

Climatology and L4 Inter-Comparison (IC)

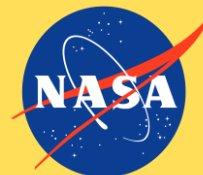
Chair: Daniele Ciani (CNR-ISMAR)

Co-chair: Jorge Vazquez-Cuervo (NASA JPL/Caltech)

Presenters: Daniele Ciani, Jorge Vazquez-Cuervo



**CNR
ISMAR**
ISTITUTO
DI SCIENZE
MARINE



Current Members

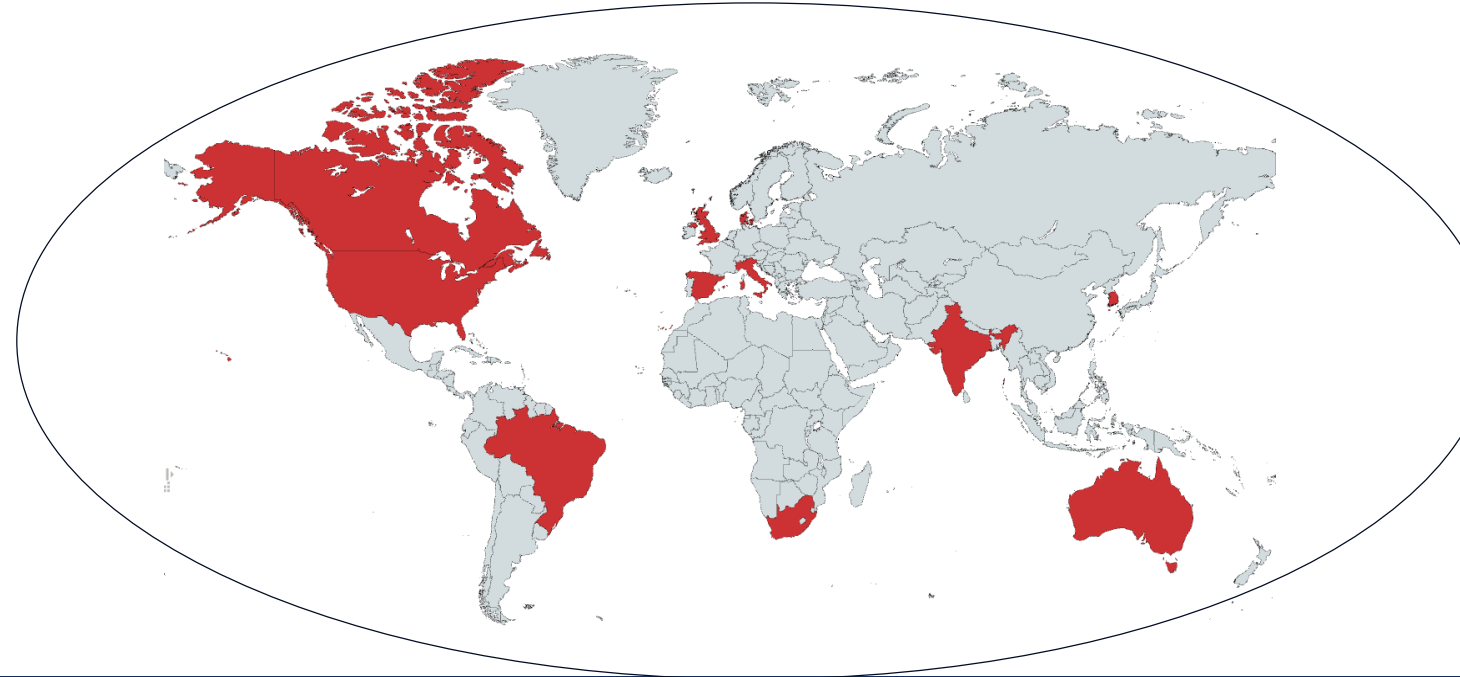
GHRST26

INTERNATIONAL SST USERS'
SYMPOSIUM AND GHRST
SCIENCE TEAM MEETING

Neeraj Agarwal (ISRO, India)
Sheekela Baker-Yeboah, (NOAA, USA)
Helen Beggs (BOM, Australia)
Marouan Bouali (ORBTY Ltda., Brazil)
Davide Cavaliere (CNR-ISMAR, IT)
Prasanjit Dash (CSU CIRA/ NOAA STAR, USA)
Toshio M. Chin (JPL, USA)
Owen Embury (U. Reading, UK)
Cristina Gonzalez Haro (ICM-CSIC, Spain)
Pallavi Govekar (BOM, Australia)
Andy Harris (NOAA, USA)
Boyin Huang (NOAA Federal)
Ioanna Karagali (DMI, Denmark)
Andrea Massi (CNR-ISMAR, IT)
Chongyuan Mao (Met Office, UK)

Jishad M. (ISRO, India)
Kyung-Ae Park (Seoul University, KR)
Salvatore Marullo (CNR-ISMAR, IT)
Andrea Pisano (CNR-ISMAR, IT)
Mattia Sabatini (CNR-ISMAR, IT)
Rosalia Santoleri (CNR-ISMAR, IT)
Dorina Surcel-Colan (ECCC, Canada)

Nico Weidberg (Uni. Oviedo, Spain)
David S. Wethey (Uni. South Carolina, USA)
Christo Whittle (CSIR, South Africa)
Gary Wick (NOAA, USA)
Chunxue Yang (CNR-ISMAR, IT)
Xungang Yin (NOAA, USA)
Huai-min Zhang, (NOAA, USA)



Interested in join? Please contact

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jorge.vazquez@jpl.nasa.gov

Purpose and Main Objective of the TT

TASK TEAM ON CLIMATOLOGY AND L4 INTER-COMPARISON (IC)

Gap-free SST analyses using satellite, and possibly *in situ* data, are the most widely used SST products for both operational and research applications. Currently, several level 4 (L4) near real-time and reprocessed SST analyses are publicly available from organisations and operational agencies.

