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

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EUMETSAT

- 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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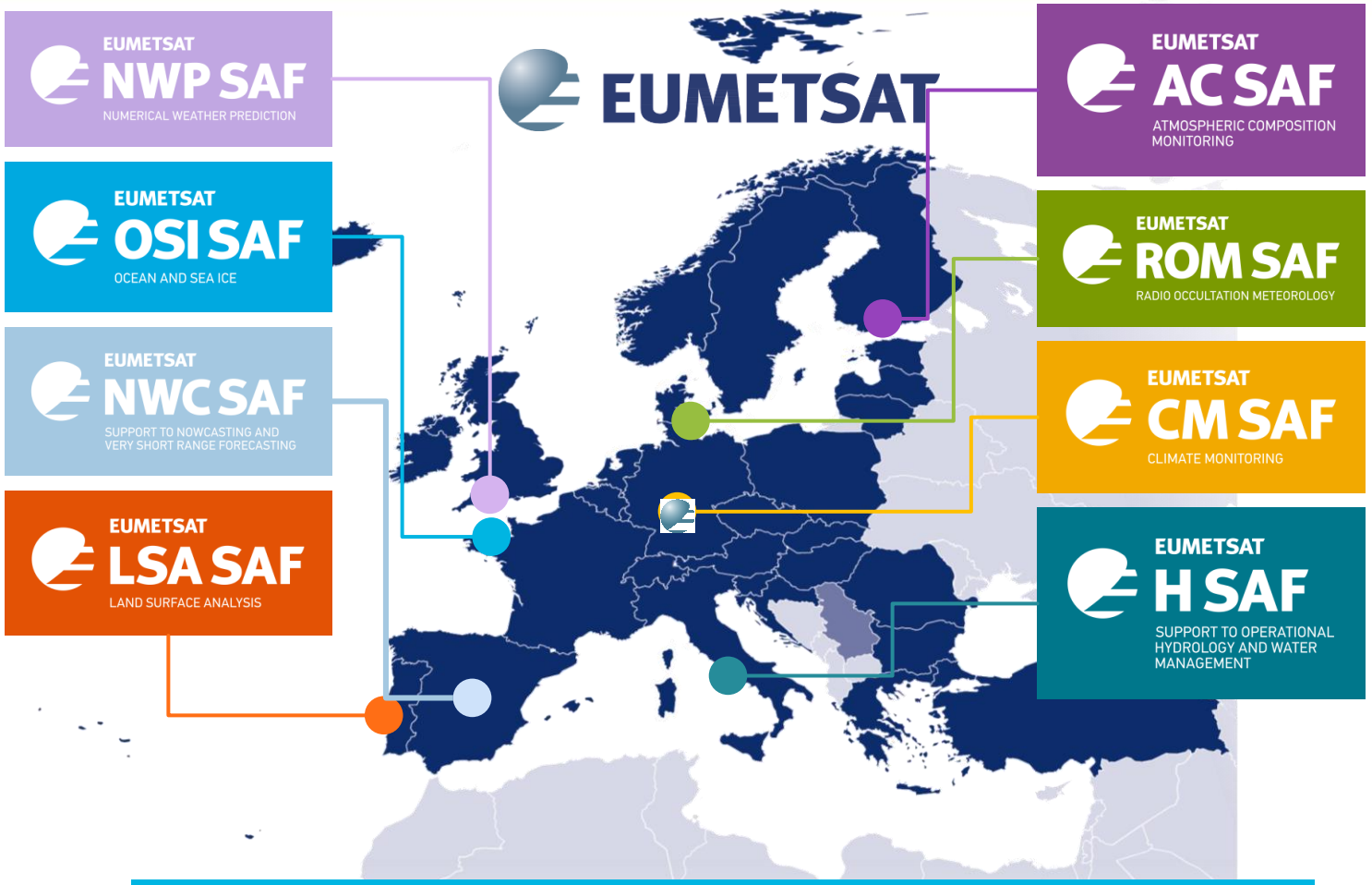

Satellite Application Facility for Ocean and Sea Ice

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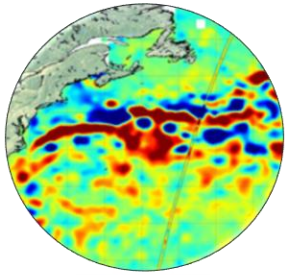
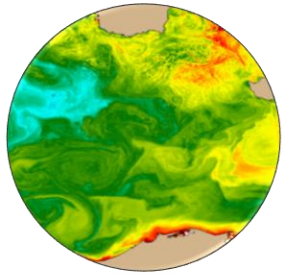
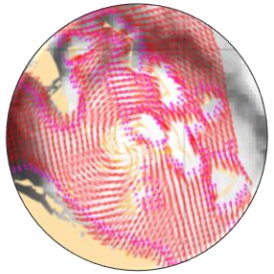
EUMETSAT marine products stream overview

