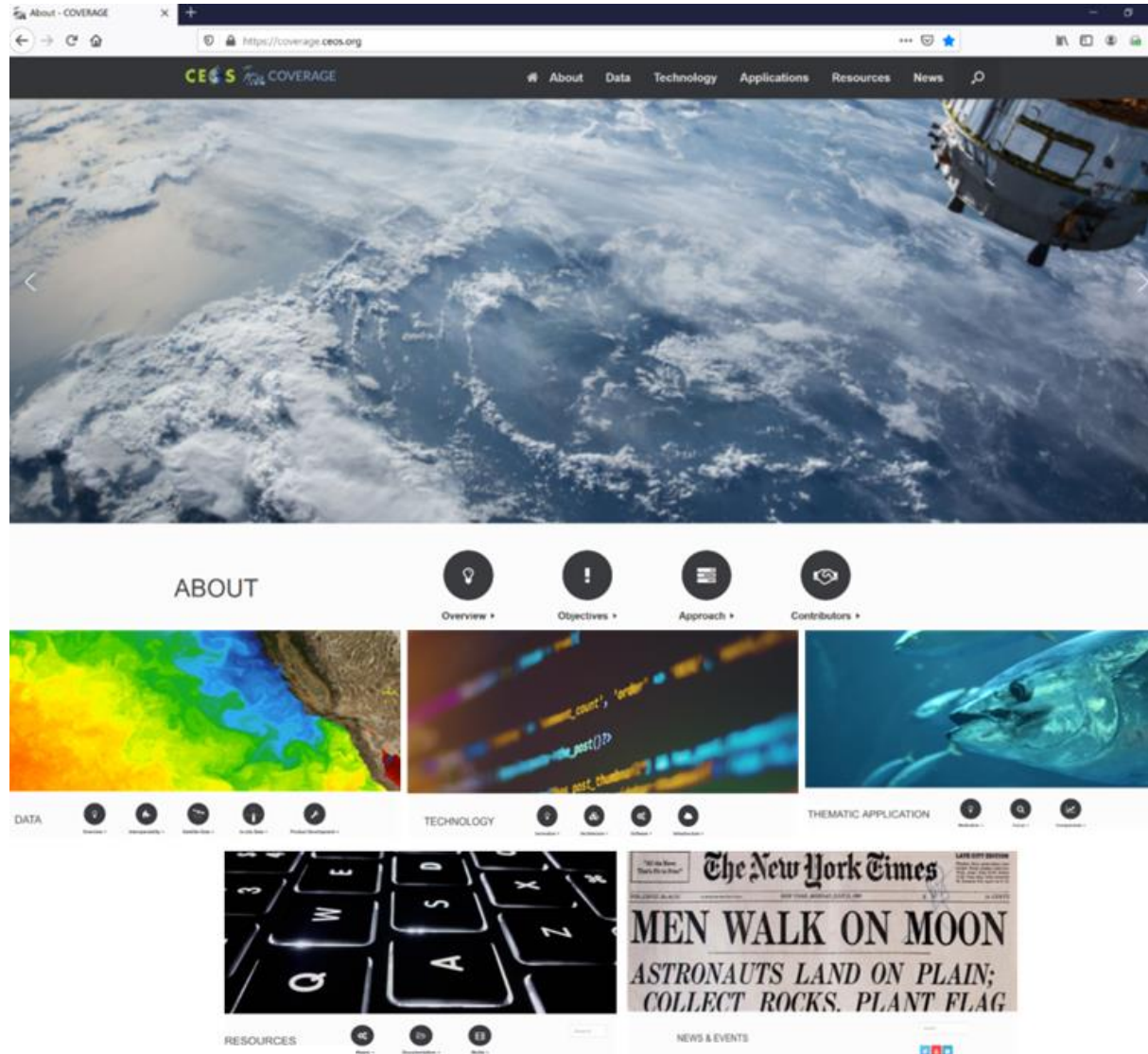
Stakeholder agencies: eg. RFMOs, NOAA/NMFS, GEO-MBON (Marine Biodiversity Observation Network), GEO-Blue Planet

Supporting Data *(publicly available)*

- RFMO monthly spatial catch/effort time series by species, aggregated spatially at 1 & 5 deg. spatial resolution, 1952-2018
- Electronic tagging datasets: high resol. trajectory-profile series
- AIS fishing vessel movement data products by category (daily, since 2012 from *Global Fishing Watch*)







