The CMEMS In Situ TAC multi-year & multi-variate products to monitor & understand the ocean variability

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Virtual EGU General Assembly – April 28, 2021

Introduction

Highlighting the capacity of *in situ* observations to describe, analyse & understand the blue & green ocean state & variability from sea surface to deep ocean, from coastal to open sea waters at both short-term (event) & long-term temporal scales, through the In Situ TAC contributions to the CMEMS Ocean State Report.

Outline

1. CMEMS In Situ TAC multi-platform observations
2. CMEMS In Situ TAC scientific applications
3. Contributions to the CMEMS Ocean State Report
4. CMEMS In Situ TAC in the next decade

CMEMS INSTAC network

Multi-variate multi-scale *in situ* observations

Multi-platform network


Profiling floats


Vessels


Moorings


Tide gauges


Drifters


Gliders


Sea mammals


HF radars[a]

Saildrones[b]

(a) *Implemented in April 2019* (b) *Since December 2019*

Global

Polar

Regional

Coastal

Local

Boundary currents

45000 platforms integrated, 7000 active platforms in NRT, 300 providers

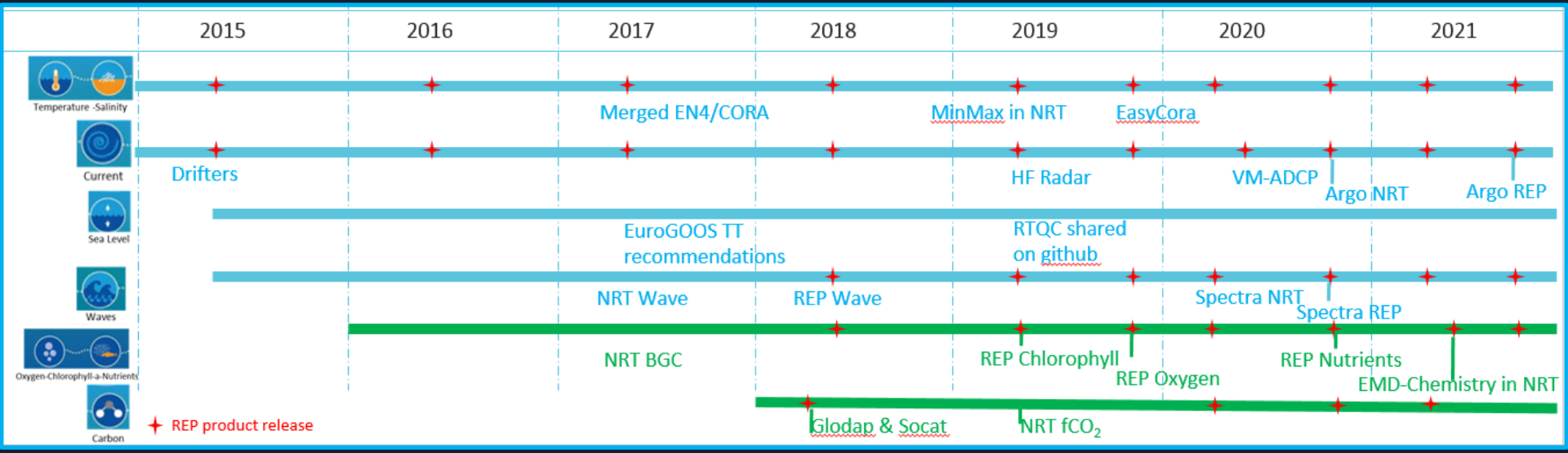
CMEMS In Situ TAC

Global & 6 Europeans seas
Near-Real Time & REProcessed
Quality Controlled, free, homogenised
Physical (c) & biogeochemical (d) data
Various (x,y,z,t) scales
Surface & deep ocean
Since 1950

(c) Temperature, salinity, currents, waves, sea level
(d) Oxygen, chlorophyll, nutrients, carbon, pH

CMEMS INSTAC network

Multi-variate multi-scale *in situ* observations



Portfolio In Situ TAC

	NRT	REP
T&S	Global + all regions	Global
Currents	Global + NWS/MED/BAL	Global
Sea level	Global + all regions	Not yet
Waves	Global + all regions	Global
BGC	Global + all regions	Global
Carbon	Global	Global

