Uncertainty in Global mean sea level from Satellite Altimetry

Approach: estimate directly the GMSL error variance-covariance matrix from an error budget of the altimetry system. Then use the matrix to evaluate the uncertainty on some metrics like sea level trends and sea level acceleration (context: ESA climate change Initiative coastal sea Level project)

Uncertainty in sea level acceleration deduced from the var-covar matrix
Uncertainty in sea level trends deduced from the var-covar matrix

Ablain et al., ESSD, 2019, Prandi et al, Nature Scientific Data, in revision
Closure of the Global Mean Sea Level Budget over the Altimetry Era

Observed global mean sea level

Sum of thermal expansion and ocean mass change

Residuals (rms = 2.2 mm, residual trend = 0.14 +/- 0.3 mm/yr)

Thermal expansion

Glaciers

Greenland

Antarctica

Land waters

Observed

Sum of contributions

Sea Level (mm)

Time (yr)

1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017

Sea Level (mm)

Time (yr)


Dieng et al., GRL, 2017, Cazenave et al., ASR, 2018; The WCRP Global Mean Sea Level Team, ESSD, 2018; The ESA Sea Level Budget Closure project, Horwath et al., in preparation, 2020
Approach: estimate the global steric sea level from the difference between GMSL estimated by altimetry and ocean mass estimated by GRACE. Then estimate the global ocean heat content, which is a precise proxy of the Earth energy imbalance, by estimating the expansion efficiency of heat and multiplying it with the global steric sea level.

Global ocean heat content from alti-Grace, Argo data and ocean reanalysis

Uncertainty in Global ocean heat content and EEI from alti-Grace, Argo data and ocean reanalysis

Meyssignac et al. 2019, Frontiers in Marine Science
Coastal Sea Level Changes from Reprocessed Satellite Altimetry

**Approach:** retracking of Jason-1, 2, 3, Envisat and Saral/AltiKa altimetry missions to estimate sea level trends in the world coastal zones (context: ESA climate change Initiative coastal sea Level project)

**Graphs:**
- Difference in sea level trends between open ocean and coast (mm/yr) (2002-2018)
- Closest distance to coast (km) where reliable sea level trends can be estimated

→ In 20% of the sites, the coastal trend significantly differs from open ocean trend
→ Coastal processes (e.g., T/S changes, currents, waves, fresh water input from rivers, etc.) are under investigation to explain this observation

Marti et al., ASR, 2019; Gouzenes et al., Ocean Sciences, 2020; The CCI Coastal Sea Level Team, Nature Scientific Data, 2020