- Descriptive information on COVERAGE Initiative
- Data services/tool integration coming soon



https://twitter.com/coverage_ceos

Project announcements



<https://tinyurl.com/coverage-channel>

Demonstration/tutorial Materials

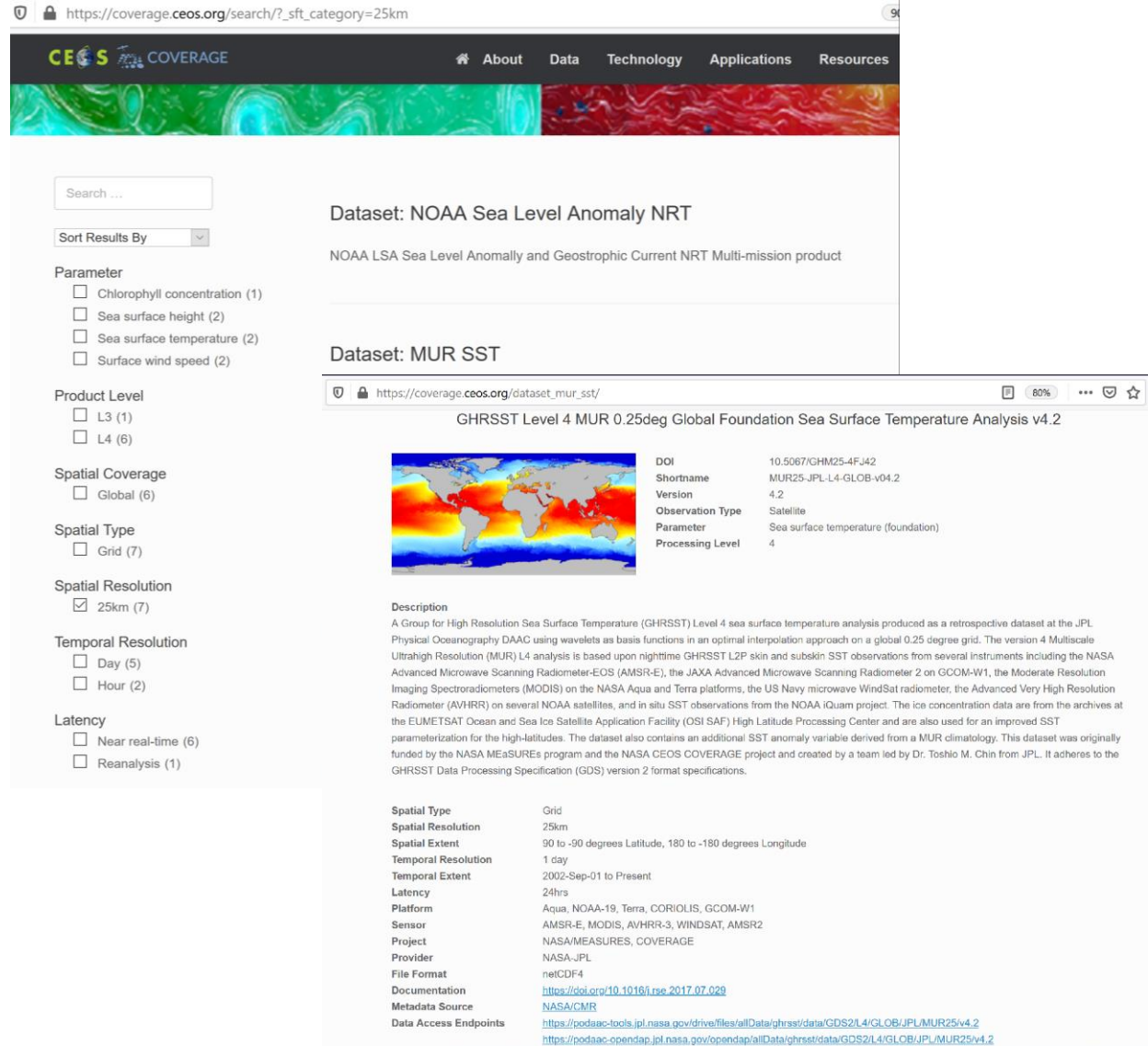
- Leverages CEOS-WGISS IDN and CDA
- Integrates Dataset Metadata from multiple repositories:
e.g.
 - NASA/CMR
 - FedEO (CMEMS)
 - IMOS
 - CSIRO “Marlin”

}

satellite

}

in situ
- Features
 - Keyword search
 - Facetted search filters
- Returns dataset descriptive & access point information



The screenshot displays the CEOS COVERAGE Integrated Data Search portal. The top navigation bar includes links for About, Data, Technology, Applications, and Resources. The main content area shows search results for the query "https://coverage.ceos.org/search/?_sft_category=25km".

