

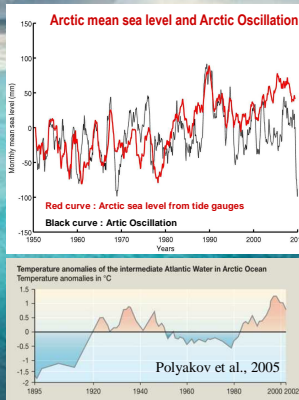
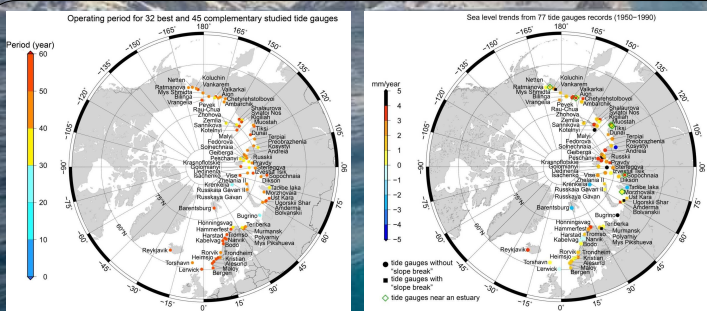
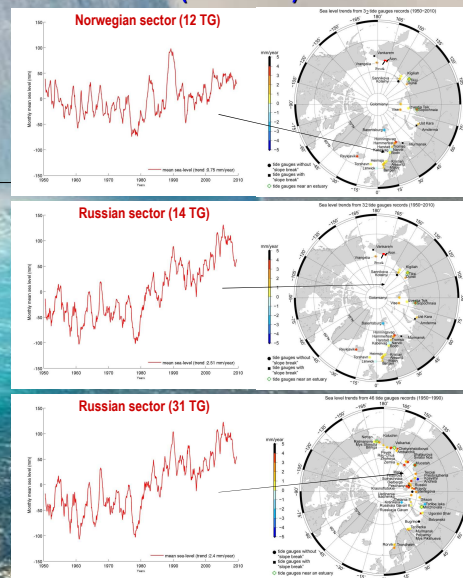
Sea level change and variability in the Arctic region since 1950 from tide gauges, satellite altimetry, in situ hydrography and OGCM

Olivier HENRY (1), Pierre PRANDI (2), and Anny CAZENAVE (1)

(1) LEGOS/CNES, Toulouse, France , (2) CLS, Toulouse, France – Contact : Olivier.Henry@legos.obs-mip.fr ; anny.cazenave@legos.obs-mip.fr

ABSTRACT. In the context of the European project 'MONARCH', we have investigated sea level change and variability since 1950 in the Arctic Ocean using tide gauge, satellite altimetry and in situ hydrographic data, and outputs from the DRAKKER/NEMO ocean general circulation model. Long good quality tide gauge records are limited to the Norwegian and Russian sectors. The mean sea level curves of the Norwegian and Russian sectors are very comparable. Merging data from the two regions lead to a mean sea level showing little trend between 1950 and 1980. However, as of ~1980, a strong sea level rise is observed. Such an abrupt rise is also seen in the steric sea level, suggesting a thermal origin for this behaviour. So far we cannot conclude if this is related to anthropogenic warming or if this results from natural variability only. Important correlation is noticed at interannual time scale between sea level and the Arctic Oscillation, an indication that natural climate modes drive sea level variability in the Arctic region.

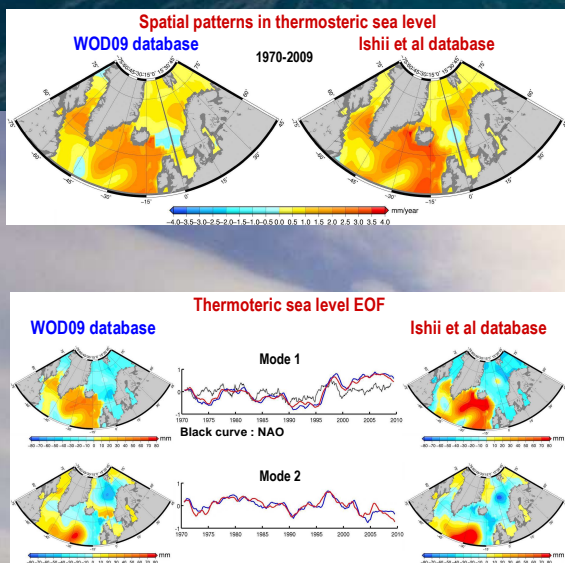
Tide-gauge-based sea level (1950-2010)



