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Poster: C 18

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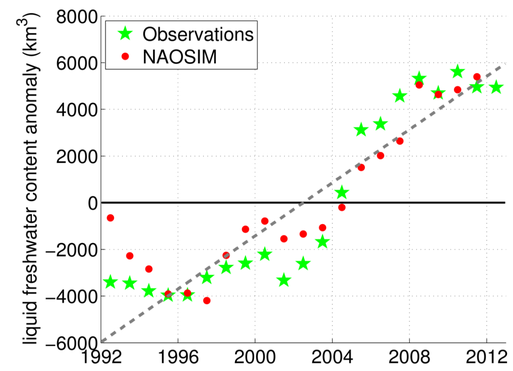
Link between multidecadal freshwater anomalies in the AO and SPNA

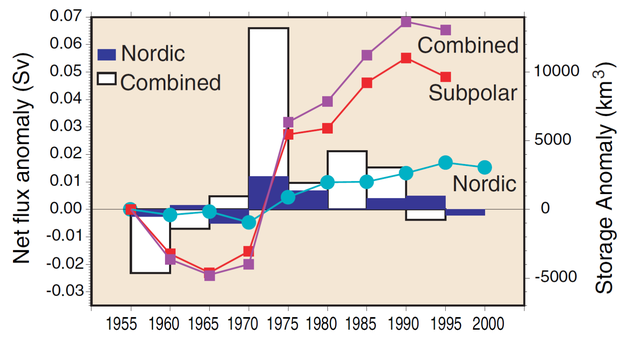
Introduction

A rapid increase in liquid freshwater content (FWC) has been observed in the Arctic Ocean (AO) in the past two decades (e.g. Rabe et al., 2014). In the same time a significant part of Arctic sea ice volume has been lost to melt (e.g. Haine et al., 2015). In contrast to the AO, the subpolar North Atlantic (SPNA) became more saline in recent years (e.g. Mauritzen et al., 2012). Observational and model studies concerning the freshwater variability of the two regions have seen independent processes to be responsible for the observed changes. Here we analyze the congruence of the salinity changes in the Arctic Ocean and the SPNA and propose a tight linkage between the FWC anomalies on a multidecadal time scale.



Rabe et al. (2014)