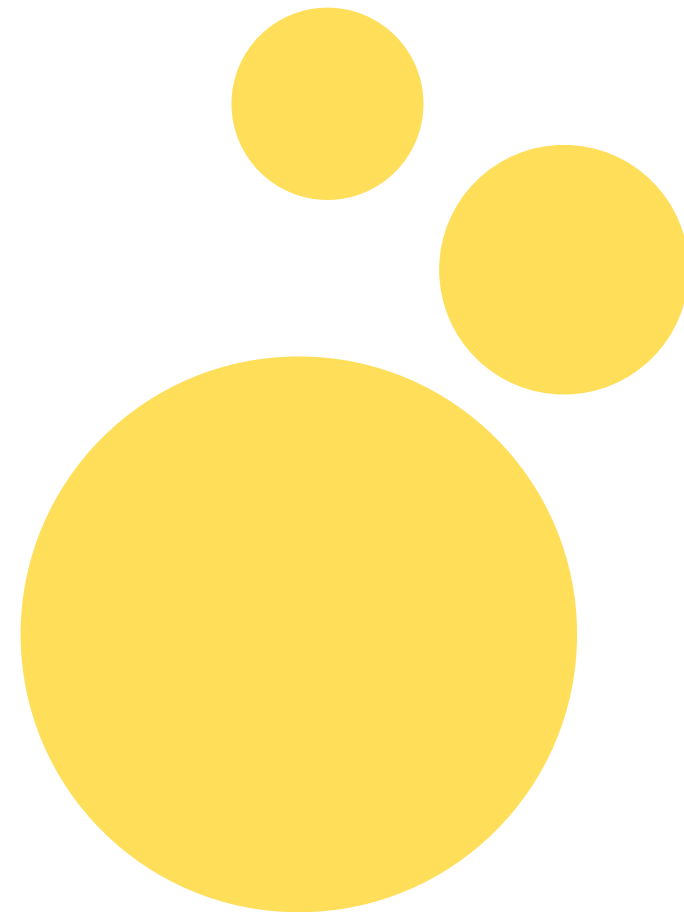
OBJECTIVES

Compare the SST analyses and their validation, in order to provide information to producers to enable them to improve their analysis systems and to provide guidance to users in their applications.



Expected Closure of TT

*Continue through 2025/2026 to ensure
progress in TT activities and include cross-
TT meetings*



Summary of activities during 2024/2025

IC-TT Sharepoint Setup (hosted at dmicloud)

includes meetings recordings/minutes/presentations

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CL IC-TT: Climatology and L4 Intercomparison Task Team Private group 39 members

Home + New Page details Analytics Published 9/9/2024 Share Edit

Task Team on Climatology and L4 Inter-Comparison (IC)

Documents

+ New Upload Edit in grid view Sync All Documents

Name	Modified	Modified By
General	August 19, 2024	Erika Hayashi
GPO and Administration	September 5, 2024	Erika Hayashi
Meetings	August 19, 2024	Erika Hayashi

Activity

2024.06.12 Trends in satellite-based ocean parameters through integrated time series decomposition and spectral analysis (J. Chantigny, see surface temperature, and sea level anomaly)