Dataset: NOAA Sea Level Anomaly NRT
NOAA LSA Sea Level Anomaly and Geostrophic Current NRT Multi-mission product

Dataset: MUR SST
GHRSSST Level 4 MUR 0.25deg Global Foundation Sea Surface Temperature Analysis v4.2

The left sidebar contains search filters:

- Search ...**
- Sort Results By** (dropdown)
- Parameter**
 - ☐ Chlorophyll concentration (1)
 - ☐ Sea surface height (2)
 - ☐ Sea surface temperature (2)
 - ☐ Surface wind speed (2)
- Product Level**
 - ☐ L3 (1)
 - ☐ L4 (6)
- Spatial Coverage**
 - ☐ Global (6)
- Spatial Type**
 - ☐ Grid (7)
- Spatial Resolution**
 - ☒ 25km (7)
- Temporal Resolution**
 - ☐ Day (5)
 - ☐ Hour (2)
- Latency**
 - ☐ Near real-time (6)
 - ☐ Reanalysis (1)

The right sidebar displays metadata for the selected dataset:

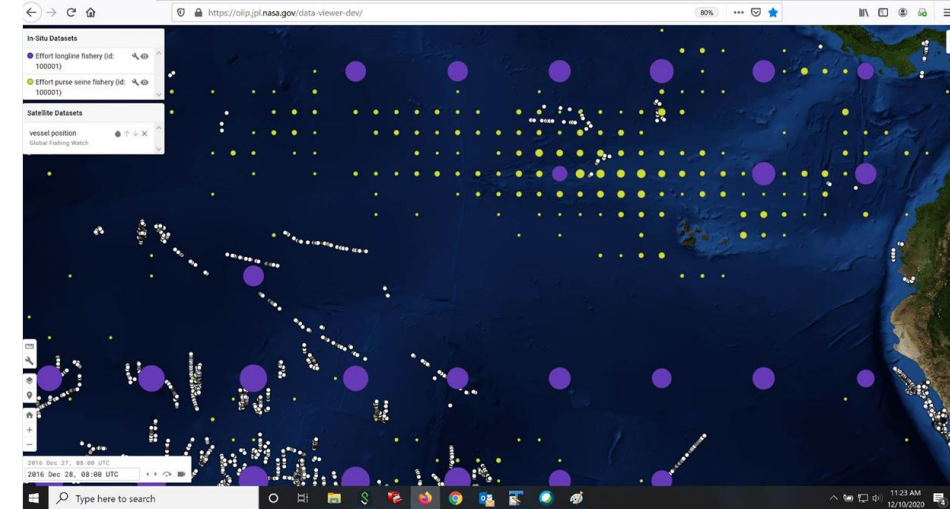
DOI	10.5067/GHM25-4FJ42
Shortname	MUR25-JPL-L4-GLOB-v04.2
Version	4.2
Observation Type	Satellite
Parameter	Sea surface temperature (foundation)
Processing Level	4

Description
A Group for High Resolution Sea Surface Temperature (GHRSSST) Level 4 sea surface temperature analysis produced as a retrospective dataset at the JPL Physical Oceanography DAAC using wavelets as basis functions in an optimal interpolation approach on a global 0.25 degree grid. The version 4 Multiscale Ultrahigh Resolution (MUR) L4 analysis is based upon nighttime GHRSSST L2P skin and subskin SST observations from several instruments including the NASA Advanced Microwave Scanning Radiometer-EOS (AMSR-E), the JAXA Advanced Microwave Scanning Radiometer 2 on GCOM-W1, the Moderate Resolution Imaging Spectroradiometers (MODIS) on the NASA Aqua and Terra platforms, the US Navy microwave WindSat radiometer, the Advanced Very High Resolution Radiometer (AVHRR) on several NOAA satellites, and in situ SST observations from the NOAA iQuam project. The ice concentration data are from the archives at the EUMETSAT Ocean and Sea Ice Satellite Application Facility (OSI SAF) High Latitude Processing Center and are also used for an improved SST parameterization for the high-latitudes. The dataset also contains an additional SST anomaly variable derived from a MUR climatology. This dataset was originally funded by the NASA MEaSUREs program and the NASA CEOS COVERAGE project and created by a team led by Dr. Toshio M. Chin from JPL. It adheres to the GHRSSST Data Processing Specification (GDS) version 2 format specifications.

