MERCATOR OCEAN INTERNATIONAL

Satellite observations for ocean prediction

Evolution of the satellite observing system (European perspective) and role of Ocean Predict

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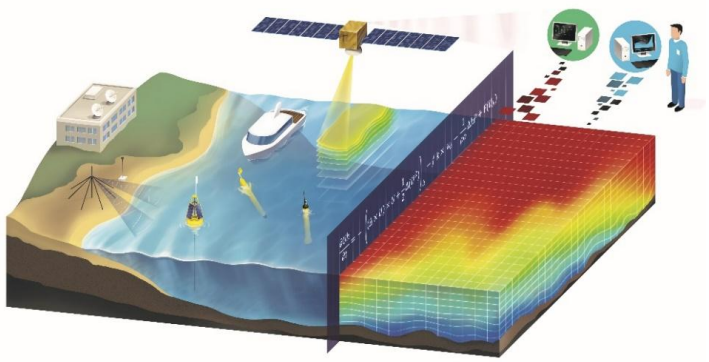
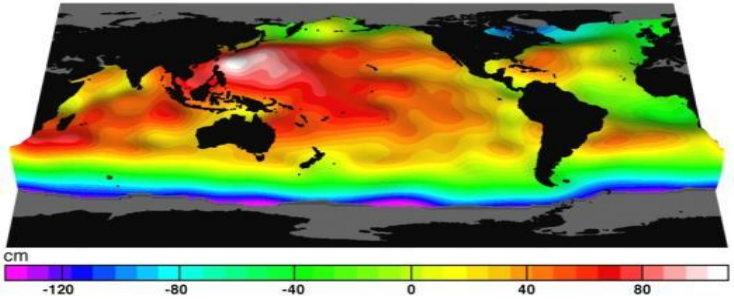
Mercator Ocean International

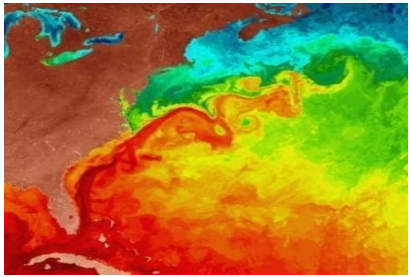


Unique contribution of satellite oceanography

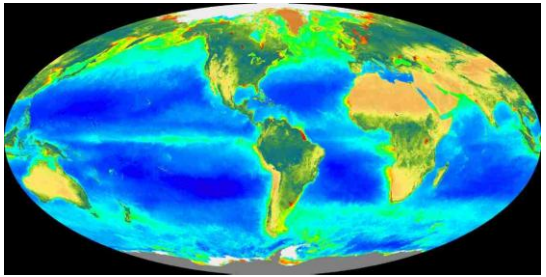
Global, real time and high resolution parameters needed to **constrain ocean, wave and sea ice models** through data assimilation and/or to validate them



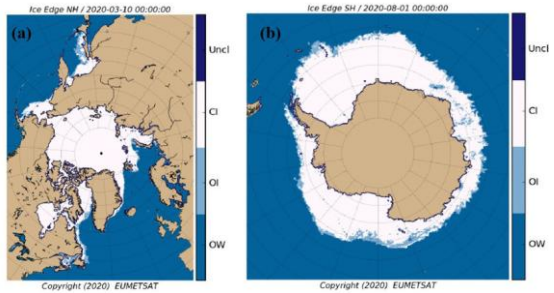
Sea Level, ocean currents (geostrophy)