2025.03.15 Copernicus Marine Service Sea Surface Temperature TAC

Meeting Recordings

Webpage updates

Access requests to:
daniele.ciani@cnr.it
jorge.vazquez@jpl.nasa.gov
erh@dmu.dk

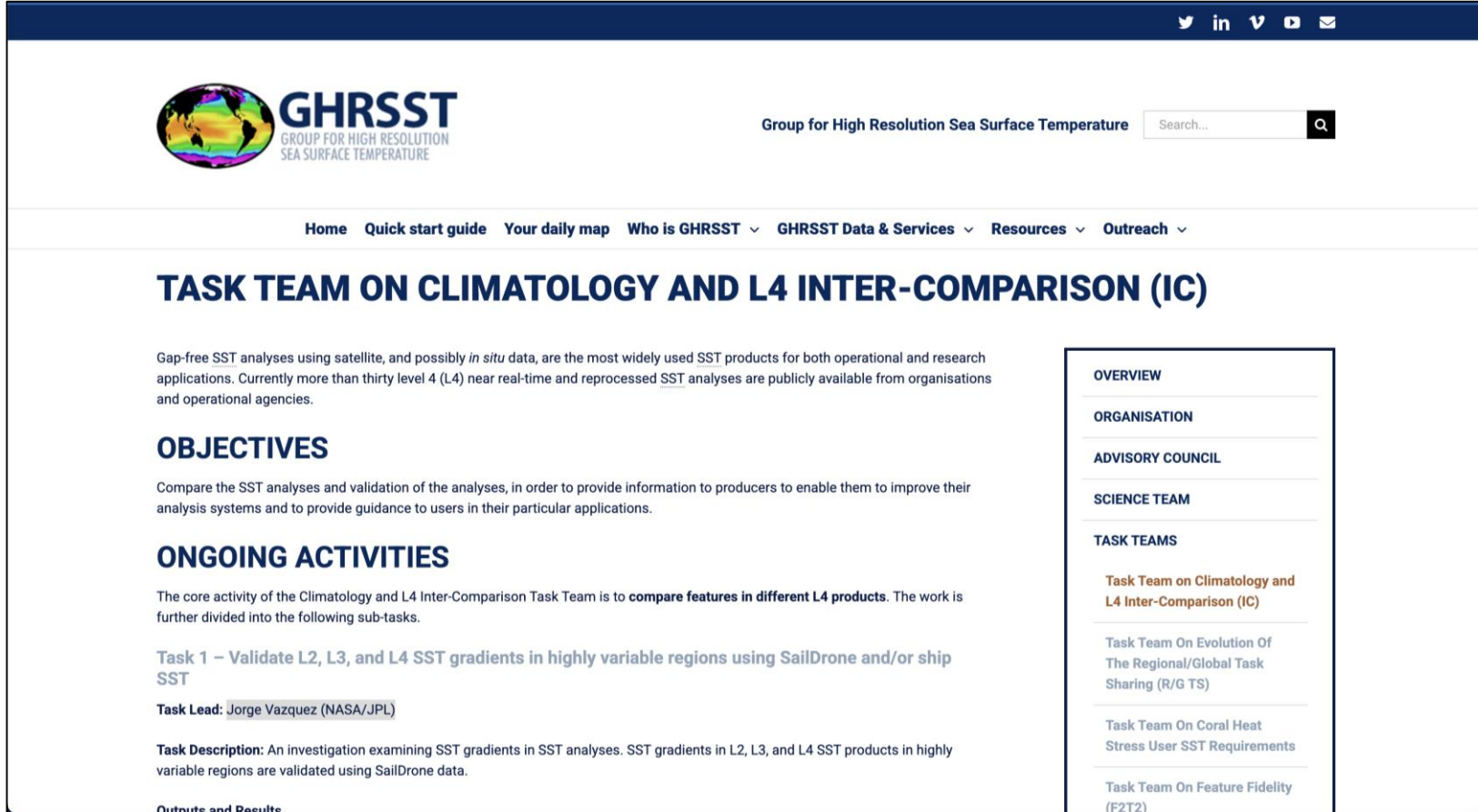


Thanks to Erika for the support!

Update of the GHR SST IC-TT Website

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The screenshot shows the GHR SST website interface. At the top, there is a dark blue header with social media icons (Twitter, LinkedIn, Facebook, YouTube, Email) and the GHR SST logo. Below the header, a navigation bar contains links: Home, Quick start guide, Your daily map, Who is GHR SST, GHR SST Data & Services, Resources, and Outreach. The main content area is titled "TASK TEAM ON CLIMATOLOGY AND L4 INTER-COMPARISON (IC)". It includes a paragraph about gap-free SST analyses, a section for "OBJECTIVES" comparing SST analyses, and a section for "ONGOING ACTIVITIES" detailing Task 1 (Validate L2, L3, and L4 SST gradients) and its lead, Jorge Vazquez. A sidebar on the right lists various task teams under the heading "TASK TEAMS", with "Task Team on Climatology and L4 Inter-Comparison (IC)" highlighted in orange.

GHR SST
GROUP FOR HIGH RESOLUTION
SEA SURFACE TEMPERATURE

Group for High Resolution Sea Surface Temperature

Home Quick start guide Your daily map Who is GHR SST GHR SST Data & Services Resources Outreach

TASK TEAM ON CLIMATOLOGY AND L4 INTER-COMPARISON (IC)

Gap-free SST analyses using satellite, and possibly *in situ* data, are the most widely used SST products for both operational and research applications. Currently more than thirty level 4 (L4) near real-time and reprocessed SST analyses are publicly available from organisations and operational agencies.

OBJECTIVES

Compare the SST analyses and validation of the analyses, in order to provide information to producers to enable them to improve their analysis systems and to provide guidance to users in their particular applications.

ONGOING ACTIVITIES

The core activity of the Climatology and L4 Inter-Comparison Task Team is to **compare features in different L4 products**. The work is further divided into the following sub-tasks.

Task 1 – Validate L2, L3, and L4 SST gradients in highly variable regions using SailDrone and/or ship SST

Task Lead: Jorge Vazquez (NASA/JPL)

Task Description: An investigation examining SST gradients in SST analyses. SST gradients in L2, L3, and L4 SST products in highly variable regions are validated using SailDrone data.

Outputs and Results

OVERVIEW

ORGANISATION

ADVISORY COUNCIL

SCIENCE TEAM

TASK TEAMS

- Task Team on Climatology and L4 Inter-Comparison (IC)**
- Task Team On Evolution Of The Regional/Global Task Sharing (R/G TS)
- Task Team On Coral Heat Stress User SST Requirements
- Task Team On Feature Fidelity (F2T2)



Thanks to Erika for the support!

Bi-monthly TT meetings

6 meetings held between July 2024 and May 2025 (~15-20 participants each meeting)

- 1st meeting : summary of ongoing/finished tasks, presentations of tasks for 2024/2025
- 2nd to 5th meeting: SCIENCE TALKS from TT members/ST members
- 6th meeting: WRAP UP / Preparation for GHRST 26th