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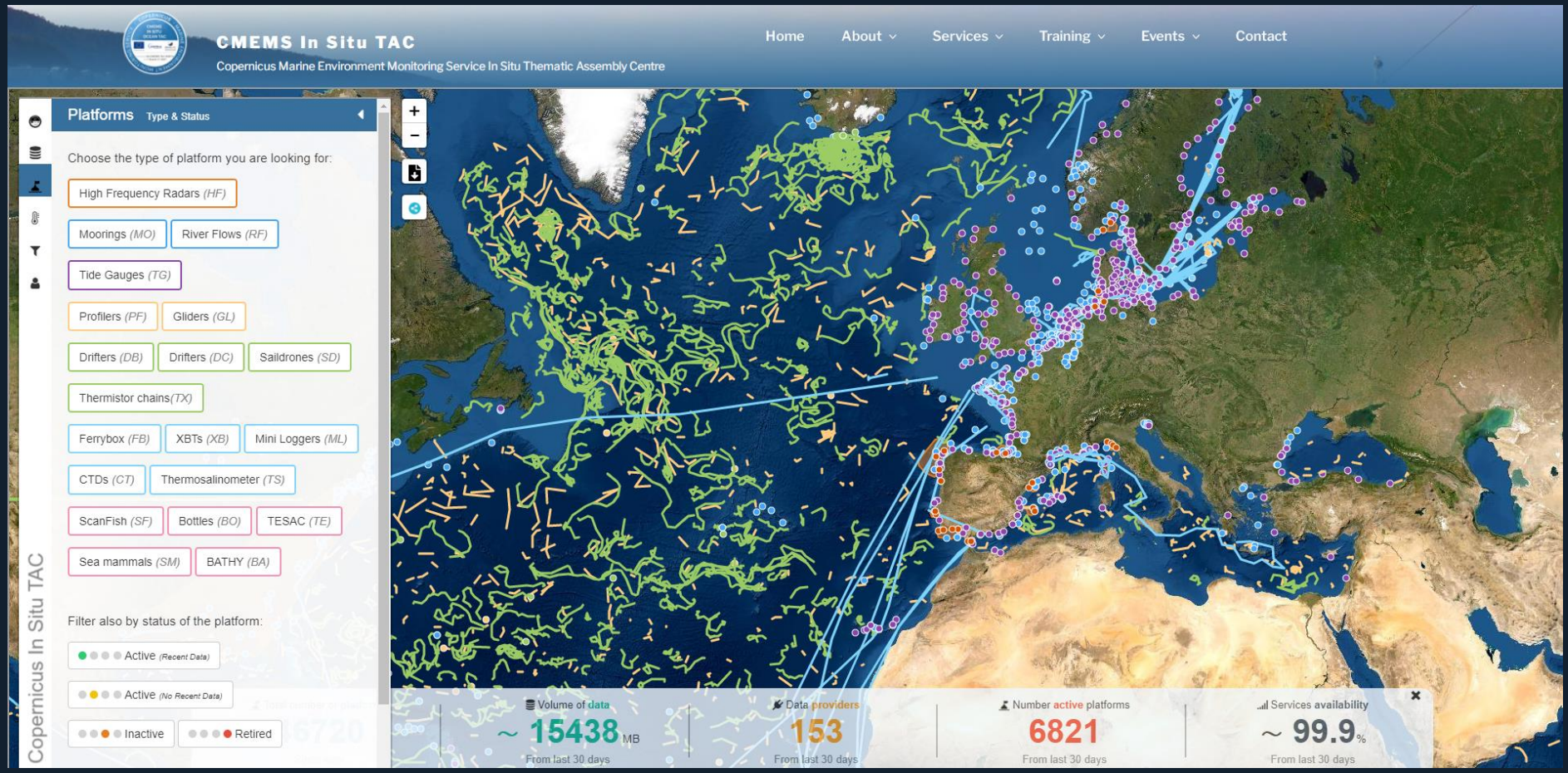
CMEMS INSTAC network

Multi-platform multi-variate multi-scale *in situ* observations



Last 30 days (accessed on April 21, 2021)

www.marineinsitu.eu

→ *Dashboard (next talk by P. Rotllán-García)*

CMEMS INSTAC scientific applications

Support to operational oceanography

- Models (initialization, forcing, data assimilation, model validation)
- Blue & green ocean forecasting / analysis / reanalysis
- Satellite calibration/validation
- Downstream services