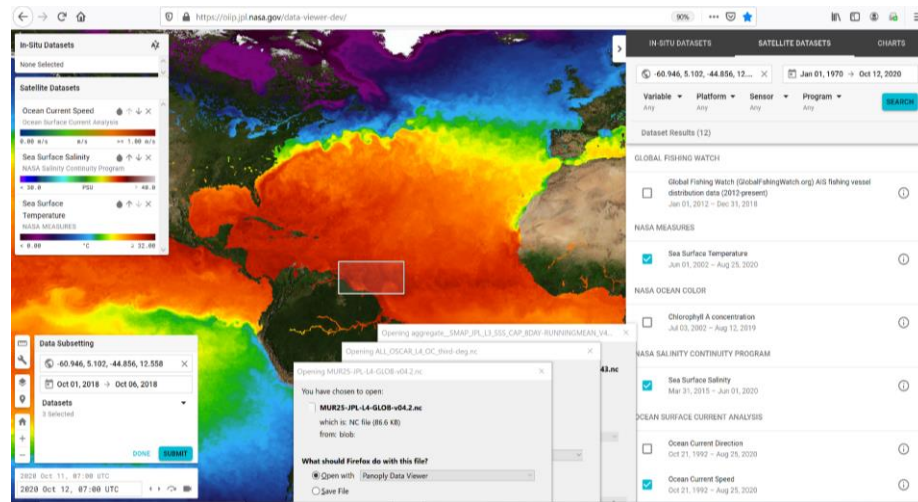
Metadata

Spatial Type	Grid
Spatial Resolution	25km
Spatial Extent	90 to -90 degrees Latitude, 180 to -180 degrees Longitude
Temporal Resolution	1 day
Temporal Extent	2002-Sep-01 to Present
Latency	24hrs
Platform	Aqua, NOAA-19, Terra, CORIOLIS, GCOM-W1
Sensor	AMSR-E, MODIS, AVHRR-3, WINDSAT, AMSR2
Project	NASA/MEASURES, COVERAGE
Provider	NASA-JPL
File Format	netCDF4
Documentation	https://doi.org/10.1016/j.rse.2017.07.029
Metadata Source	NASA/CMR
Data Access Endpoints	https://podaac-tools.jpl.nasa.gov/drive/files/allData/ghrsst/data/GDS2/L4/GLOB/JPL/MUR25v4.2 https://podaac-opendap.jpl.nasa.gov/opendap/allData/ghrsst/data/GDS2/L4/GLOB/JPL/MUR25v4.2

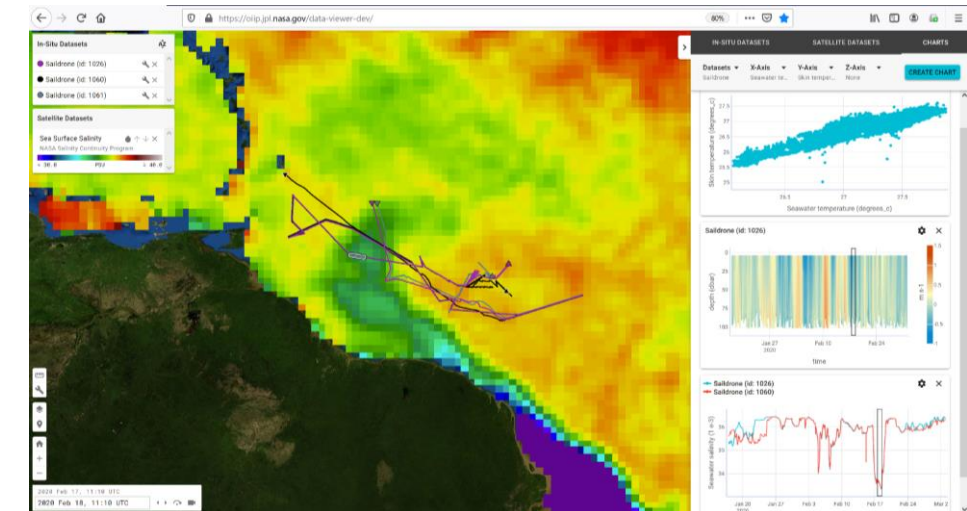
- Integrated visualization of satellite & in-situ data
- Synchronized horizontal and vertical views of data and their evolution over time
- Integrated dataset Search
- “One-stop” Data Subsetting capability (both satellite & in-situ)
- Open Source: JPL Common Mapping Client
- What’s Next: Analytics API integration