Science Talks Overview

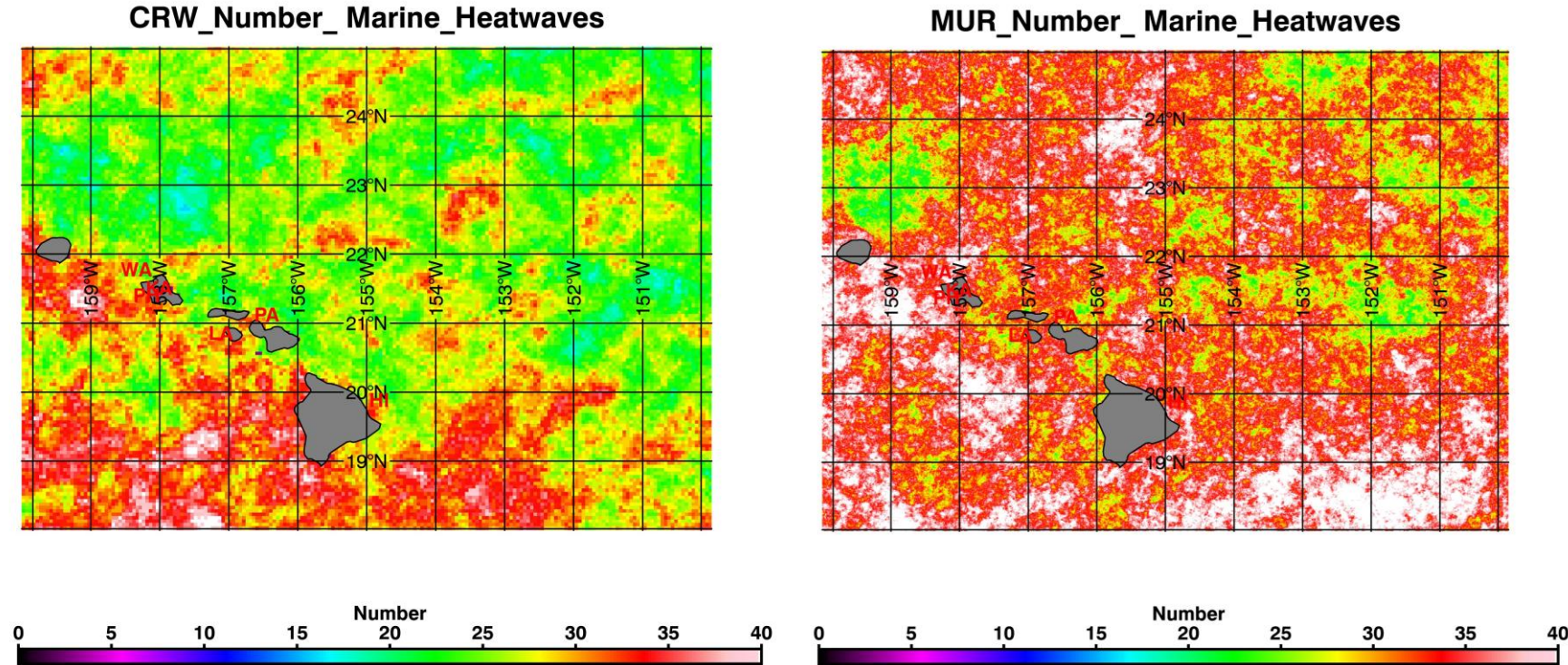
Marine Heat Waves

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Inter-comparison of Coral Reef Watch (CRW) and MUR MHW detection 2000-2020
Algorithm based on 90 percentile methodology, relying on the 2000-2020 daily clim.

- Similar number of max MHW event
- Differences in spatial distribution likely due to the difference in CRW (0.05°) and MUR (0.01°) spatial resolutions
- Discussion on the importance of L4 SST effective resolution for MHW detection
- Discussion on the contributions of future HR Thermal missions (SBG, TRISHNA, LSTM,...)



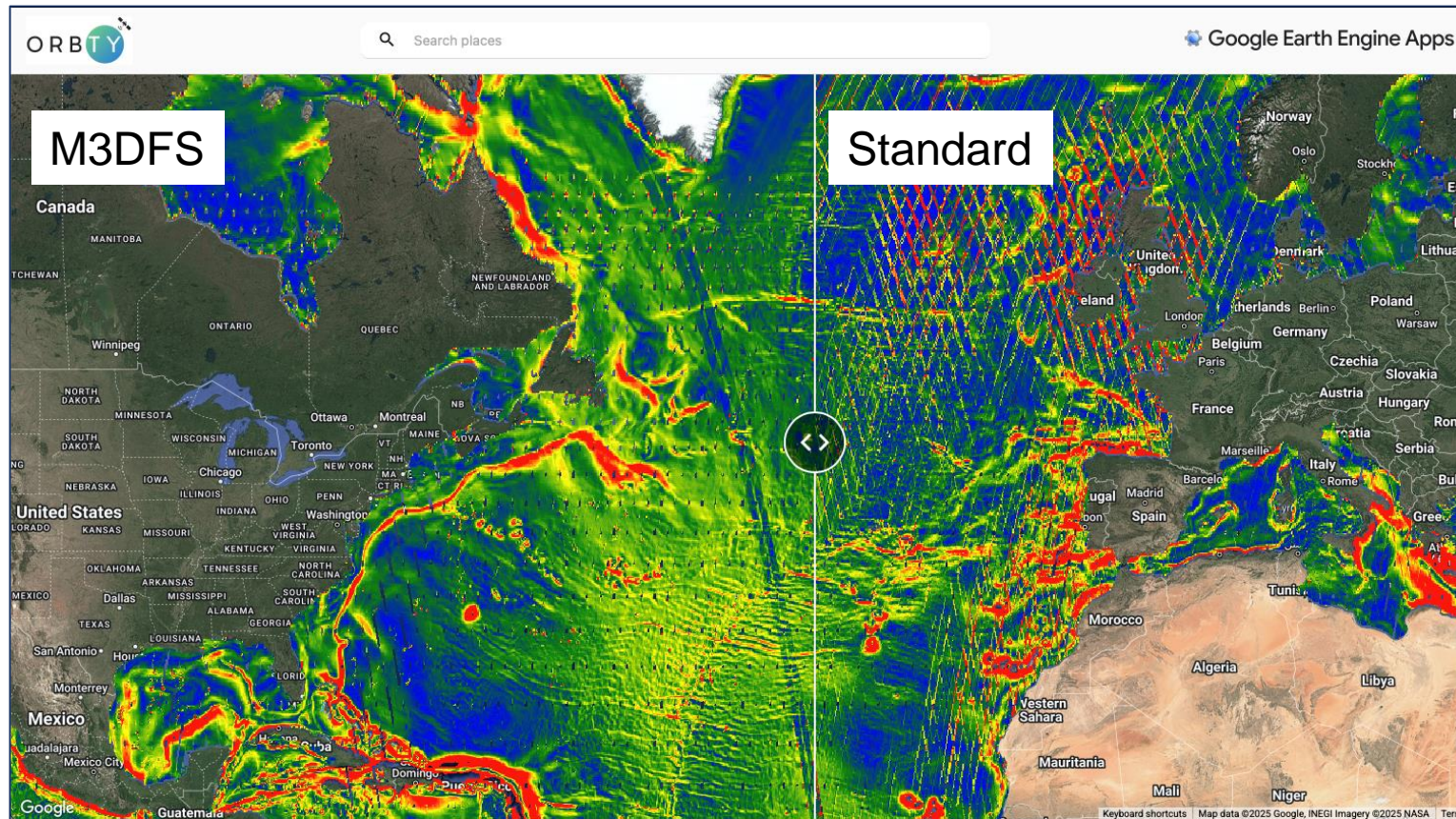
Contributor: J. Vazquez Cuervo (NASA/JPL-Caltech)

