WORLD OCEAN CIRCULATION USER CONSULTATION MEETING

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UPPER OCEAN CIRCULATION FROM THE COMBINED USE OF IN SITU AND SPACEBORNE OBSERVATIONS

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MULTIOBS product

- Part of the Ocean Multi Observations TAC of CMEMS
- Based on the combination of satellite & in-situ observations using statistical methods
- Global 3D Ocean Temperature, Salinity and Geostrophic currents
  - Global, Weekly/Monthly, 1/4°, [0-1500m] on 24 levels, REP (1993-2017) & NRT (~7D)
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- Part of the Ocean Multi Observations TAC of CMEMS
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  - Weekly/Monthly, 1/4°, [0-1500m] on 24 levels, REP (1993-2017) & NRT (-7D)

- Main idea behind: to take advantage of the strength of the two main components of the GOOS
  - High resolution space/time but integrated/surface satellite observations
  - Sparse in situ observations, providing the vertical structure
Overview of the method

- Geoide (GOCE)
- Sea Level (Multi satellite Altimetry)
- SST (Multi satellite)
- SSS (SMOS)
- Mean dynamic topography
- Ocean surface salinity
- 3D Ocean geostrophic currents
- Surface drifters
- Argo floats
- Ocean surface geostrophic currents
- 3D Ocean temperature and salinity
- Argo floats
Overview of the method

- **3D TS**: multiple linear regression + optimal interpolation methods

  *Guinehut, Dhomps, Larnicol & Le Traon (2012)*

MULTIOBS SSS dataset: multivariate optimal interpolation method

Droghei, Buongiorno Nardelli & Santoleri (2016, 2018)
Overview of the method

CNES-CLS13: multivariate optimal interpolation method

Rio, Mulet & Picot (2014)

DUACS Altimetry-Derived Current Products

Talk: Faugere et al.
Overview of the method

- **Geoide (GOCE)**
- **Sea Level (Multi satellite Altimetry)**
- **SST (Multi satellite)**
- **SSS (SMOS)**
- **Surface drifters**
- **Argo floats**
- **Mean dynamic topography**
- **Ocean surface geostrophic currents**
- **Ocean surface salinity**
- **3D Ocean temperature and salinity**
- **3D Ocean geostrophic currents**

3D UVg: thermal wind equation

Mulet, Rio, Mignot, Guinehut & Morrow (2012)
Geostrophic current (100 m)
Geostrophic current (100 m)
Validation with VM-ADCP observations

**Coriolis data base**

42°S

54°S

130°E 150°E

**ADCP 6-hourly mean**

**MULTIOBS**

**Zonal**

**Meridional**

**Coriolis data base**

42°S

54°S

130°E 150°E

**ADCP 6-hourly mean**

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**Coriolis data base**

42°S

54°S

130°E 150°E

**ADCP 6-hourly mean**

**MULTIOBS**
Validation with VM-ADCP observations

Cravatte & al., JPO 2017

VM-ADCP (box C 1993-2015)

MULTIOBS (2013 mean, 170°W)
Validation with velocities from Argo drift at depth

**MEAN** of **MULTIOBS** versus **YoMaHa**, 1998-2017 in 1°x1° boxes (cm/s) – **1000m**

**YoMaHa**
Lebedev et al., 2007
Validation with velocities from Argo drift at depth

**RMSD** of MULTIOBS versus YoMaHa, 1998-2017 in 10°x10° boxes (cm/s) – 1000m

**Improvement:** Argo drift at depth to be used as an additional constraint
AMOC variability at 25°N

Floride Strait Transport from electrical cable

AMOC = Geost + Ekman + Florida
(MULTIOBS, Bryden et al., 2005)

Ekman Transport from wind stress ERAInterim

Geostrophic Transport from 75°W to 15°W and from the surface to 1000m
(MULTIOBS, Bryden et al., 2005)

⇒ Very consistent with Bryden et al, 2005
**Elephant Seal** tracks (black) match very well with **micronekton biomass** in mesopelagic layer estimated from **SEAPODYM** model forced by **MULTIOBS**.
Recommendations

- **Multi observations products** approach to be **continued & improved**: operational through CMEMS but **additional R&D required** (upstream obs, method)

- **Complementary approach** between **observed products** and **models** to be continued

- **Ageostrophic components** of the circulation to be added (effect of wind, turbulent mixing, inertial oscillations...) → **combination with COPERNICUS-GLOBCURRENT** surface current fields

- **Increase** of temporal, horizontal, vertical **resolutions**, improvement near coastal areas, have **dedicated products at regional scales**

- **In situ measurements** are needed (physical content, forcing & validation → uncertainty information), especially at depth