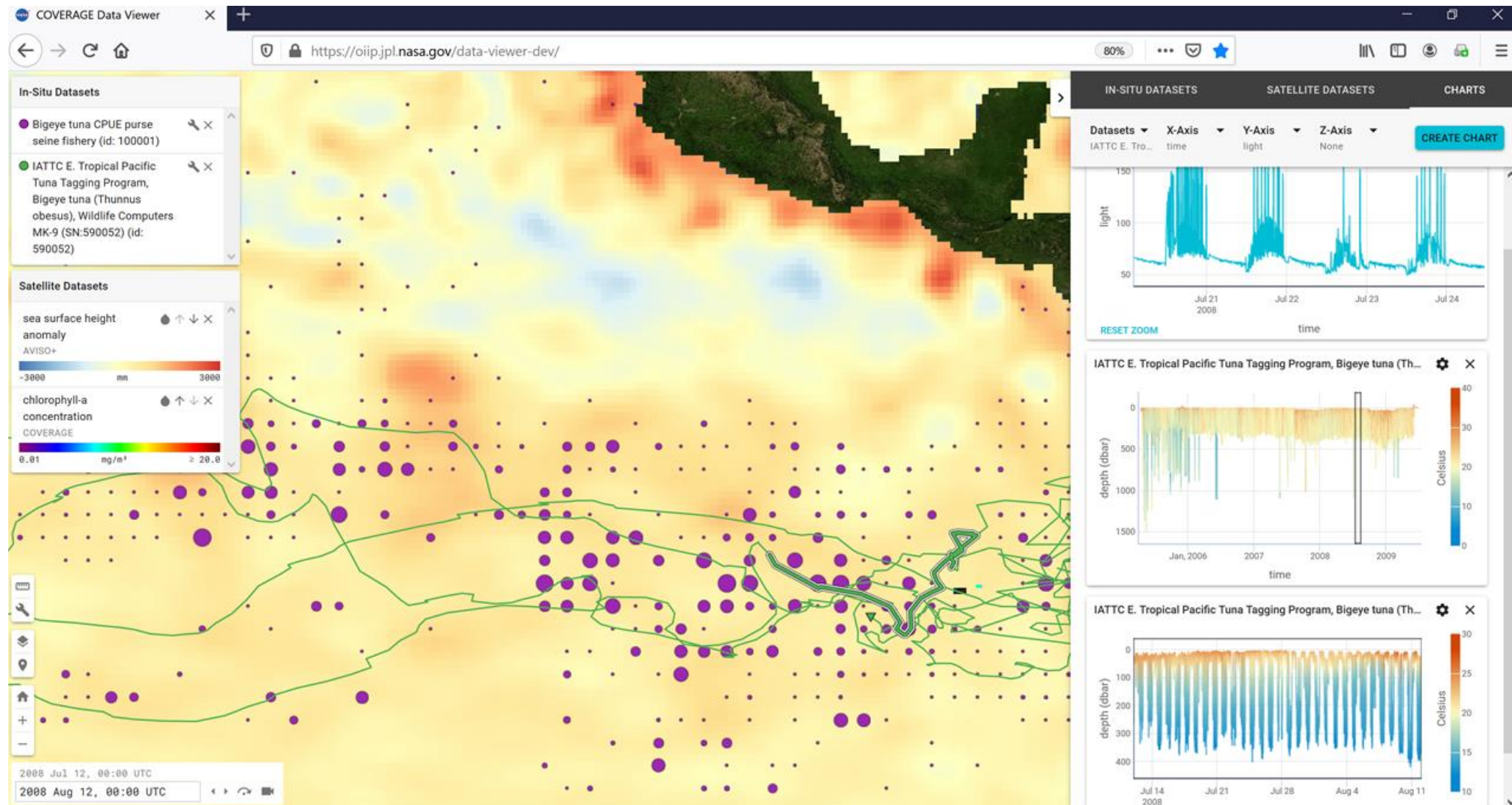
RFMO monthly aggregate longline and purse seine spatial effort distribution data from IATTC in relation to daily AIS data from Global Fishing Watch



Data Search & Subsetting



Saildrone ATOMIC cruise ADCP and CTD data overlaid on Sea Surface Salinity data from SMAP

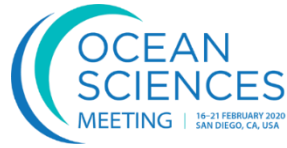


IATTC Bigeye Tuna archival tag & spatial catch distribution data in relation to AVISO-SSHA and animal telemetry environmental measurements