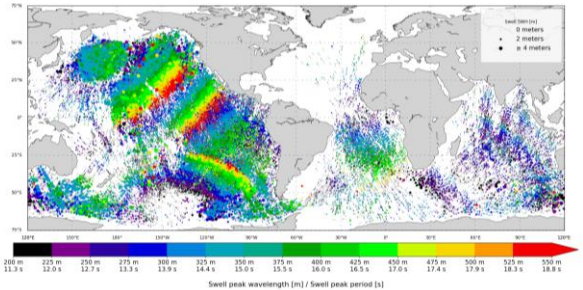
Sea Surface Temperature



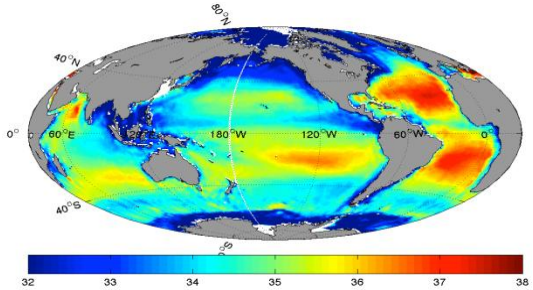
Ocean Colour, Primary production



Sea Ice (concentration, drift, thickness)



Waves and Winds

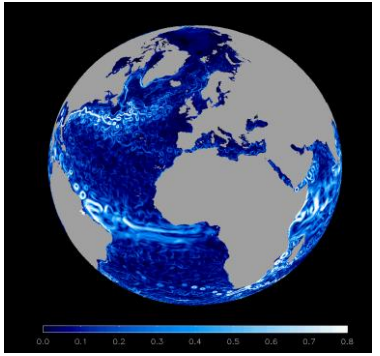


Sea Surface Salinity

Satellite altimetry

Major role for ocean prediction

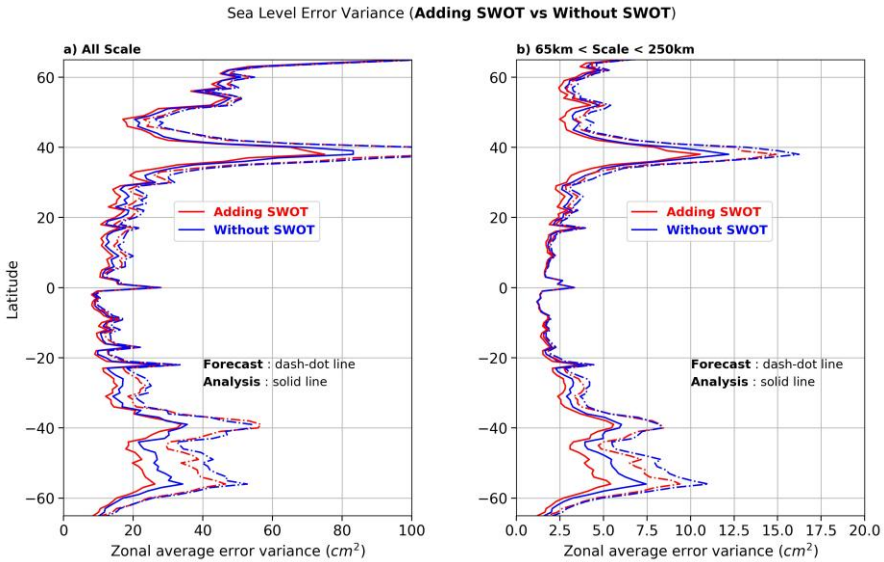
- T/P, Jason 1/2/3 and Sentinel 6 A&B: reference missions
- Imperative need to observe the ocean at higher resolution for operational applications => at least 4 altimeters (more needed)
- Improvement of radar altimeter technology (SAR mode) (Cryosat-2, S3, S6)
- from 2023: a new revolution with wide-swath interferometry altimetry and the SWOT satellite.



- Launch of Sentinel 3C – September 2026.
- 2028/2029. Launch of first CRISTAL mission
- 2030. Continuity of the reference mission at risk (Sentinel 6C cancellation). Sentinel 6 NG in 2033/2034 only.
- 2034 – Sentinel 3 NG TOPO (constellation of two swath altimeters)

SWOT: a game changer

- Impact of SWOT in the MOi global 1/12 system (Benkiran et al., GRL, 2026)
- Use of L3 CNES products. Very positive results.
- Operational implementation in the Copernicus Marine portfolio planned from the end of 2026.
- L3 NRT processing capabilities (2 days) planned.



Sea level error variance (cm^2): (a) all scales, (b) scales between 65 and 250 km; assimilation of 3 nadirs (blue lines) or SWOT (red lines). Error calculated wrt Saral/Altika (not assimilated).

