climate change initiative

OCEAN THEME ECVS

Science leaders of sea level, state, colour, temperature, salinity

sst cci

University of Reading

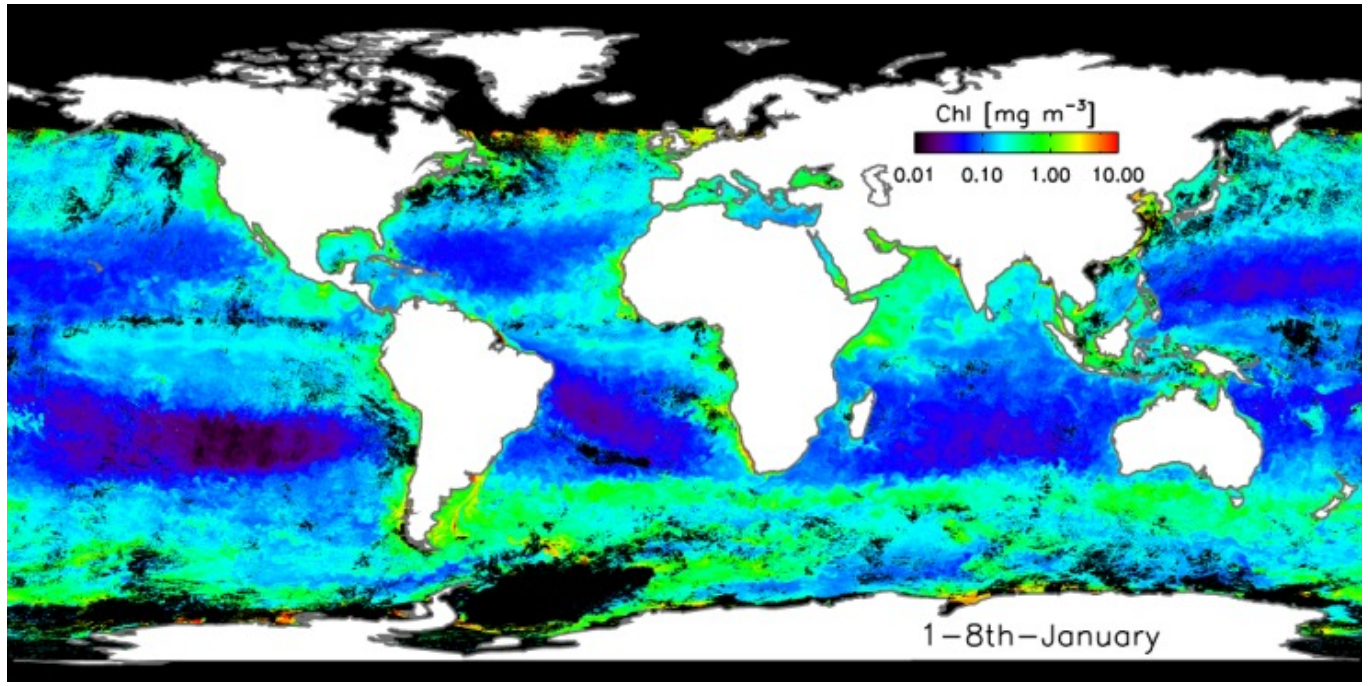
Met Office

Danish Meteorological Institute

Key features of the OC-CCI v6.0 products

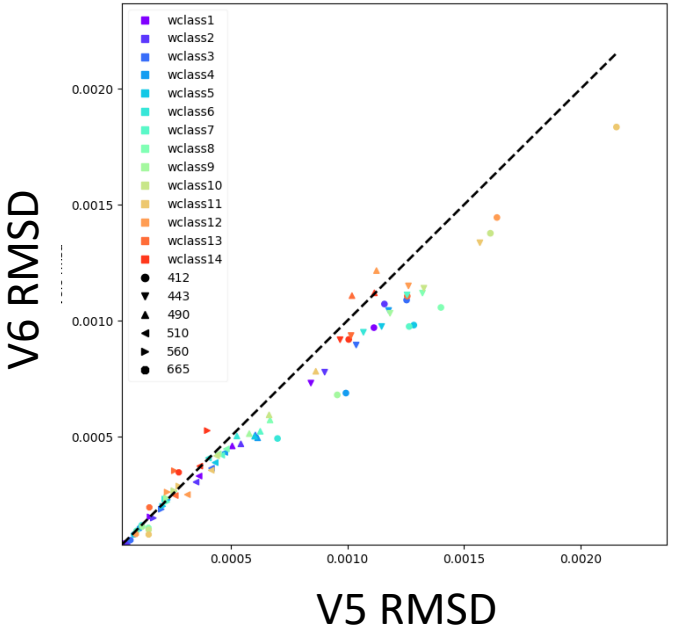
The OC-CCI v6.0 products are a significant improvement over previous versions:

- Includes data from Ocean and Land Colour Instrument (OLCI) aboard Sentinel 3B.
- Includes MERIS-4th reprocessing.
- With respect to in-water algorithms, the Quasi-Analytical algorithm (QAA) has been upgraded.
- Minor update to the inter-sensor bias correction.
- MODIS and VIIRS data have been discontinued from the record after 2019 on the basis of quality control.
- Selected products (chlorophyll-a, remote sensing reflectance values, and water classes) are available at 1km resolution.
- Temporal coverage has been extended to 2022.



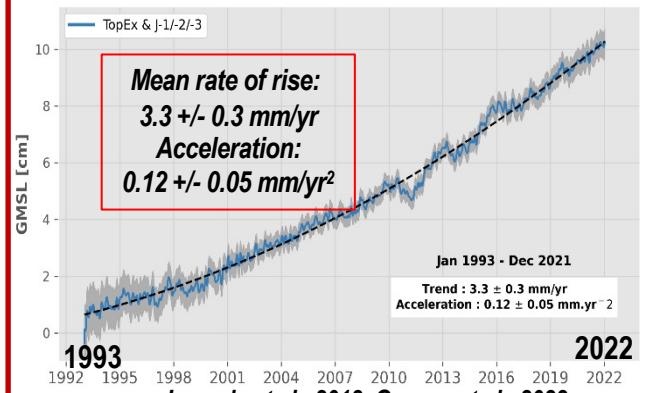
Sample weekly image

RMSD (compared with in situ observations) are generally lower for the V6, compared with V6.



ESA Climate Change Initiative: Sea Level ECV from Satellite Altimetry; Global to Coastal

A. Global Mean Sea Level (GMSL)

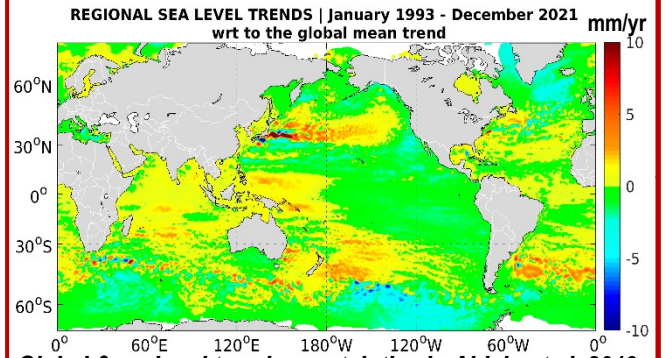


Legeais et al., 2018, Guerou et al., 2022

Key scientific progress

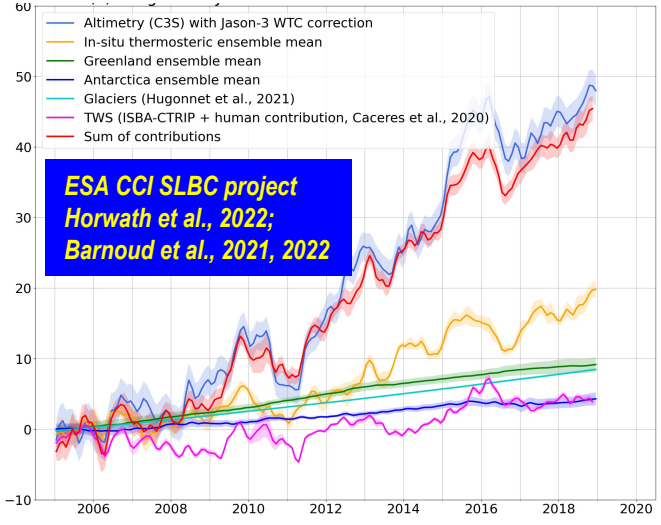
1. GMSL time series with associated uncertainty (see A)
2. Uncertainty estimates on GMSL trend and acceleration
3. Regional trend grids (see B) with associated trend uncertainty
4. Closure of the GMSL buget (see C)
5. Use of the GMSL (corrected for ocean mass) to estimate the Earth Energy Imbalance
6. Novel estimates of sea level change in the world coastal zones (see D)