	Sea Surface Height Significant Wave Height Wind Speed	Sea Surface Temperature Fluxes	Wind Vectors Sea Ice Parameters	Ocean Colour
				
Weather Forecasting (NWP, long term forecasts, high impact events)	✓	✓	✓	
Marine Meteorology	✓	✓	✓	
Marine Environment Monitoring		✓		✓
Climate Monitoring	✓	✓		
Operational Oceanography	✓	✓	✓	✓

National Meteorological Services

CMEMS, Ocean Prediction / Information Services

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The growing stream of EUMETSAT marine products

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

MSG
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

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Copernicus Sentinel-3 Constellation

Sentinel-3A launched on 16th February 2016

Its twin Sentinel-3B launched on 25th April 2018

Constellation fully operational since November 2018

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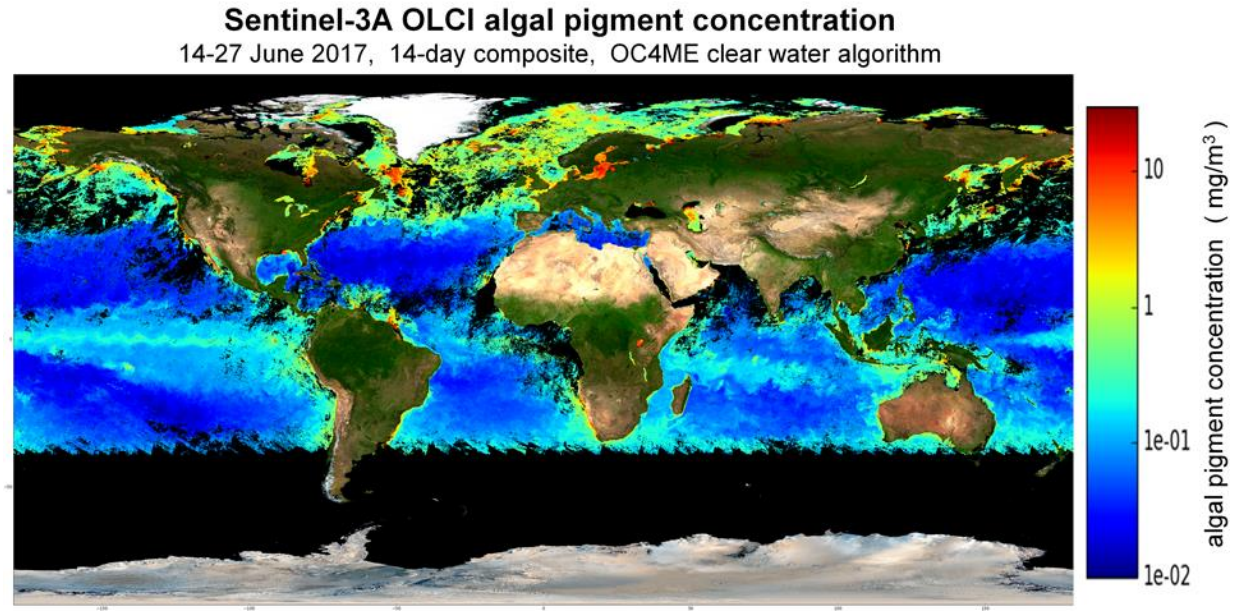
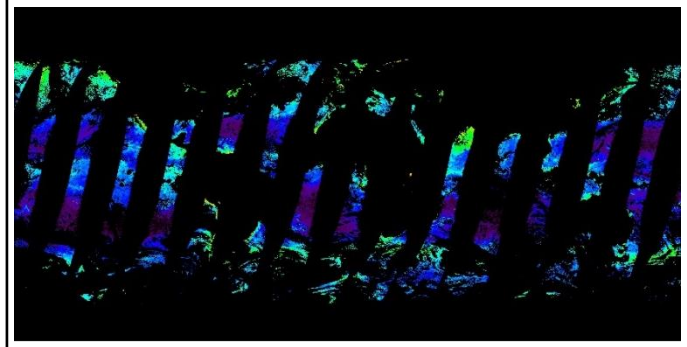
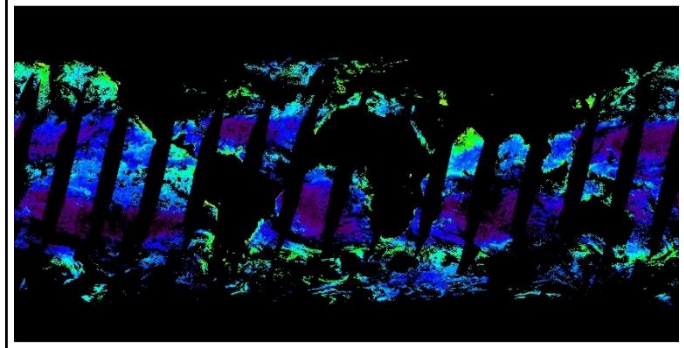
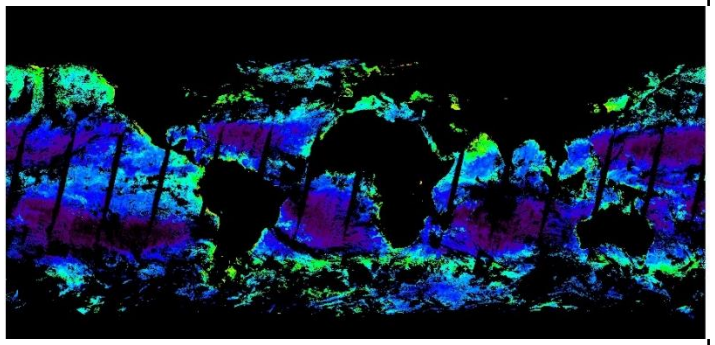
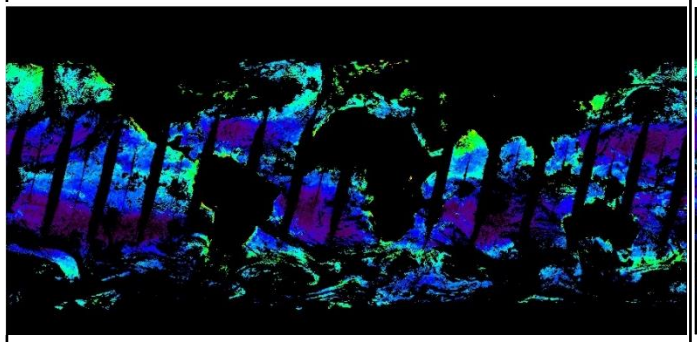
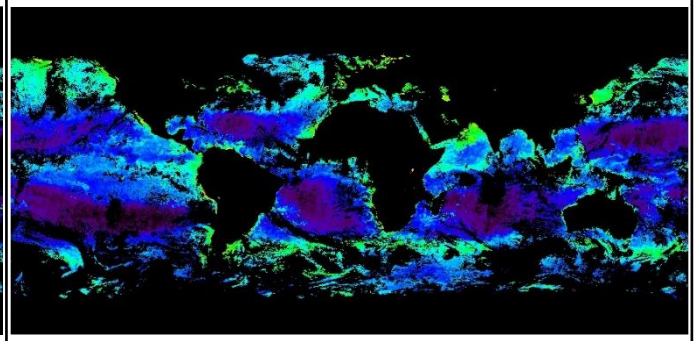
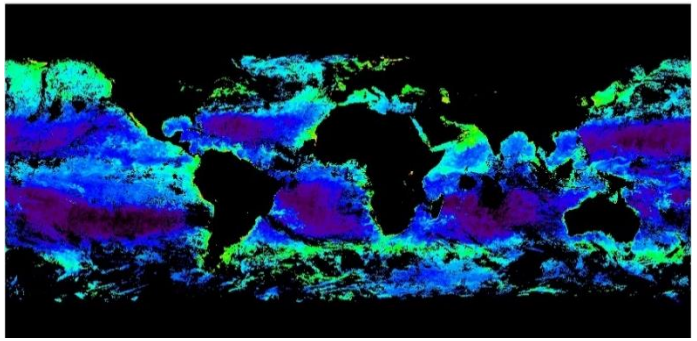
Sentinel-3 OLCI Ocean Colour Products Outlook

- 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

OLCI-A, 1-day coverage CHL_OC4ME	OLCI-A, 2-day coverage	OLCI-A, 3-day coverage
		
OLCI-A + OLCI-B, 1-day coverage	OLCI-A+OLCI-B, 2-day coverage	OLCI-A+OLCI-B, 3-day coverage
		