Copernicus Context

CURRENT GENERATION SENTINELS

Sentinel-1 A + B C-Band Radar	**Sentinel-1 C + D** C-Band Radar
Sentinel-2 A + B High Res Optical	**Sentinel-2 C + D** High Res Optical
Sentinel-3 A + B MR Optical + Altimeter	**Sentinel-3 C + D** MR Optical + Altimeter
Sentinel-4 A Atm. Chemistry (GEO)	**Sentinel-4 B** Atm. Chemistry (GEO)
Sentinel-5P Atm. Chemistry (LEO)	**Sentinel-5** Atm. Chemistry (LEO)
Sentinel-6 A Altimeter	**Sentinel-6 B** Altimeter

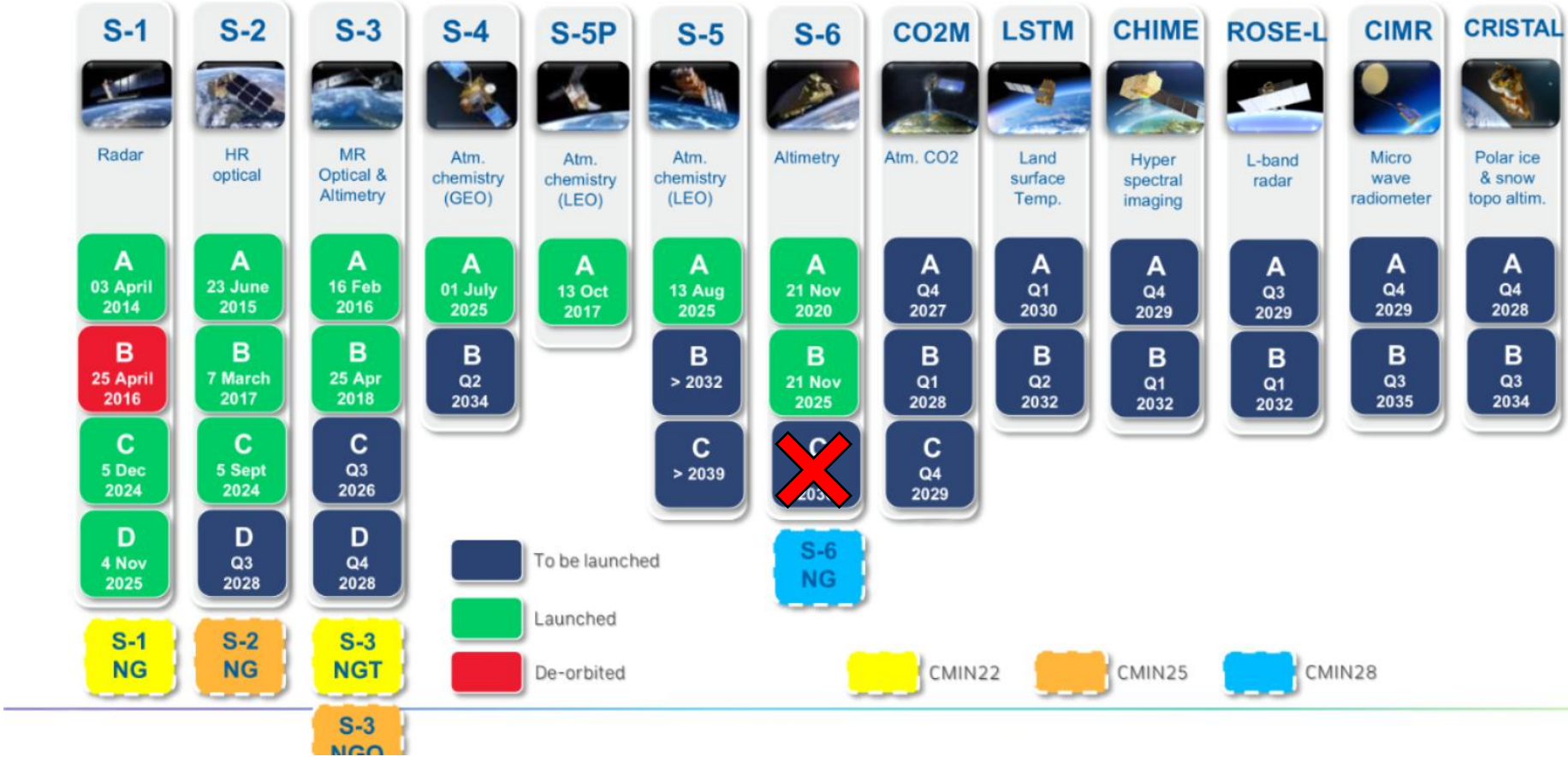
NEXT GENERATION SENTINELS

- **Sentinel-1 NG**
  C-Band Radar
- **Sentinel-2 NG**
  High Res Optical
- **Sentinel-3 NG Topogr.**
  Altimeter
- **Sentinel-3 NG Optical**
  MR Optical

COPERNICUS EXPANSION

- **ROSE-L**
  L-Band Radar for Arctic and Cryosphere Monitoring, Land and Emergency Mapping, Ground Motion, Soil Moisture
- **CO2M**
  Carbon Dioxide Monitoring
- **CRISTAL**
  Polar Ice & Snow Topogr Altim.
- **CHIME**
  Hyperspectral Imaging
- **LSTM**
  Land Surface Temperature
- **CIMR**
  Imaging Microwave Radiometer

Copernicus Satellite Component – Planning of launches

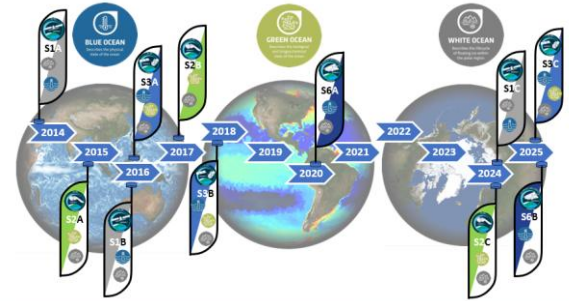


European perspective on the interactions between ocean prediction community and satellite agencies

Interactions between Copernicus Marine and the Copernicus Space component

- ❑ Integration of Sentinels (S1, S2, S3 and S6)

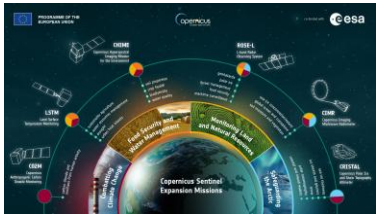
=> Regular impact assessments



- ❑ Preparing for expansion missions (Arctic, Coastal) (CIMR, CRISTAL, ROSE-L, LSTM, CHIME)