B. Regional trends in sea level

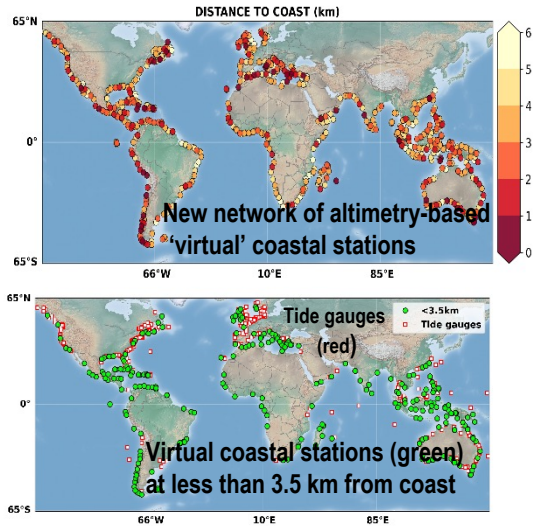


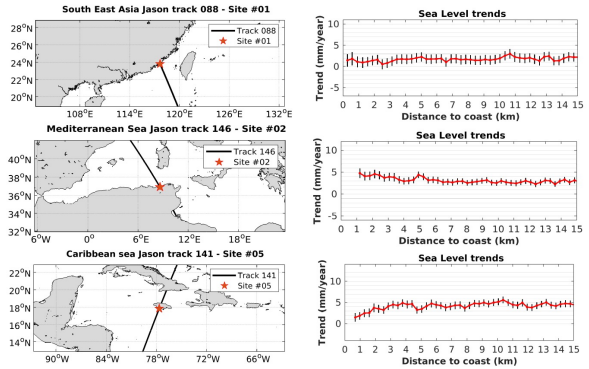
Global & regional trend uncertainties in Ablain et al. 2019 and Prandi et al., 2022

C. Closure of the GMSL budget



D. Coastal sea level change from reprocessed altimetry in the world coastal zones





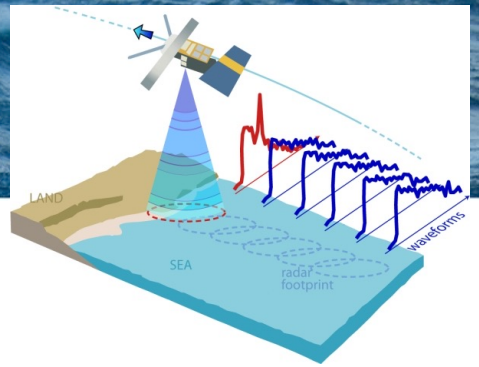
Examples of altimetry-based sea level trends (2002-2020) against distance to coast

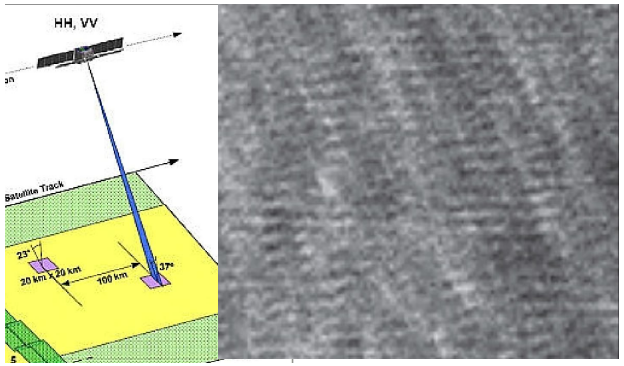
ESA CCI Coastal Sea Level Project (on going)

Cazenave et al., 2022

New challenges: Assess closure of the regional sea level budget; Extend coastal sea level time series and explain observed trends in terms of physical processes; Quantify the local impacts of coastal sea level rise (shoreline erosion/retreat, etc.)

Sea state





We use altimeters and SAR imagery to produce estimates of :
- Significant wave height (from both types of sensors)
- Mean wave periods T_{m01}, T_{m02} (only from SAR imagery)

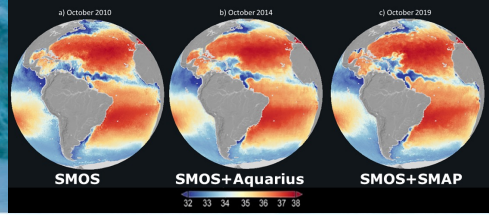
Sea State CCI phase 1 completed in June 2022

Version 3 of Seastate dataset:
- first dataset on ocean waves that combines both altimetry ans SAR imagery

- first dataset with retracked waveforms: lower noise and more data (coastal), allows to see small scales in unprecedented details (effect of currents on wave heights, coastal areas …)