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- The diagram illustrates the SDAP architecture. At the bottom, a 'Client Host at JPL' (represented by a laptop icon) connects to a cloud. The cloud connects to a '1 Master Node' (represented by a server icon). The Master Node connects to three '3 Worker Nodes' (represented by server icons). Each Worker Node is associated with a database icon and a data store icon. The Master Node is labeled with the following details:
- 1 Master Node
 - Web tier
 - Job request handler / orchestrator
- The Worker Nodes are labeled with the following details:
- 3 Worker Nodes
 - Parallel computations
 - Tiled data store
 - Rapid geospatial search and tiled data retrieval



3 Workshop Events:



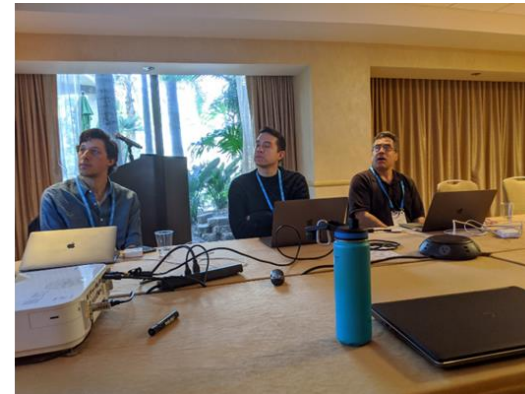
Feb. 2020



Jul. 2020



Aug. 2020



Conference presentations

ESIP-Summer 2020, GEO-BON2020, Ocean Sciences 2020, Fall AGU2019

Stakeholder consultations: Advisory Board Meetings, CEOS, Agency partners: EUMETSAT, Sargasso Sea Commission (SSC), Inter-American Tropical Tuna Commission (IATTC), CSIRO, IMOS, US IOOS-ATN