Monitor the 4-D ocean at various spatial & temporal scales

- Essential information on ocean state, variability & changes
- Long-term variability analysis & detection of events
- Ocean health, climate monitoring, ocean response in real time

↳ Contributions to CMEMS Ocean State Report

INSTAC contributions to CMEMS OSR

Ocean State Report (*von Schuckmann et al*. , 2016, 2018, 2019, 2020, 2021)

1. Ocean monitoring indicators (CMEMS atlas)

- Temperature & salinity
- Ocean heat content
- Water mass & heat exchanges
- SL / SST / wave extreme variability

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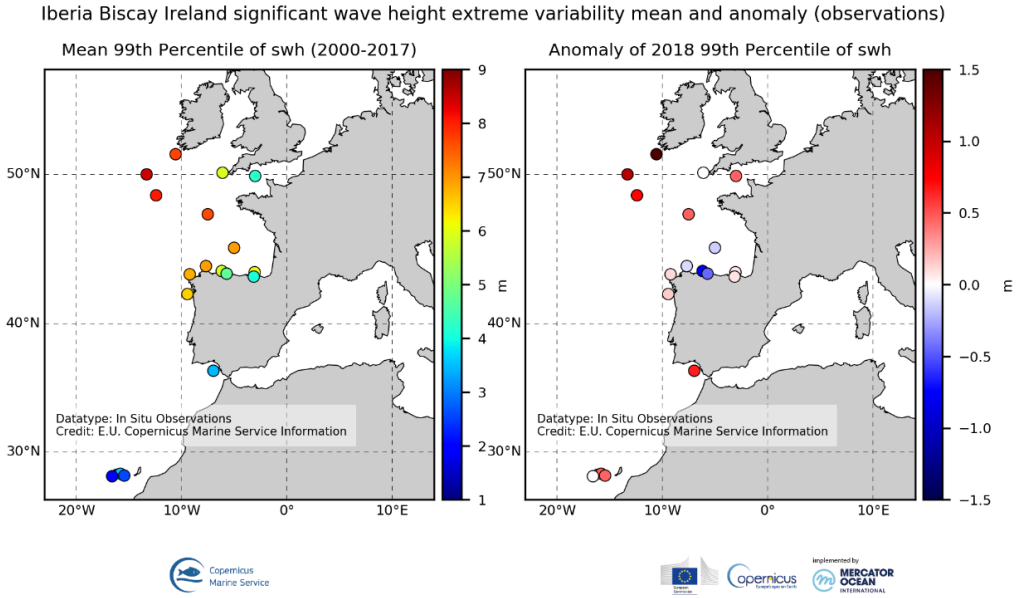
Ocean State Report (*von Schuckmann et al.* , 2016, 2018, 2019, 2020, 2021)

1 Ocean monitoring indicators (CMEMS atlas)

- Temperature & salinity
- Ocean heat content
- Water mass & heat exchanges
- SL / SST / wave extreme variability

- Illustration for wave in IBI region
- Also applied to
  - data: observations & models
  - variables: SL/SST/SWH
  - regions: IBI/MED/NWS/BAL
- Published in OSR#3 (*Álvarez Fanjul et al.*, 2019)
- On-line in CMEMS website



(from marine.copernicus-.eu/access-data/ocean-monitoring-indicators)

INSTAC contributions to CMEMS OSR

Ocean State Report (*von Schuckmann et al*. , 2016, 2018, 2019, 2020, 2021)

1. Ocean monitoring indicators

2. Ocean circulation variability

- Intensification of Iberian Poleward Current
- Cold-fresh anomaly in North Atlantic
- Deep convection in Labrador Sea
- Anticyclonic eddy anomaly in western Med
- Unusual salinity pattern in South Adriatic

INSTAC contributions to CMEMS OSR

Ocean State Report (*von Schuckmann et al.* , 2016, 2018, 2019, 2020, 2021)

1. Ocean monitoring indicators

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- Intensification of Iberian Poleward Current
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- Published in OSR#3 (*Gourrion et al.*, 2019)
- CORA obs dataset GLORYS12v1 model

