Sea level budget in the Arctic during the satellite altimetry era

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2002-2010 : spatial trend patterns

Observed patterns from Envisat satellite altimetry

DTU

CLS
2002-2010 : spatial trend patterns

Observed patterns from Envisat satellite altimetry

➔ Altimetric trend patterns differ much in the Beaufort Gyre region
2002-2010: spatial trend patterns

DTU trend 2002-2010

Observed patterns from Envisat satellite altimetry

Steric patterns from ORAP5 reanalysis

➔ Altimetric trend patterns differ much in the Beaufort Gyre region

CLS trend 2002-2010
2002-2010: spatial trend patterns

**Observed patterns from Envisat satellite altimetry**

**Steric patterns from ORAP5 reanalysis**

➔ In the Beaufort Gyre area and along the eastern coast of Greenland, the steric component contributes to observed sea level trends.

➔ Altimetric trend patterns differ much in the Beaufort Gyre region.
2002-2010: spatial trend patterns

- Altimetric trends
  - DTU
  - CLS

- Steric trends
  - Halosteric
  - Thermosteric
2002-2010 : spatial trend patterns

In the Beaufort Gyre area and along eastern coast of Greenland altimetric trends are mostly due to the halosteric component
2002-2010: spatial trend patterns

Observed patterns from altimetry minus steric trend patterns
2002-2010: spatial trend patterns

Observed patterns from altimetry minus steric trend patterns

GRACE trend patterns
2002-2010 : interannual variability

➔ Small contribution of the mean steric component

➔ Good agreement between altimetric datasets in terms of regional average
2002-2010: interannual variability

- 2 GRACE solutions (TELLUS and MASCONS)

- Good agreement with the TELLUS solution

- The TELLUS product is better correlated with the altimetry-based sea level (corrected for the steric effect) than the MASCONS product
2002-2010 : interannual variability

➔ 2 GRACE solutions (TELLUS and MASCONs)

➔ Good agreement with the TELLUS solution

➔ The TELLUS product is better correlated with the altimetry-based sea level (corrected for the steric effect) than MASCONs product

In the Arctic, at interannual time scale and in terms of regional average, the mass component dominates the observed sea level signal
2002-2010 : Study by sectors (altimetry - steric)
The best results are obtained with the TELLUS solution in the Greenland sector.
2002-2010 : Conclusions

➔ A halosteric origin of regional sea level trends in the Beaufort Gyre

➔ A dominant mass contribution on average in the Arctic region

➔ Best results in terms of sea level budget are obtained in the Greenland sector using the TELLUS GRACE product
1992-2010: spatial trend patterns

Altimetric trends
Steric trends
Halosteric trends
Thermosteric trends
As for the 2002-2010 time span, the mean steric contribution is small.

The residual time series provides an estimate of the non steric components (atmospheric loading effect, mass redistribution, fresh water input, ...).
Conclusions and perspectives

➔ Use of other ocean reanalyses (e.g. MERCATOR, GECCO2, ....) for the steric component

➔ Deeper investigation of the GRACE products (e.g., the LEGOS product)

➔ Comparison with CMIP5 models

➔ Cryosat data from 2010 to 2015
Appendix