Sentinel-3 Altimetry Products Outlook

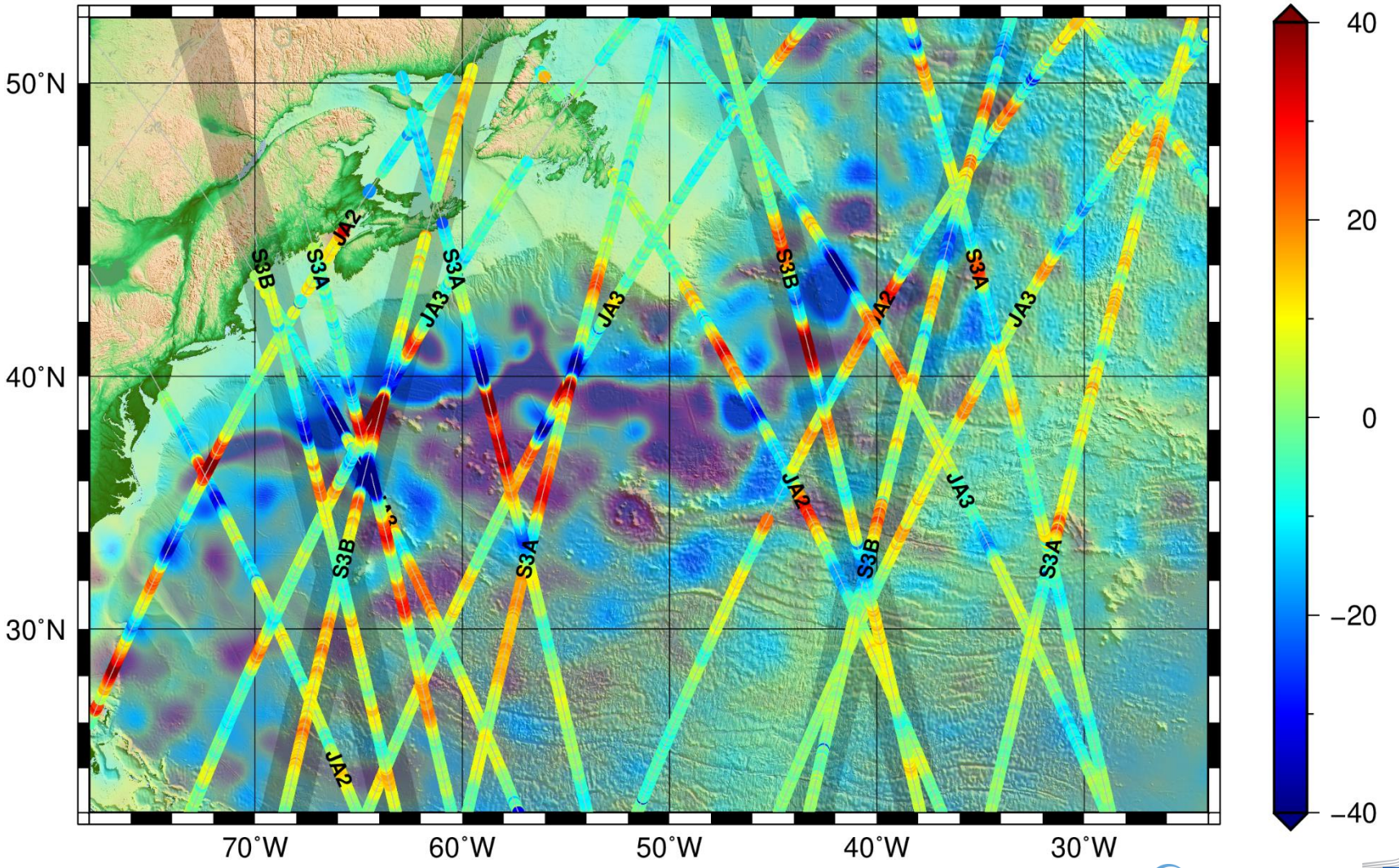
- Level 2 products are fully operational in Near Real Time (3h timeliness), Short Time Critical (36h), Non Time Critical (2 months) timeliness

- 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)