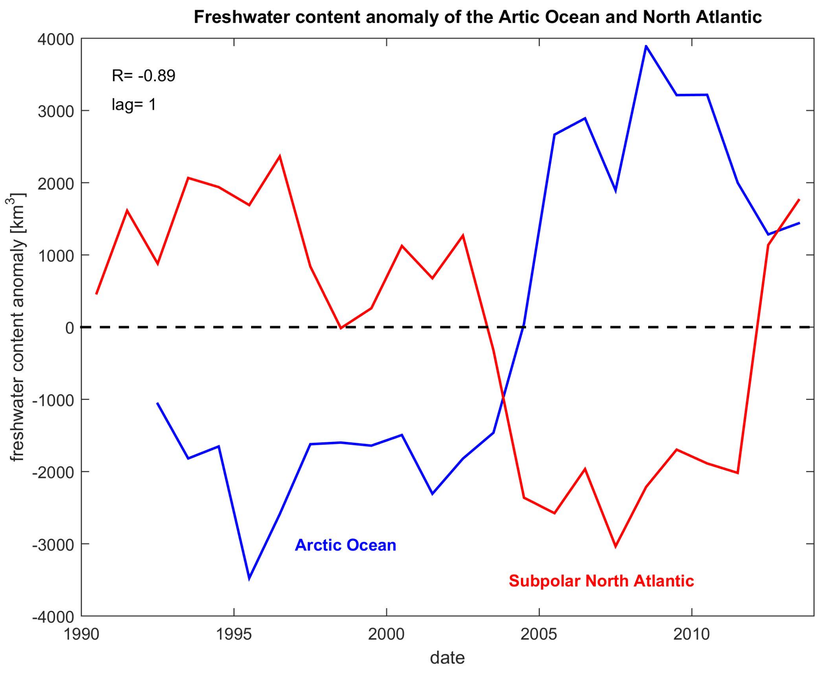
Arctic Ocean



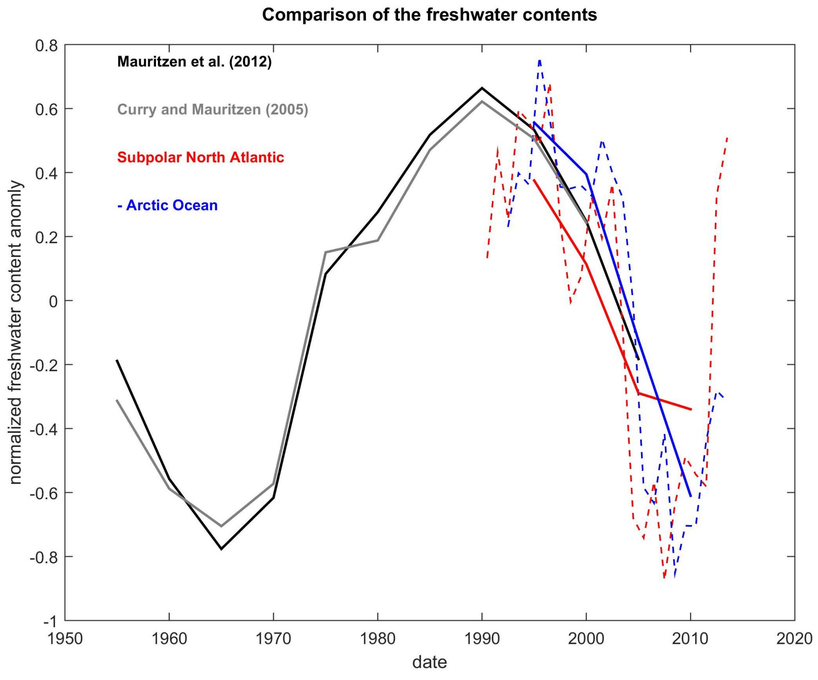
Curry and Mauritzen (2005)

Subpolar North Atlantic

Do the FWCs of the AO & SPNA co-vary?



Significant anti-correlation (R=-0.89) of the SPNA liquid FWC (red) and the AO total FWC (blue) with a 1-year lag of the AO FWC.



Pentadal means of the AO total FWC (blue) and the SPNA liquid FWC (red) compared to previously published analyses with longer timescales (gray, black)

Data & Method

Arctic Ocean:

- liquid FWC of the deep basins (z>500m) from Rabe et al. (2014) extended to 2013 (Sref=35)
- solid FWC from Haine et al. (2015) derived from PIOMAS Assimilation Product

SPNA:

- Liquid FWC calculated from CORA 4.1 salinity fields (Sref=35)

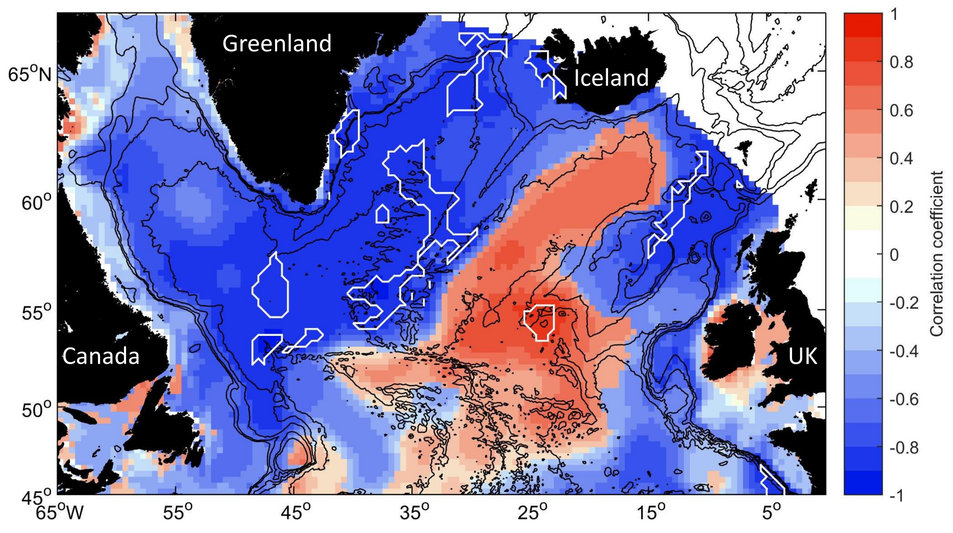
Inventory of liquid freshwater

$$LFWI = \int_{z=0m}^{h} \frac{S_{ref}-S}{S_{ref}}\, dz \quad [m]$$

Liquid freshwater content

$$LFWC = \oint LFWI\, dA \quad [km^3]$$

Spatial cross-correlation



Cross correlation of the AO total FWC and SPNA liquid FWIs. White contours show the significant correlations (95% significance).

- Positive correlations: salinity changes in the North Atlantic Current are advected into the AO
- Negative correlations: FW in the AO may be redistributed as a response to frequent changes in atmospheric pressure patterns

Conclusions

- Freshwater changes in the AO and the SPNA have been anti-correlated during the last 20 years and suggest a multidecadal oscillation.
- Decadal scale changes of the FWC in the deep water formation sites of the SPNA are likely to originate in the AO.

References
Rabe, B. et al. Arctic Ocean basin liquid freshwater storage trend 1992-2012. *Geophys. Res. Lett.* **41**, 961-968 (2014).
Haine, T. W. N. et al. Arctic freshwater export: Status, mechanisms and prospects. *Global Planet Change* **125**, 13-35 (2015).
Mauritzen, C., Melsom, A. & Sutton, R. T. Importance of density-compensated temperature change for deep North Atlantic Ocean heat uptake. *Nat. Geosci.* **5**, 905-910 (2012).
Curry, R. & Mauritzen C. Dilution of the Northern North Atlantic Ocean in Recent Decades. *Science* **308**, 1772-1774 (2005).

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