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Project announcements



<https://tinyurl.com/coverage-channel>

Demonstration/tutorial Materials

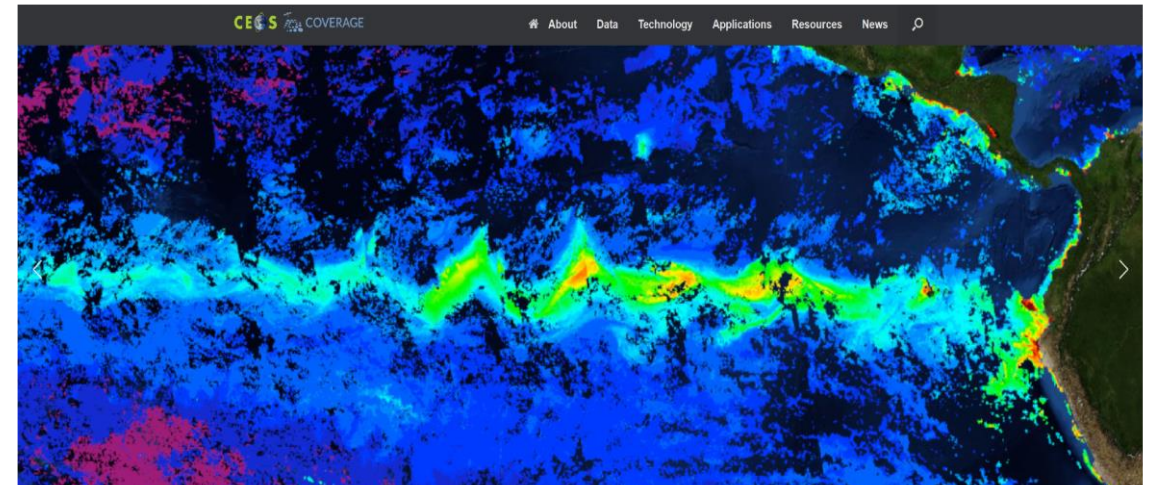
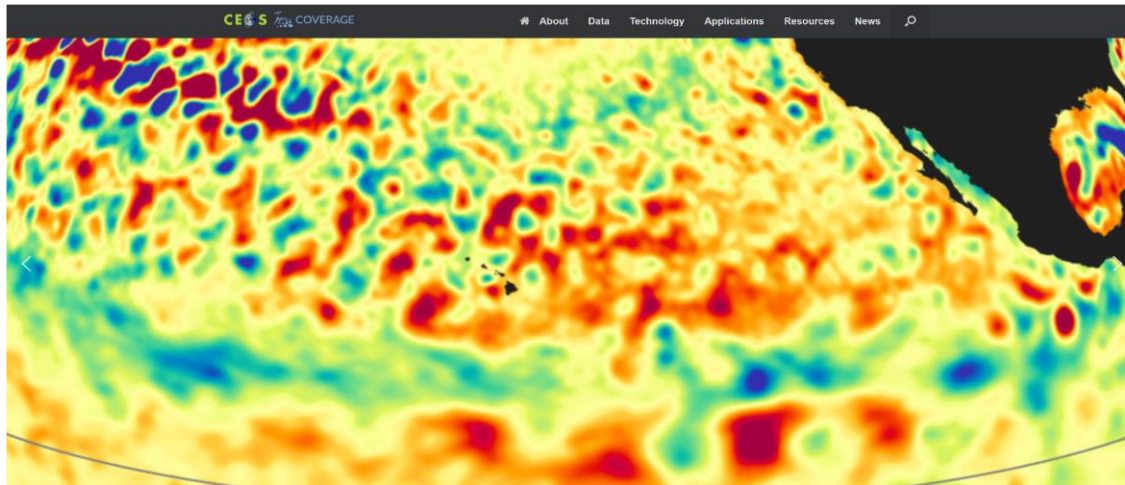
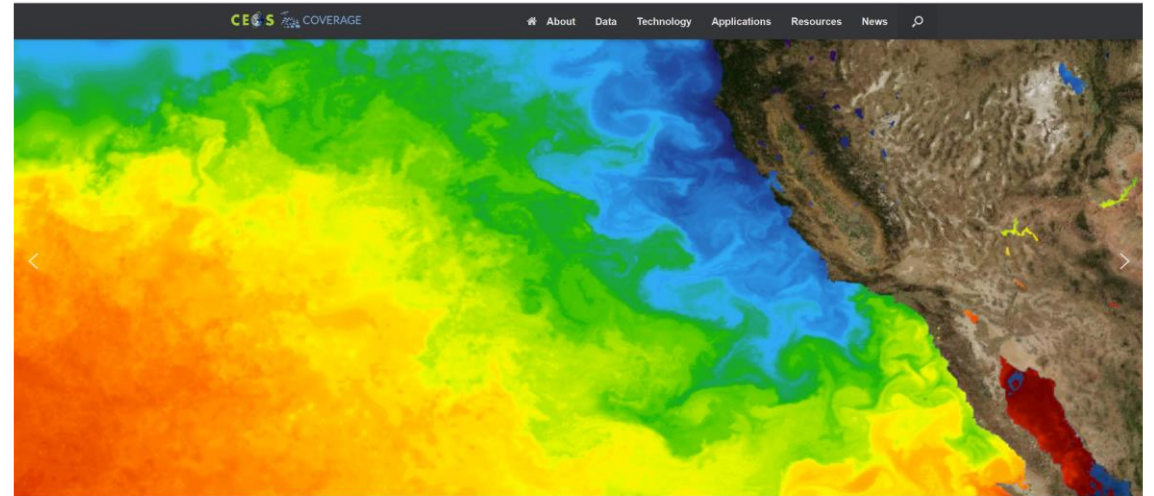
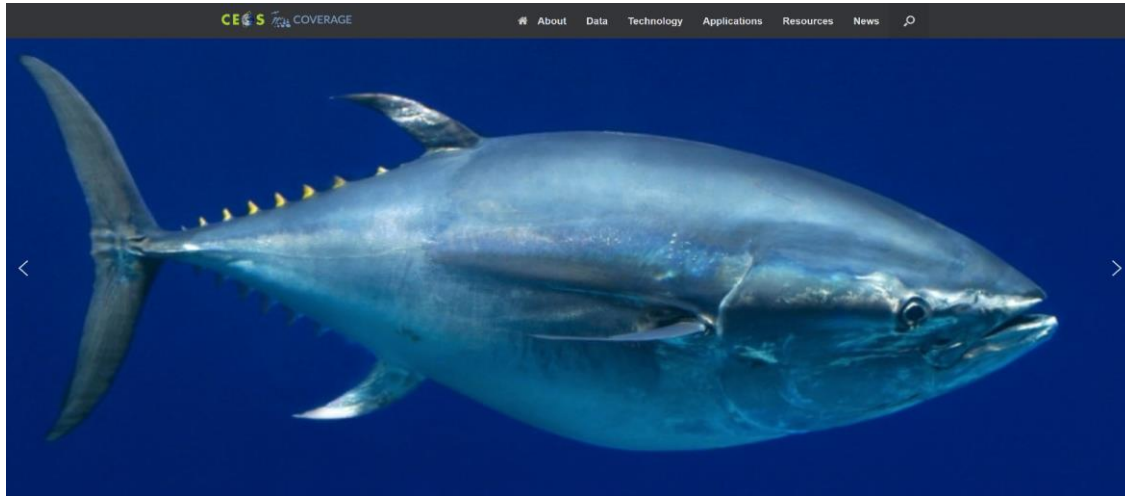