L3S mapping algorithm with M3DFS

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Multi-Dimensional Dynamic Data Fusion System - Generation of L3C/L3S data minimizing mapping artifacts



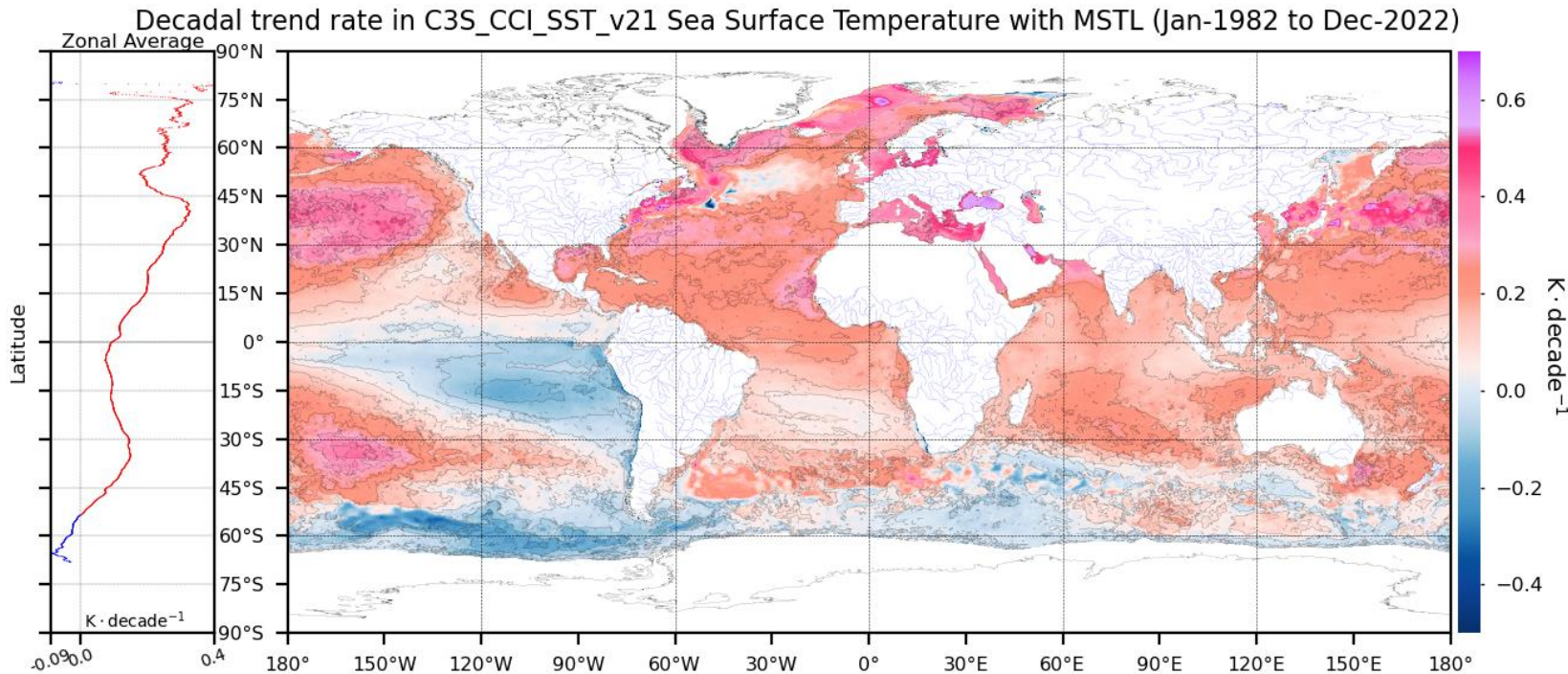
- M3DFS accounts for Dynamics in synoptic data, using information on space-time (3D) variability
- L3 Mapping applied to SST, OC, wind-speed/direction, and Sea level data (example on the left is for sea level from SWOT). Benefits on SST mapping expected (e.g. synergistic applications based on SSH-SST)
- Validation, inter-comparison studies ongoing/ suggested implementation to HR Thermal imagery (e.g. ECOSTRESS)

Contributor: Marouan Bouali - ORBTY

SST/Chl/Sea Level Trends (ESA-CCI)

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Dash et al. 2025 <https://doi.org/10.1175/JTECH-D-24-0007.1>