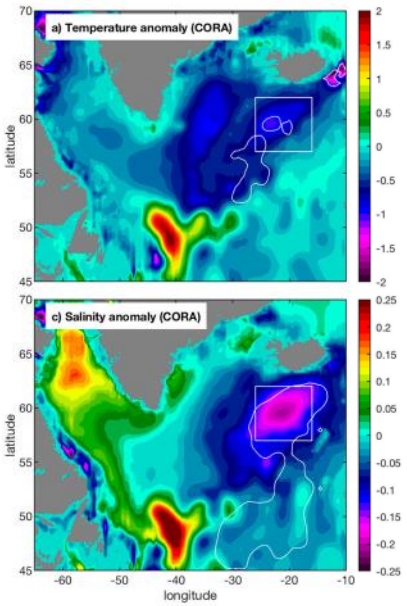

Fig 1. T & S anomaly within the 100-400m layer in 2017

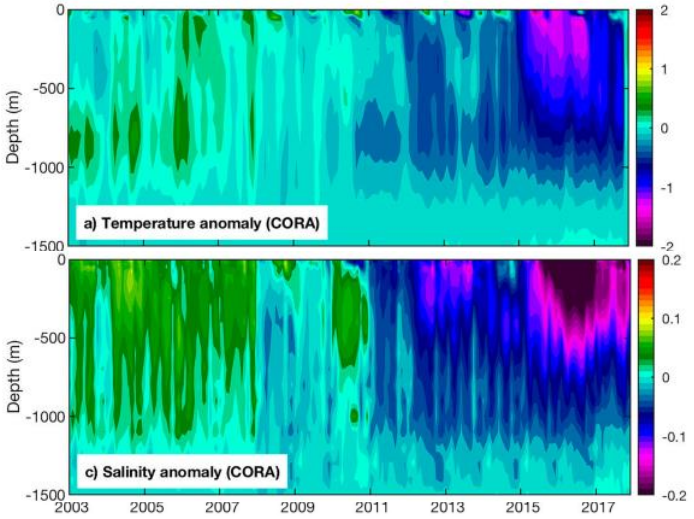

Fig 2. Depth-time diagram of T & S anomalies averaged over the control box (Fig1).

INSTAC contributions to CMEMS OSR

Ocean State Report (*von Schuckmann et al*. , 2016, 2018, 2019, 2020, 2021)

1. Ocean monitoring indicators

2. Ocean circulation variability

3. Marine ecosystem variability

- Decline of silicate/nitrate in northern North Atlantic
- Changes in salinity & phytoplankton in south Adriatic

INSTAC contributions to CMEMS OSR

Ocean State Report (*von Schuckmann et al*. , 2016, 2018, 2019, 2020, 2021)

1. Ocean monitoring indicators
2. Ocean circulation variability
3. Marine ecosystem variability
4. Climate change / warming
   - Water mass exchanges & impact on ecosystem
   - Mediterranean water mass changes
   - Tropical cyclones, “Medicanes”
   - Decline of oxygen in Black Sea
   - Extreme waves during storm in Baltic Sea

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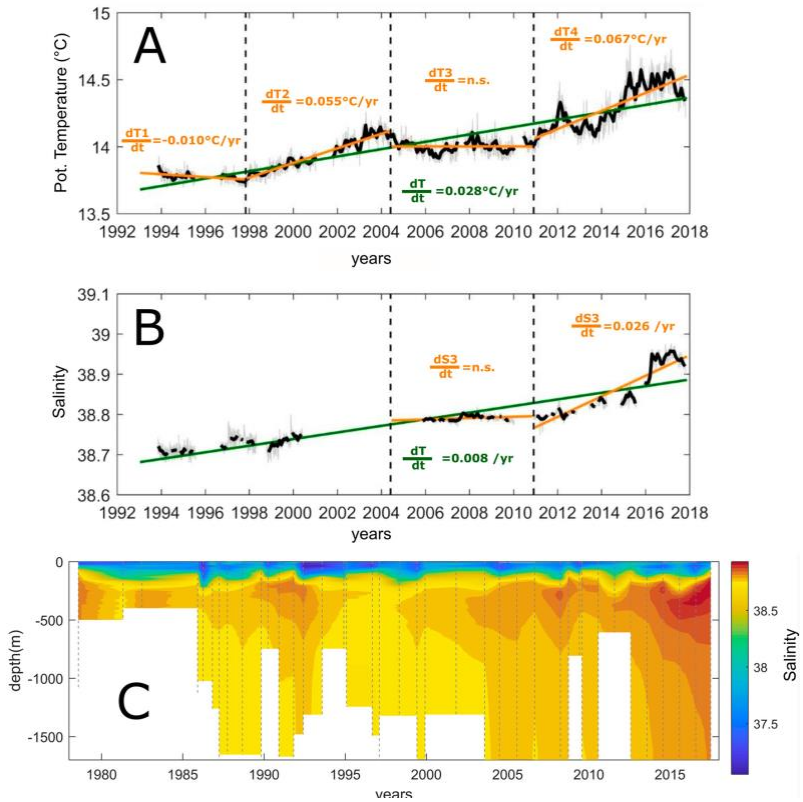