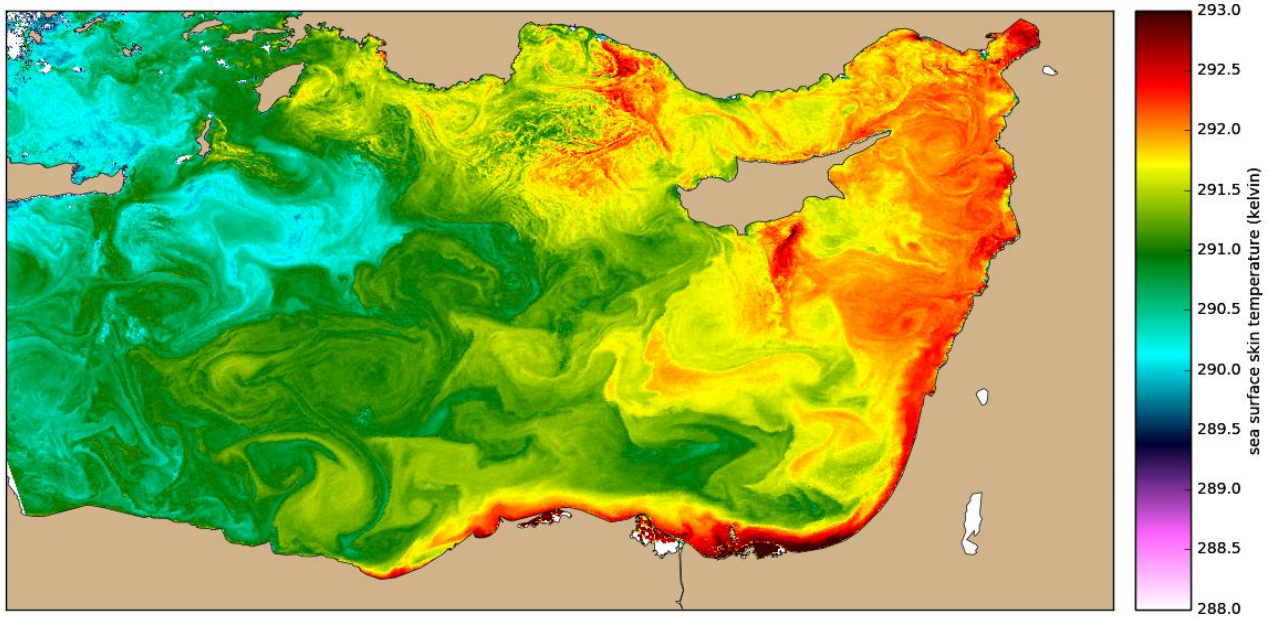
Copernicus Sentinel-3 constellation is now operational

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

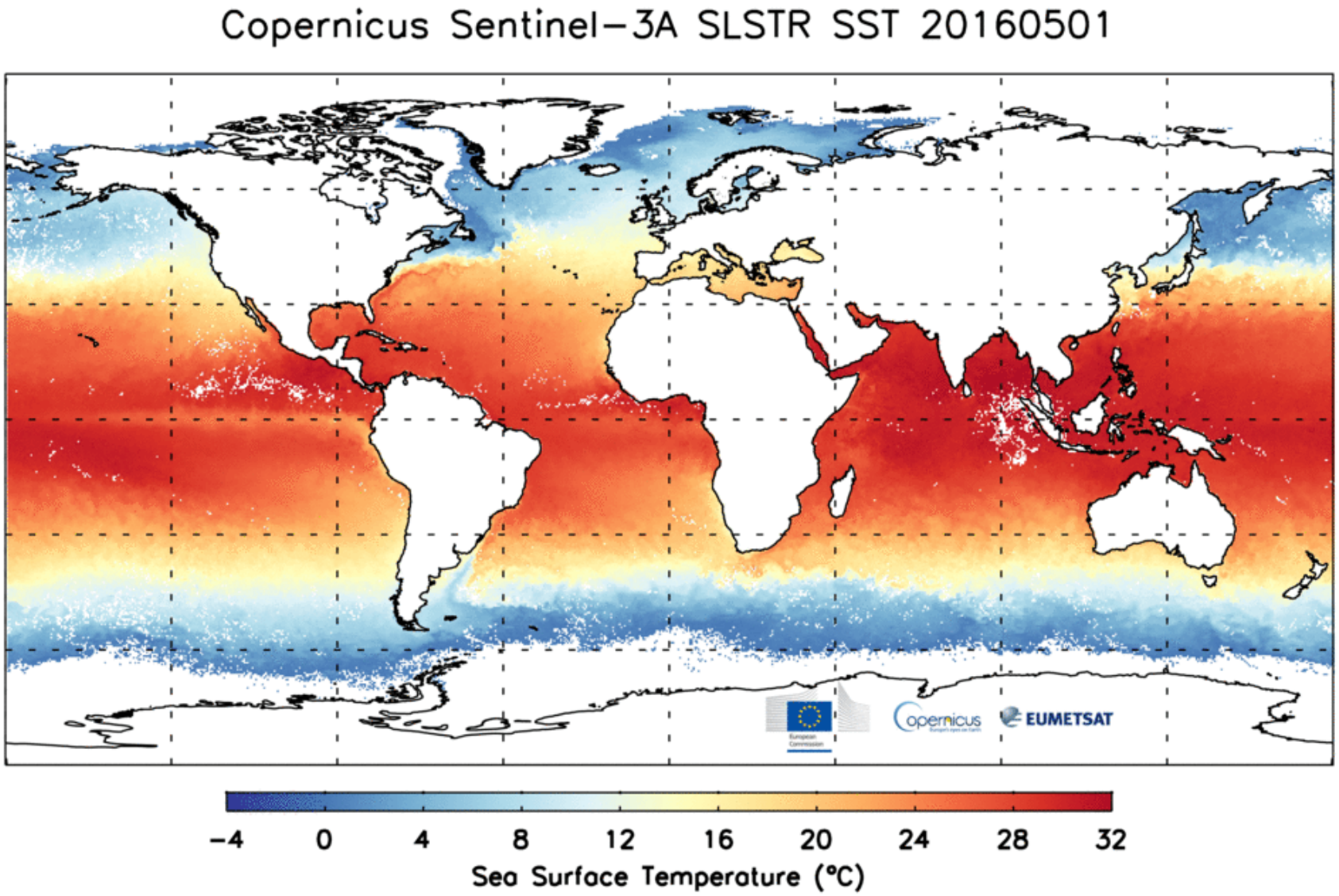
Perfo. factor	Require-ment Threshold, [goal]	S3A current status	S3B current status
SST absolute accuracy	0.3K	Compliant	Compliant
SST temp. stability	0.2K/decade	Preliminary	Preliminary