Ready for phase 2 (no starting date defined yet)
- extending in time to the past and present (at least to 1992 and 2023)
- Merging CFOSAT/SWIM and SAR imager – derived parameters
- Adding calibrated nadir NRCS that can be used for wind retrieval, but also air-sea fluxes …

Sea Surface Salinity



Key scientific progress

CCI v3.2 SSS & uncertainties (2010-2020) available @ CEDA (big improvement in uncertainties)

SSS signals at large mesoscale (~50km, 1 week) in river plumes, eddies: coastal-open ocean exchanges

SSS is a good tracer of biogeochemical properties (=> improve air-sea CO_2 flux estimates)

Key challenges / new questions or applications

Extend time series backward to 2002 in tropical river plumes (C/X band radiometer)

Polar regions & RFI filtering (development of new algorithms; focus on Arctic SSS variability)

SSS contribution to validate and/or improve physical & biogeochemical models (e.g. assimilation)?

Programmatic considerations

Missions continuity & enhancement (SMOS 13yr, SMAP 7.5yr): CIMR (urgent!) AND??? SMOS-HighResolution or ???

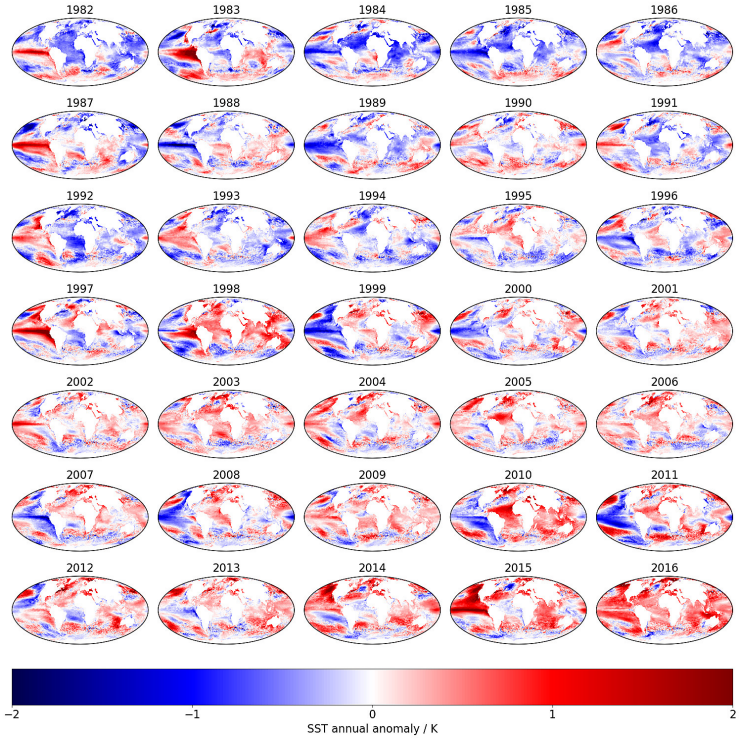
Cross-ECVs (Chl, SST, SSS, ice…) analysis to be encouraged both for algorithm devt and science studies

Harmonization of uncertainty characterization between various communities (obs, modellers), various ECVs – Difficulty for SSS: Highly non gaussian distribution (very interesting measurements are extremas!)

Sea Surface Temperature

Key scientific achievements

- SST v3 covering 1980 – present
- Multi-sensor harmonised, stabilized with respect to LECT, partial independence from in situ, validated uncertainty Fiduceo
- Leading algorithm innovation, trail-blazer users, HadISST centennial reconstruction
- (v2) NOAA Coral Reef Watch climatology, IPCC AR6



Future challenges

- 1980s stability improvements and evolving satellite constellation (including future)
- Integrate SST and ice ST – seamless all-ocean temperature
- Climate sensitivity and importance of SST pattern effect – address energy budget jointly with sea level budget
- Coastal climate services (coral heat stress, key coastal ecosystems…)

General Ocean Theme Comments

- Ocean ECVs need to work with other variables that are just “ocean”
  - E.g. global energy budget: SST, steric sea level, cloud, water vapour + …
- For climate services, support to climate adaptation, need capability to re-organize and link-up datasets
  - Multi-variate, local, commonly gridded, “analysis ready”
  - E.g. SST, coastal sea level, colour, sea state, salinity to characterize a local coastal environment
- Uncertainty provision in ocean variables relatively mature at L2/L3
  - Propagation of uncertainty across scales (e.g. to obs4MIPs resolution for ESMvaltool) requires attention from data experts
  - Don’t reinvent earlier CCI uncertainty work or FIDUCEO