Daily & monthly time series (1993-2017) of (A) temperature & (B) salinity at 400m in Sicily Channel (mooring). (C) Hovmöller diagram of salinity in the central part of the channel from repeated CTD casts, 1978-2017.

- Published in OSR#3 (*Schroeder et al.*, 2019)

INSTAC contributions to CMEMS OSR

Ocean State Report (*von Schuckmann et al*. , 2016, 2018, 2019, 2020, 2021)

1. Ocean monitoring indicators
2. Ocean circulation variability
3. Marine ecosystem variability
4. Climate change / warming
5. Operational applications & services
   - Pollution risk (particle retention conditions)
   - Marine emergency & search-and-rescue (IBISAR)
   - Storm / waves forecasts & associated alerts
   - Extreme river discharges

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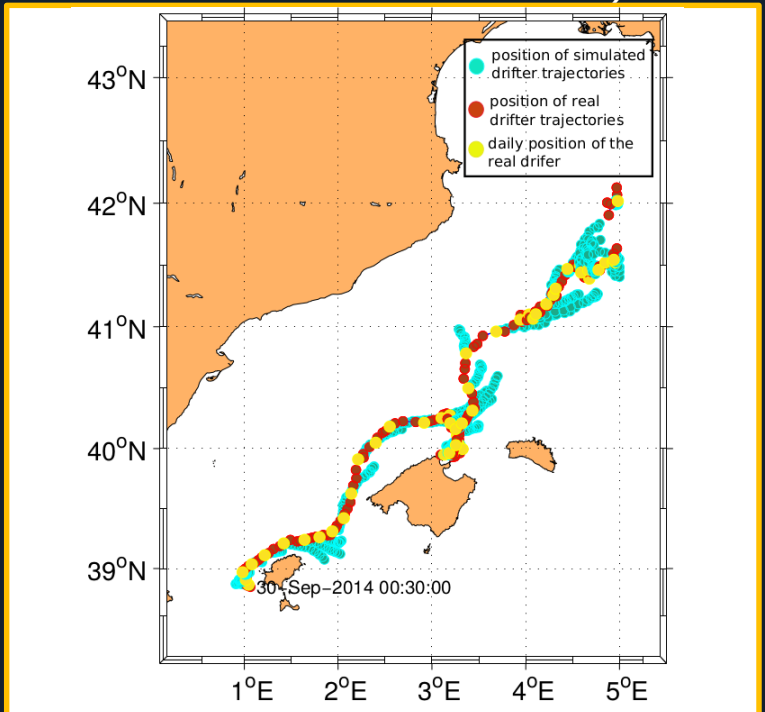

Comparison of virtual trajectories of particles advected with the IBI model velocity field with a real CODE drifter trajectory. (from ibisar.es)

Talk by E. Reyes at 14:06

CMEMS INSTAC in the next decade

In line with present & future scientific-societal-environmental challenges, INSTAC will continue to serve the overall need to understand and predict the ocean state and variability:

- Maintaining the data flow of the current observational network
- Integrating new platforms
- Enhancing activities in coastal & polar regions
- Enhancing the integration of biogeochemical data
- Enhancing the spatial & temporal resolutions
- Improving methodologies & developing new metrics
- Developing new *in situ* products
- Cooperating with main European integrators
- Supporting user uptake
- Strengthening the user engagement

Thanks for your attention, thanks to all partners!