Sentinel-3A SLSTR Sea Surface temperatures in eastern Mediterranean Sea.

- 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/

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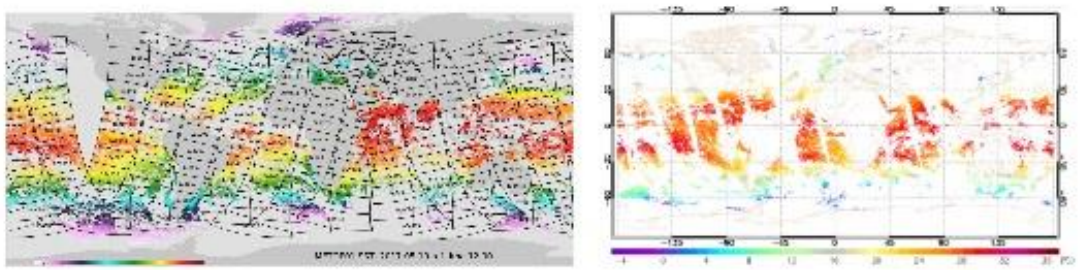
OCEAN AND SEA ICE

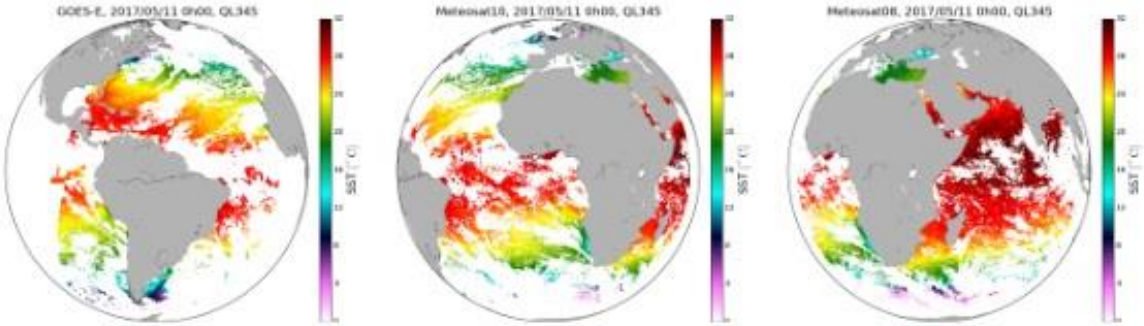
METEO FRANCE
Ifremer
Royal Netherlands Meteorological Institute
Ministry of Infrastructure and Water Management
Danish Meteorological Institute
Norwegian Meteorological Institute

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



Global SST products from Metop-B/AVHRR (left) and IASI (right).