- ❑ Support the EC and ESA for Sentinel NG mission design
- ❑ Analyse the potential of contributing missions and New Space actors from the private sector

⇒ Maintain reference document on requirements

⇒ Advocacy



Recommendations for the evolution of the Copernicus Satellite Component

- Continuity of the Sentinel 1, 2, 3 and 6 missions.
- Develop new capabilities for wide swath altimetry to complement S6 and S3 altimeter observations. This is planned as part of the S3 NG TOPO.
- Fly a geostationary ocean colour mission over Europe to complement S3 and S2 present and future (NG) observations. Gap.
- Fly a European microwave mission for high spatial resolution (< 10 km) ocean surface temperature and sea ice concentration. Planned with CIMR.
- Ensure continuity (with improvements) of the Cryosat-2 mission for sea ice thickness and sea level monitoring in polar regions. Planned with CRISTAL.
- Develop capabilities to observe ocean currents from space. Fly one or several research missions. Gap (ODYSEA not selected).
- Reinforce international coordination to optimize and make the best use of satellite observations from a growing number of space agencies.

Working with the space agencies - main messages to Ocean Predict

Closely follow the evolution of satellite missions

Communicate when integrating new satellite missions

Assess the impact and communicate on results

Support the design of future missions

Gap analyses / common view

Authoritative voice wrt recommendations