Saha et al., <https://doi.org/10.1175/JTECH-D-24-0008.1>

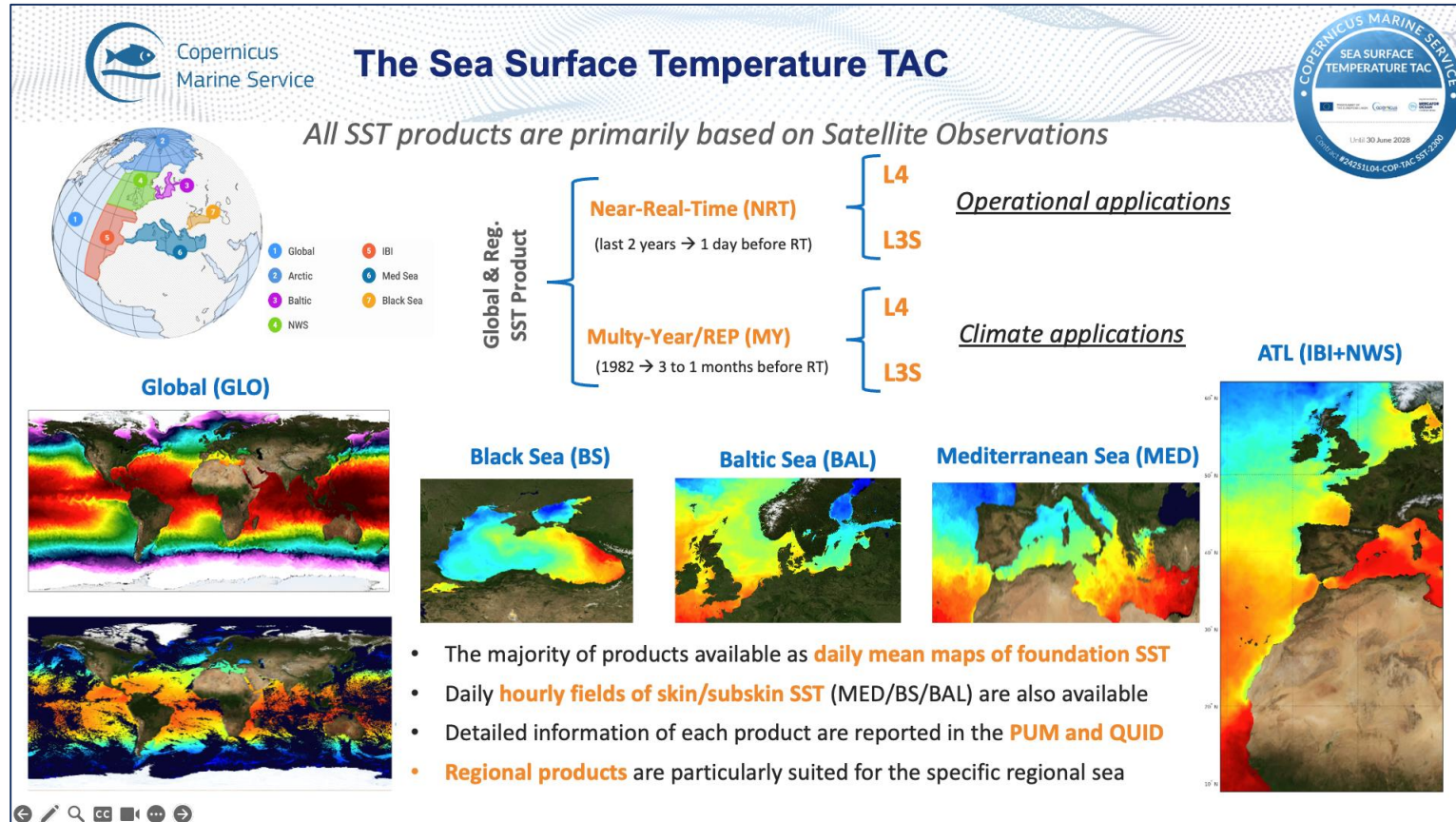
- Thorough review, user-friendly introduction on signal decomposition methods for time series (including technical tools, useful Python Libraries...)
- -SST Trends hotspots: North ATL/Pacific, MED/Black Seas, Red Sea, Persian Gulf (similarities with patterns on Sea Level Trends);
-No significant trend in Chl data (1998-2022), except in some coastal areas (e.g. Benguela);
- Future investigations will include cross-parameter linking. The results are included in the NOAA CEOS COAST viewer

Contributor: Prasanjit Dash - NOAA

Copernicus Marine Service SST Thematic Assembly Center

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- Structure of the Copernicus Marine SST-TAC
- Detailed presentation of SST-TAC products portfolio (GHRST format) and its main evolutions based on technological advancements (new mapping methodologies, future satellite missions and inter-comparison studies between L4 products) and impact on users
- Contribution of SST TAC for generating climate data records (Copernicus Climate Change C3S clause)

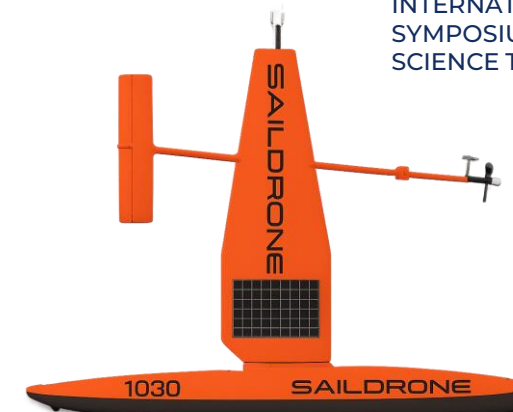
Contributors: Andrea Pisano (CNR-ISMAR) and SST TAC Team (CNR-DMI-Ifremer-UKMO-METNO)

Task Team Activities

Task 1: Validate L2, L3, and L4 SST gradients in highly variable regions using SailDrone and/or ship SST

