EGU 2016
Poster: X4.9

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

Myriel Horn, **Benjamin Rabe** & **Ursula Schauer** (AWI)

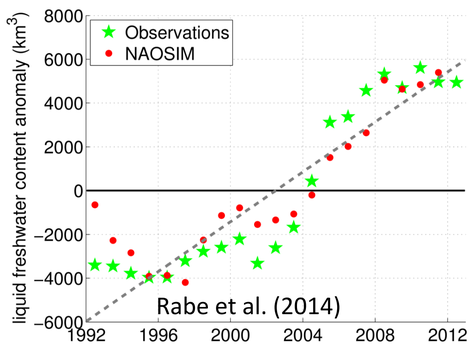
myriel.horn@awi.de

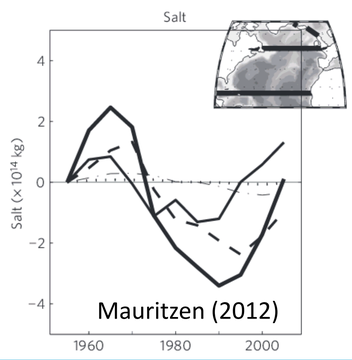
Freshwater variability in the AO and SPNA: a Comparison from the 1990s to Present

Introduction

A rapid increase in liquid freshwater content has been observed in the **Arctic Ocean (AO)** in the past two decades (e.g. Rabe et al., 2014). At 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)** and the **Nordic Seas (NS)** became more saline since the 1990s (e.g. Mauritzen, 2012).

Arctic Ocean





Subpolar North Atlantic

Data & Method

Arctic Ocean (1992-2013):

- Upper ocean liquid freshwater content of the deep basins (z>500m) from Rabe et al. (2014) extended to 2013 (Sref=35, h=depth of 34 isohaline)
- solid freshwater content from Haine et al. (2015) derived from PIOMAS Assimilation Product

Subpolar North Atlantic & Nordic Seas (1990-2013):

- Liquid freshwater content calculated from CORA 4.1 salinity fields (Sref=35, h=2000 m)