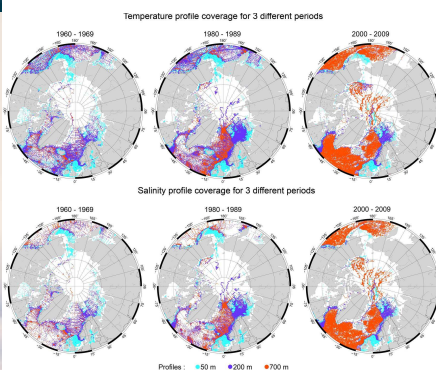
Tide gauge location, record length and trends

Regional sea level trends in the Arctic region

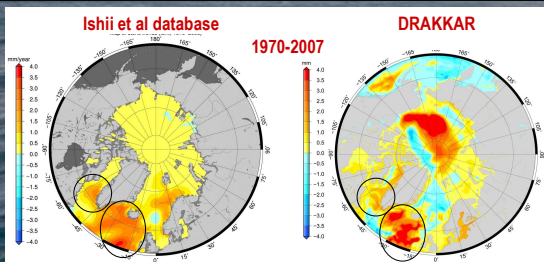
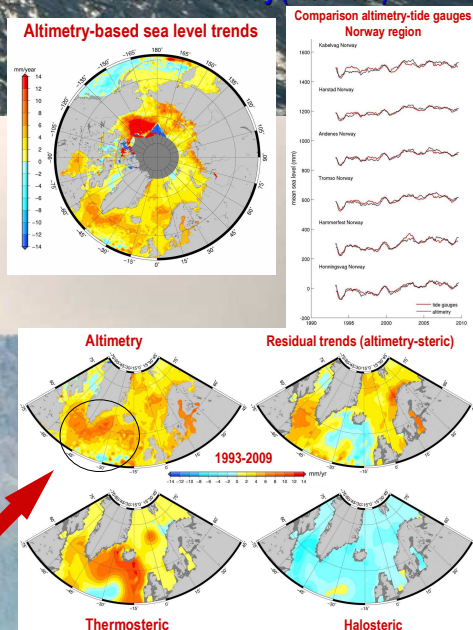
Steric sea level trend patterns



Temporal coverage and depth distribution of steric data



Sea level trend patterns from multi mission satellite altimetry (1993-2009)



DRAKKAR sea level trend patterns – 1993-2007

DRAKKAR ocean general circulation model

- Global 1/4° model; NO DATA ASSIMILATION
- Forcing → DFS4.1 (BRODEAU et al., 2009); 1958-2007
- ORCA025-B83 run (Barnier et al., 2006; Dussin et al., 2009; Penduff et al., 2010)

Conclusion and perspectives

On the basis of long good quality tide gauge data available since 1950 in the Norwegian and Russian sectors, we find that the mean Arctic sea level was almost stable between 1950 and 1980. As of the early 1980s, an abrupt change is reported, with a sustained rise during the past 30 years. Comparison with steric sea level suggests that this behaviour has a thermal origin. However, it is still hard to conclude whether the observed change is related to anthropogenic warming or if it results from natural climate variability, especially as we observed a high correlation between mean Arctic sea level and the Arctic Oscillation. Future work will be devoted to develop a past sea level reconstruction in the Arctic, combining the long tide gauge records with altimetry-based or OGCM-based gridded sea level time series. This will allow us to analyse spatial trend patterns in sea level over the past 60 years. Comparison with ocean reanalyses and coupled climate models dedicated to the Arctic region will also be performed.