- Growing Imperative to better marshal available Earth observations of different types in support of ocean science and marine resource management applications for societal benefit
- COVERAGE is about:
 - Development of improved data infrastructures to enable this
 - Better realizing the potential of EO data in supporting new and under-served user communities by addressing key constraints (product selection, access & usage mechanics)
 - Doing so collaboratively via stakeholder engagement within CEOS and externally
- At the conclusion of this 1-year Phase B activity, we have a range of useful outcomes:
 - A prototype system, collection of integrated, interagency data products, and a reusable set of technical capabilities that show considerable promise
 - Illustrated in the context of a thematic application that in itself has generated community interest with considerable potential for further development
 - Validated L4 gap-free ocean color CHLA product with potential to take to 1km resolution (see backup slide)
- Solid foundation for a follow-on Phase C activity:
 - involving refinement and hardening of technical capabilities
 - further development of HMS pelagic fisheries ecosystem pilot: regional focus, more detailed/hi-res. datasets
 - expanded network of collaborators



COVERAGE

Questions



<https://coverage.ceos.org>



https://twitter.com/coverage_ceos

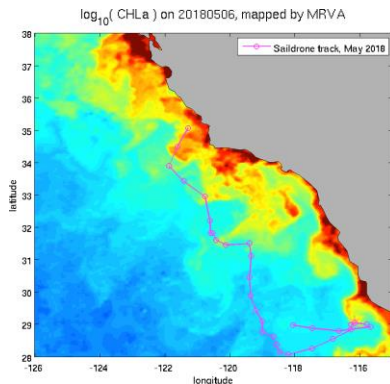
Backup



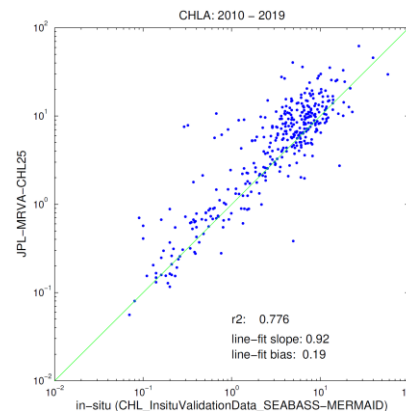
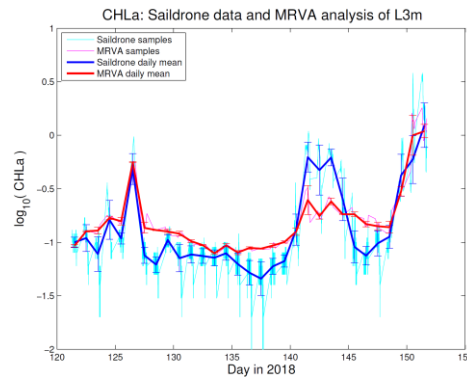
- L4 CHLA MRVA product implemented
- Based on L3 MODIS and VIIRS inputs (4km)
- Complete 0.25 degree series processed and integrated into COVERAGE services
- Validation Analyses Completed: excellent results

L4CHLA MRVA - *in situ* Comparisons

Saildrone Baja Campaign



*SEABASS/NOMAD/MERMAIDS
Matchup Database Comparisons*



L4 CHLA Product Inter-comparisons

MRVA , Globcolour, NOAA-MSL12

Datasets - Season	Correlation	Bias (mg/m**3)	RMSD (mg/m**3)
MRVA/CMEMS - Winter	0.94	-0.0575	0.144
MRVA/CMEMS - Spring	0.94	-0.0484	0.147
MRVA/CMEMS - Summer	0.95	-0.0215	0.135
MRVA/CMEMS - Fall	0.94	-0.0485	0.149
MRVA/MSL12 - Winter	0.97	-0.0189	0.094
MRVA/MSL12 - Spring	0.97	-0.0191	0.112
MRVA/MSL12 - Summer	0.93	-0.0439	0.167
MRVA/MSL12 - Fall	0.95	-0.0210	0.132

NEXT STEPS

- Write Technical Report (ATBD, Validation, Product format specification)
- Extend to use L2 MODIS, VIIRS, Sentinel 3 inputs -> can get down to 1km gap free