SST from GOES13 (left), Meteosat 10 (left), and Meteosat 8 (right).

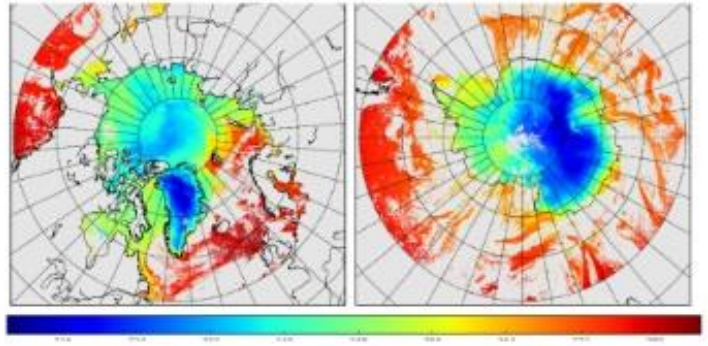
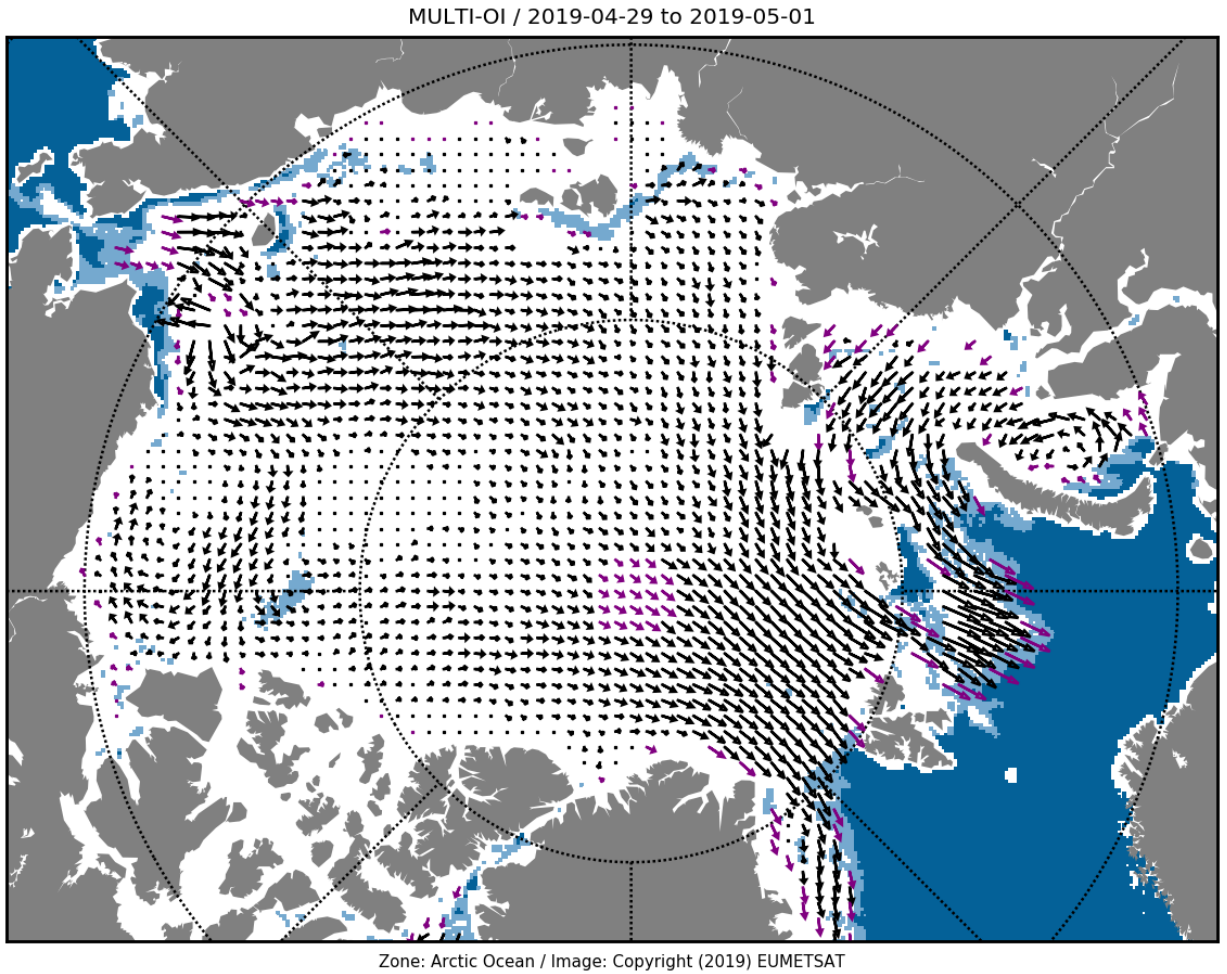


Illustration of the Sea Surface Temperature and Ice Surface Temperature product (OSI-205) from Metop-A/AVHRR: 21/2/2017.