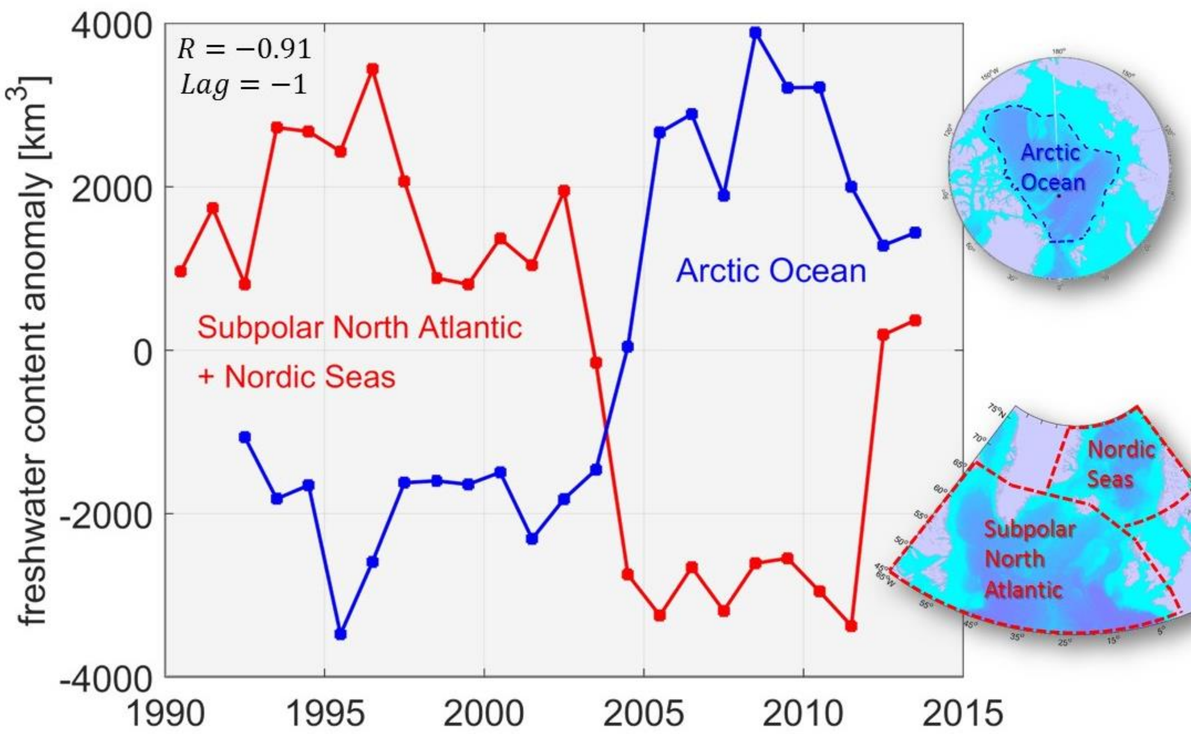
Inventory of liquid freshwater

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

Liquid freshwater content

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

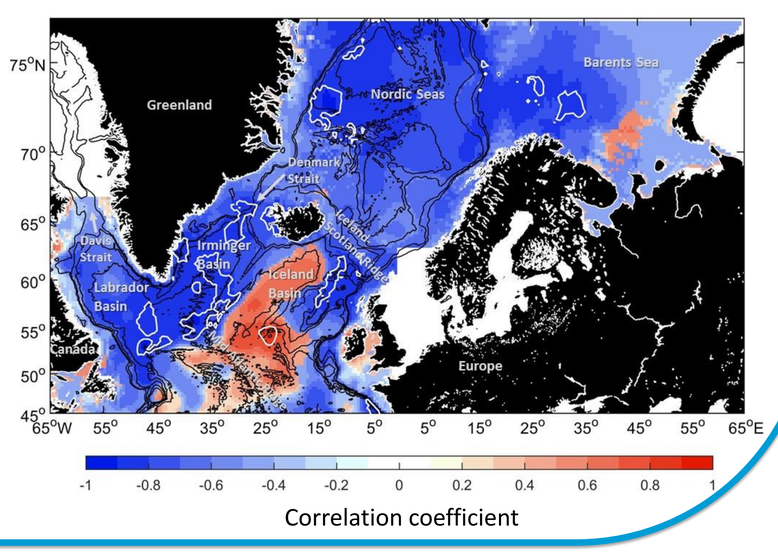
How do the freshwater contents of the two regions compare?

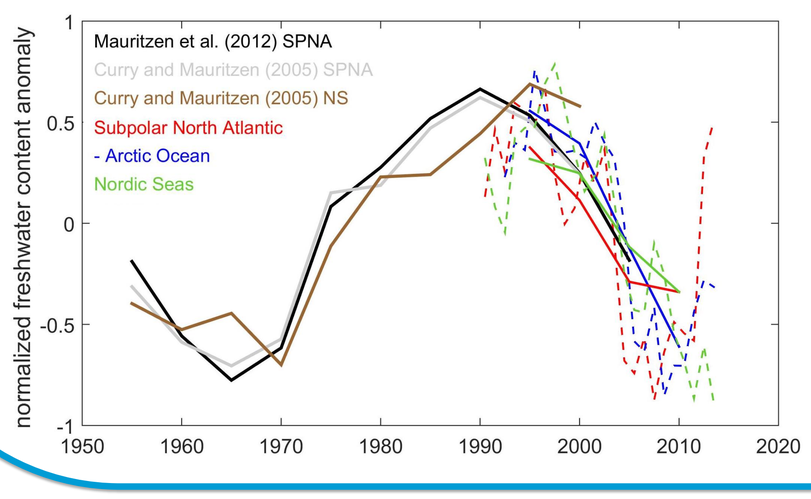


Significant anti-correlation (95 % significance) of the SPNA & NS liquid freshwater content anomalies and the AO total freshwater content anomalies with a 1-year lag of the AO freshwater content.

Cross correlation of the liquid freshwater inventories of the SPNA & NS with the AO total freshwater content. White contours enclose areas of significant correlations (95% significance).

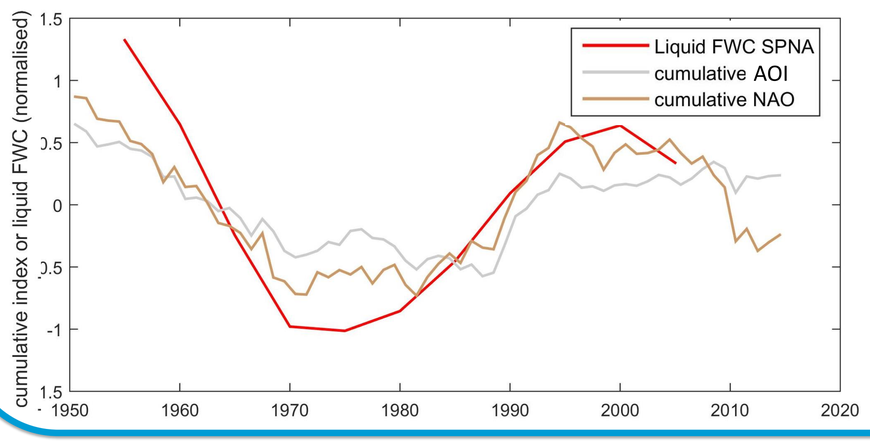
- Positive correlations: salinity changes in the North Atlantic Current are advected into the AO
- Negative correlations: different circulation modes in the AO lead to accumulation or a sudden release of freshwater





Comparison of the SPNA, NS and inversed AO freshwater contents to previously published time series (black, gray, and brown). Solid lines display pentadal means and dashed lines annual means. All time series have been normalized by twice their standard deviation.

Arctic and North Atlantic Oscillation



Significant correlation (95 % significance) of the SPNA liquid freshwater content from Mauritzen et al. (2012), the cumulative **Arctic Oscillation Index (AOI)**, and the cumulative **North Atlantic Oscillation Index (NAO)**. All time series have been normalized by twice their standard deviation, detrended, and demeaned.

Conclusions

- Freshwater changes in the AO and the SPNA & NS have been anti-correlated during the last 20 years and suggest a multidecadal oscillation.
- Decadal scale changes of the FWC in the subpolar Seas 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).

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG
BREMERHAVEN
Am Handelshafen 12
27570 Bremerhaven
Telefon 0471 4831-0
www.awi.de