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SCIENCE TEAM MEETING



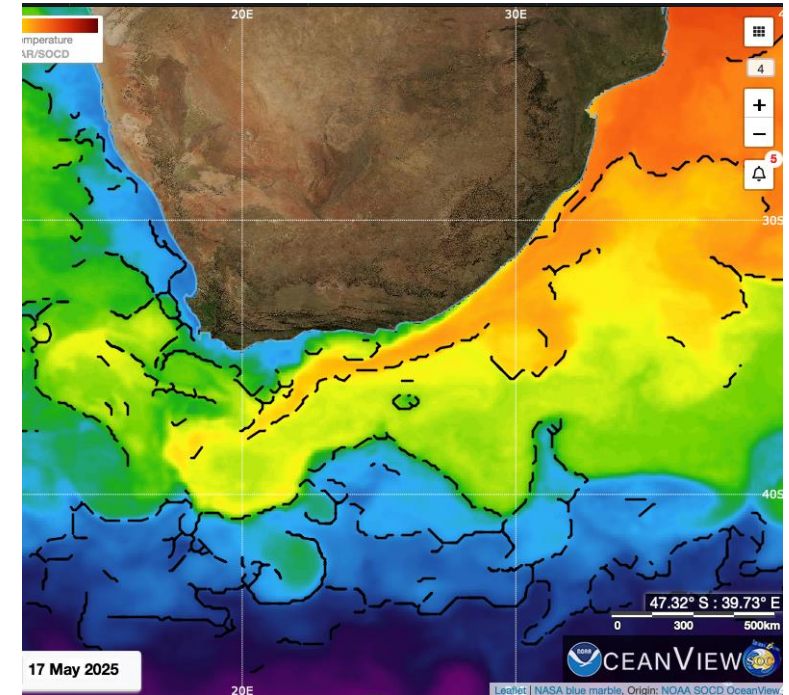
- Task Lead/Contact Point: *Jorge Vazquez-Cuervo*
- Involved TT members:
D. Wethey, M. Garcia Reyes , D. Ciani, A. Massi, M. Sabatini, A. Pisano
- Status/Expected completion:
Ongoing --> continue in 2026
- Task Description:
Inter-comparison of L4 SST products With SailDrone – derived SSTs. Interest in SST gradients inter-comparisons
- Activities carried out (2024/2025→2026):
*Internships with French Naval Academy Students for studies on the Copernicus Mediterranean L4 SSTs (supervised by D. Ciani, J. Vazquez Cuervo, A. Pisano, C. Fanelli,...)**
- Achieved Outputs and Results:
 - García-Reyes, Marisol, Gammon Koval, and Jorge Vazquez-Cuervo. "Characterizing the California Current System through Sea Surface Temperature and Salinity." *Remote Sensing* 16.8 (2024): 1311;
 - Vazquez-Cuervo, J., Steele, M., Wethey, D. S., Gómez-Valdés, J., García-Reyes, M., Spratt, R., & Wang, Y. (2024). Validation and Application of Satellite-Derived Sea Surface Temperature Gradients in the Bering Strait and Bering Sea. *Remote Sensing*, 16(14), 2530.
 - *paper in preparation, expected in 2026

Task 2: Produce online visualisation tool for L4 SST fronts

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- Task Lead/Contact Point: *Prasanjit Dash and Marouan Bouali*
- Status/Expected completion:
Ongoing --> continue in 2026
- Task Description:
online visualisation tool for L4 SST gradients has been deployed in the NOAA OceanView (OV) system and a visualisation tool for marine heatwaves is in development.
- Activities carried out/Outputs (2024/2025):
(<https://www.star.nesdis.noaa.gov/socd/ov/>),



Task 3: Develop the science to calculate SST and inter-compare

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- Task Lead/Contact Point: *Daniele Ciani and Mattia Sabatini*

- Involved TT members:

M. Sabatini, I. Karagali, A. Pisano, R. Santoleri, S. Marullo

- Status/Expected completion:

Ongoing --> continue in 2026

- Task Description:

Generation of L4 SSTs from the combination of IR and Microwave SST in the Mediterranean Region

- Activities carried out/Outputs (2024/2025→2026):

Implementation of a numerical study to evaluate the potential of the Copernicus Imaging Microwave Radiometer mission for the L4 SST mapping in the Mediterranean Sea.

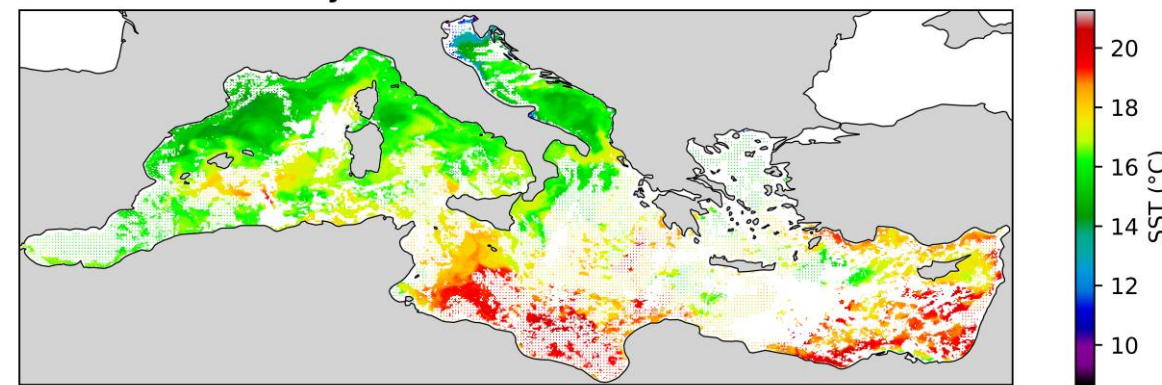
*Setup of a collaboration with DMI (thanks to Jacob, Ioanna, and Pia) for a follow-up study on the Baltic and Mediterranean Sea within the SST TAC framework**

- Achieved Outputs and Results:

Sabatini, M., Pisano, A., Fanelli, C., Buongiorno Nardelli, B., Liberti, G.L., Santoleri, R., Donlon, C. and Ciani, D., 2025. Preliminary Assessment of the Impact of the Copernicus Imaging Microwave Radiometer (CIMR) on the Copernicus Mediterranean Sea Surface Temperature L4 Analyses. Remote Sensing, 17(3), p.462.