OSI SAF sea-ice near-real-time products

- The Sea Ice portofolio 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.

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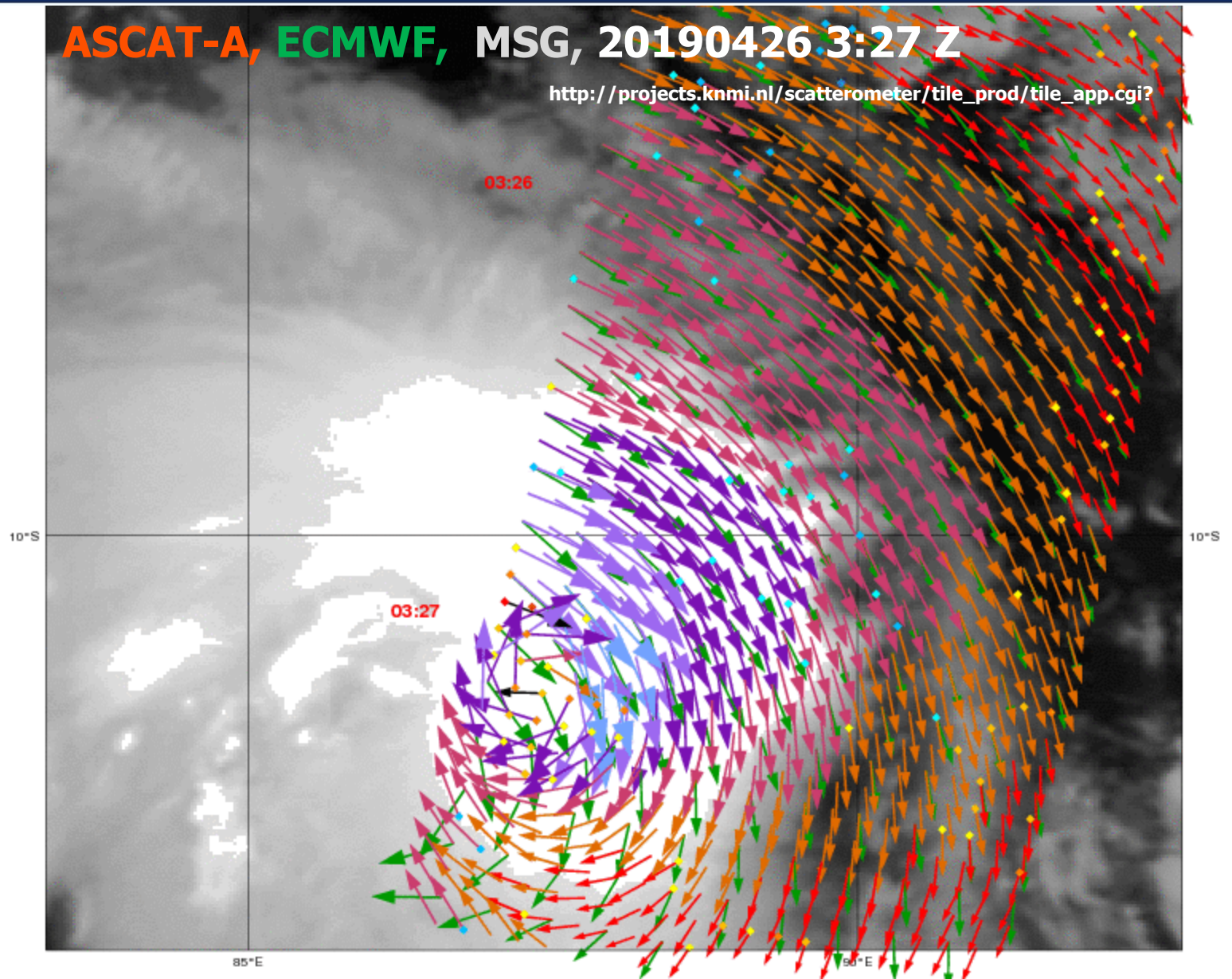
OSI SAF ocean vector wind products

- 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 !