Operational EUMETSAT Satellite Products and Services for Oceanography: Status and Outlook

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European Organisation for the Exploitation of Meteorological Satellites

Intergovernmental organisation founded in 1986

Supplies weather and climate-related satellite data, images and products – 24 hours a day, 365 days a year – to the National Meteorological Services of our Member States in Europe, and other users worldwide

Operates of a fleet of satellites in geostationary and polar orbit, which provide a wide array of Earth observation data for weather, climate and environmental monitoring.
EUMETSAT and the SAF Network

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- THE NETHERLANDS
- NORWAY
- POLAND
- PORTUGAL
- ROMANIA
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- SLOVENIA
- SPAIN
- SWEDEN
- SWITZERLAND
- TURKEY
- UNITED KINGDOM

Satellite Application Facility for Ocean and Sea Ice
# EUMETSAT marine products stream overview

## Marine Products

- **Sea Surface Height**
- **Significant Wave Height**
- **Wind Speed**
- **Sea Surface Temperature**
- **Fluxes**
- **Wind Vectors**
- **Sea Ice Parameters**
- **Ocean Colour**

## Applications

<table>
<thead>
<tr>
<th>Application</th>
<th>National Meteorological Services</th>
<th>CMEMS, Ocean Prediction / Information Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather Forecasting (NWP, long term forecasts, high impact events)</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Marine Meteorology</td>
<td>✔️</td>
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<tr>
<td>Marine Environment Monitoring</td>
<td>✔️</td>
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<tr>
<td>Climate Monitoring</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Operational Oceanography</td>
<td>✔️</td>
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</table>
The growing stream of EUMETSAT marine products

Main contribution from **Copernicus** programme and EUMETSAT own missions **Meteosat** and **Metop**

- **MSG**
  - SST, Fluxes

- **MTG**
  - SST, Fluxes

- **EPS**
  - EPS-SG
  - SST, Wind vector

- **JASON**
  - Sea surface height, Waves, Wind speed

- **SENTINEL-3**
  - SST, Ocean Colour, Sea surface height, Waves, Wind speed

Value Added Services

End Users
Copernicus Sentinel-3 Constellation

Sentinel-3A launched on 16\textsuperscript{th} February 2016

Its twin Sentinel-3B launched on 25\textsuperscript{th} April 2018

Constellation fully operational since November 2018
Sentinel-3 OLCI Ocean Colour Products Outlook

- Products are “operational with limitations” → remove limitations
  - Apply System Vicarious Calibration to S3B
  - Improve CHL retrieval algorithm
  - Improve “bright pixel correction” algorithm
- Sustained validation /monitoring with *in situ* data
  - Including Fiducial Reference Measurements

- Evolutions
  - New atmospheric correction
  - Express Uncertainties
  - New products (Inherent Optical Properties, Fluorescence)
Copernicus Sentinel-3 constellation is now operational

<table>
<thead>
<tr>
<th>OLCI-A, 1-day coverage</th>
<th>OLCI-A, 2-day coverage</th>
<th>OLCI-A, 3-day coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHL_OC4ME</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OLCI-A + OLCI-B, 1-day coverage</th>
<th>OLCI-A+OLCI-B, 2-day coverage</th>
<th>OLCI-A+OLCI-B, 3-day coverage</th>
</tr>
</thead>
</table>
Sentinel-3 Altimetry Products Outlook

• Level 2 products are fully operational in Near Real Time (3h timeliness), Short Time Critical (36h), Non Time Critical (2 months) timeliness

• Level 2 improvements under study:
  ✓ Better retrieval of sea ice parameters: freeboard, leads
  ✓ Improvement of wet tropospheric correction
  ✓ Sea state bias correction for SAR
  ✓ Development of a Coastal Altimetry product

• Level 2P and Level 3 Services for Sea Level Anomaly and Significant Wave Height
  ✓ Mono-mission satellite-based along-track products homogenized with respect to a common reference mission - currently Jason-3
  ✓ Increase of resolution to 5 Hz (target date 2021)
Copernicus Sentinel-3 constellation is now operational

Seal Level Anomaly (cm) from Sentinel-3A, Sentinel-3B, Jason-2 & Jason-3 off Newfoundland, 08/05/2018
S3 SLSTR Sea Surface Temperature Products Outlook

<table>
<thead>
<tr>
<th>Perfo. factor</th>
<th>Requirement Threshold, [goal]</th>
<th>S3A current status</th>
<th>S3B current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST absolute accuracy</td>
<td>0.3K</td>
<td>Compliant</td>
<td>Compliant</td>
</tr>
<tr>
<td>SST temp. stability</td>
<td>0.2K/decade</td>
<td>Preliminary</td>
<td>Preliminary</td>
</tr>
</tbody>
</table>

- Sustained validation /monitoring with *in situ* data
  - Including Fiducial Reference Measurements (Copernicus high resolution SST buoys, DBCP)
- Evolutions
  - SLSTR *sea-ice surface temperature*
  - Improvement of *Cloud screening* and related quality indicators
  - Express *Uncertainties*
Copernicus Sentinel-3 constellation is now operational

Sentinel-3 SLSTR SST – first 30 months
OSI SAF products portfolio

- Near Real Time products and Data Records for the ocean and sea ice related variables

- All information available at: http://www.osi-saf.org/
OSI SAF SST NRT products

- LEO and GEO satellites
- Various coverage and spatial resolution depending on satellite and sensor
- Level 2 ("swath") and Level 3
- Recent releases: GOES-16/ABI SST products, combined SST/IST products (Arctic and Antarctic)
- In the future: MTG/FCI and METOP-SG/MetImage
OSI SAF sea-ice near-real-time products

- The Sea Ice portfolio of OSI SAF covers many variables:
  - **Sea Ice Concentration**
  - **Sea Ice Edge** (3 classes: Open Water, Open Ice, Closed Ice)
  - **Sea Ice Type** (2 classes: First Year Ice, Multi Year Ice)
  - **Sea Ice Drift**
  - **Sea Ice Temperature**
  - **Sea Ice Emissivity** (at 50 GHz)

- All continuously improved, validated, and developed with user review.

Above: Example recent sea-ice drift field in the Arctic Ocean.
OSI SAF ocean vector wind products

- Currently operationally displaying:
  - ASCAT-A, -B
  - ScatSat

- Climate Data Records: Scatterometers are very stable and can detect trends < 0.1 m/s decade

- New records are being processed:
  - ASCAT-C
  - HY2A/B
  - CFOSat SCAT

- And we expect in 2020:
  - WindRad on FY3E
  - OceanSat-3
Conclusions

• EUMETSAT and the OSI SAF provide a range of operational satellite products serving oceanographic applications

• Main satellite contributions are coming from Copernicus missions and EUMETSAT own missions Meteosat and Metop

• The products and services evolve continuously to fulfil user needs

• User feedback is of prime importance to us!