**expected paper in 2026 and uptake within the Copernicus Marine Service + follow-up on SST gradients computation from L1 data based on Ciani et al. 2023 (uptake from ESA-EE10 Harmony Science Studies)*

Synthetic L3S IR+CIMR SST



Task 4: Validate SST gradients/fronts with other independent but related data

- Task Leads: David Wethey (University of South Carolina), Nico Weidberg (University of South Carolina), and Jorge Vazquez (NASA/JPL)
- Task Description: Aim to validate SST gradients/fronts with other independent but related data (e.g., sea surface salinity gradients or altimeter-derived currents), using OceanView.

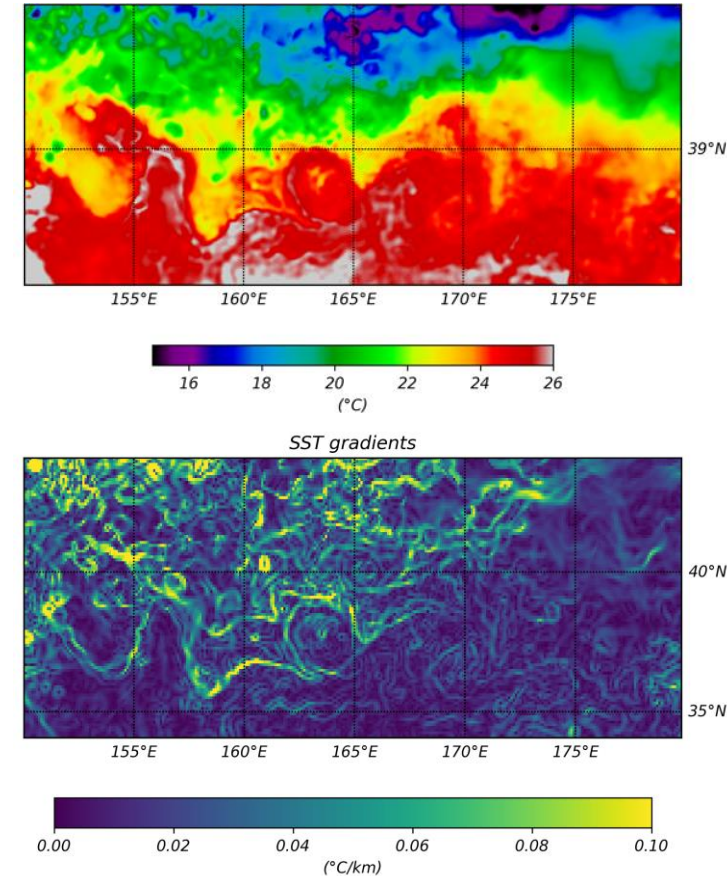
*No significant progress on this task in 2024/2025,
still evaluating ways to go for the next year*

Task 5/6: Compare feature resolution/SST gradients of various L4 products across different marine regions;

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SCIENCE TEAM MEETING

- Task Lead/Contact Point: Daniele Ciani
- Involved TT members:
*A. Pisano, C. Yang, D. Cavaliere, S. Marullo, R. Santoleri (CNR-ISMAR),
C. Gonzalez-Haro (ICM-CSIC)*
- Status/Expected completion:
Ongoing-> 2026
- Task Description:
*Implement existing/explore new methodologies to define a “resolution” metric
in the spatial domain*
- Activities carried out/Outputs (2024/2025→2026):
*feature resolution studies (using spectral analyses) for L4 SST data.
Support to the Copernicus C3S Climate Data Store EQC activities and to the
Copernicus Marine Service (SST TAC)*
- Achieved Outputs and Results:
publication of Jupyter Notebooks (e.g. <https://cds.climate.copernicus.eu/datasets/satellite-sea-surface-temperature?tab=overview>)/papers (expected in late 2025/2026)



Task 7: SST fronts and Ocean Colour Fronts

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SCIENCE TEAM MEETING

Task Leads: Prasanjit Dash (NOAA), Marouan Bouali (ORBTY Ltd.), Jishad M. (ISRO), Neeraj Agarwal (ISRO)

Task Description: Focuses on the detection of ocean front in SST and Ocean Color datasets. It also includes data fusion studies to improve the quality of satellite-derived Ocean Colour front estimates.

Status/Expected completion:

Ongoing-> 2026

Activities carried out/Outputs (2024/2025→2026)

Tested several methods for automatic detection of SST and OC fronts

Achieved Outputs and Results:

Implemented ORBTY's Multidimensional Dynamic Data Fusion System (M3DFS) for L3S SST from the constellation of polar-orbiting satellite sensors (to be presented at GHRST26)

Plans for 2026:

Adapt M3DFS for the generation of a new Multi-sensor Ocean Color product
Continue testing algorithms for the detections of SST and OC fronts

Expected outputs

New SST and Chl-a products with easier detection of bio-physical fronts

Challenges and Needs

Interactions with two Task Teams for which inter-comparison studies should be relevant:

- HIGH-LATITUDE TT
- HIGH-RESOLUTION TT (future missions, definition of coastal masks for HR Missions, e.g. SBG, TRISHNA, LSTM)
- **Challenge: put together the outcome of the ongoing tasks and collaborate on a scientific study**

Thanks for listening

