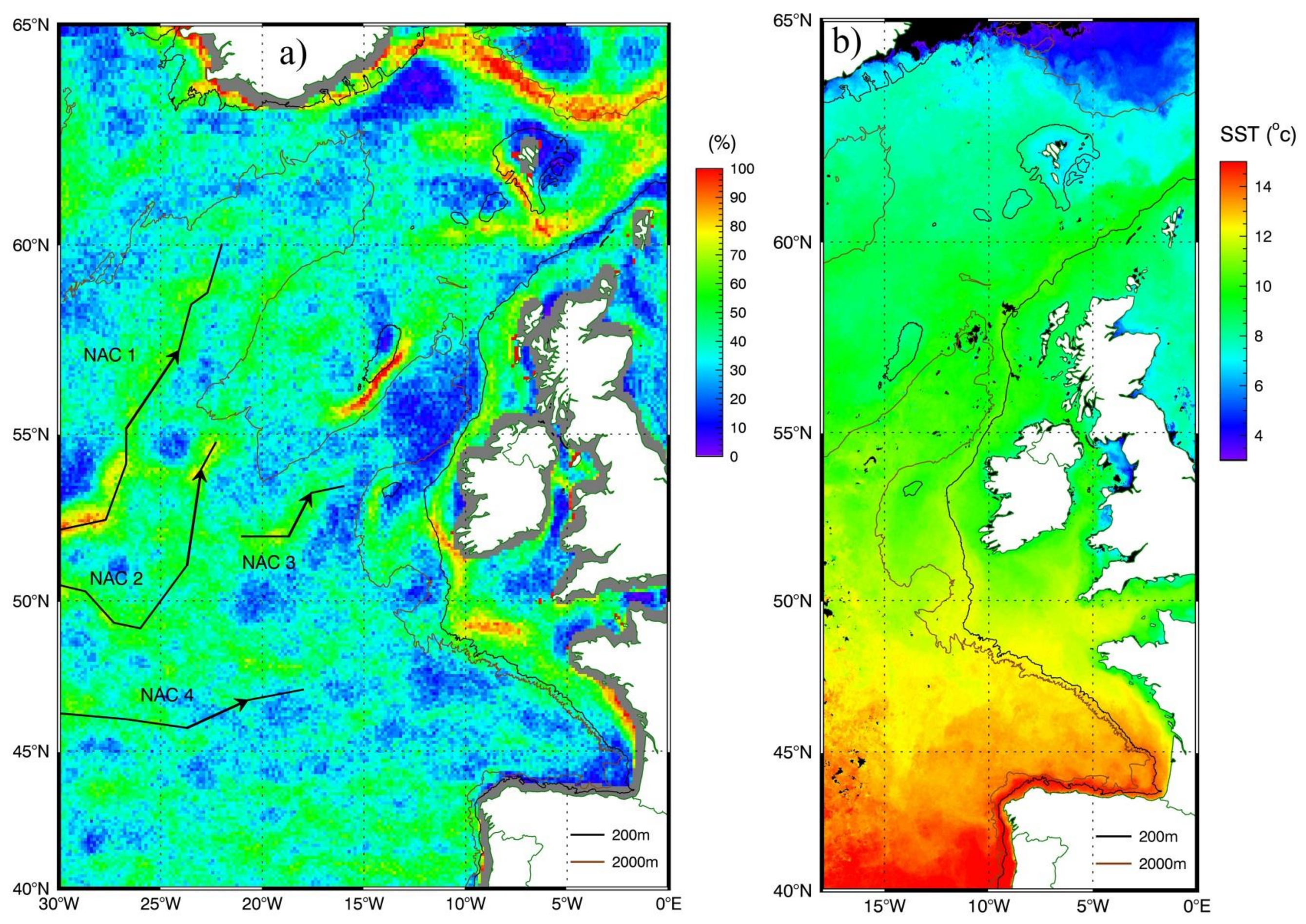
Listen to the ocean

Seasonal and Interannual Variability of the European Slope Current

Weidong Xu, Peter I. Miller, Graham D. Quartly, Robin D. Pingree

Introduction

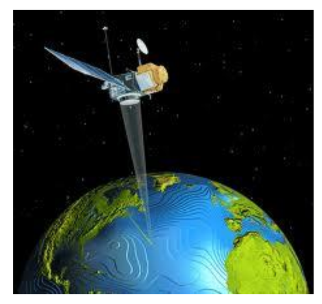
The European Slope Current (SC) is a major section of the warm poleward flow from the Atlantic to the Arctic. The heat imported with this flow keeps large areas much warmer and thereby creates favourable conditions for phytoplankton and fish stocks, which brings great economic importance to the European area.

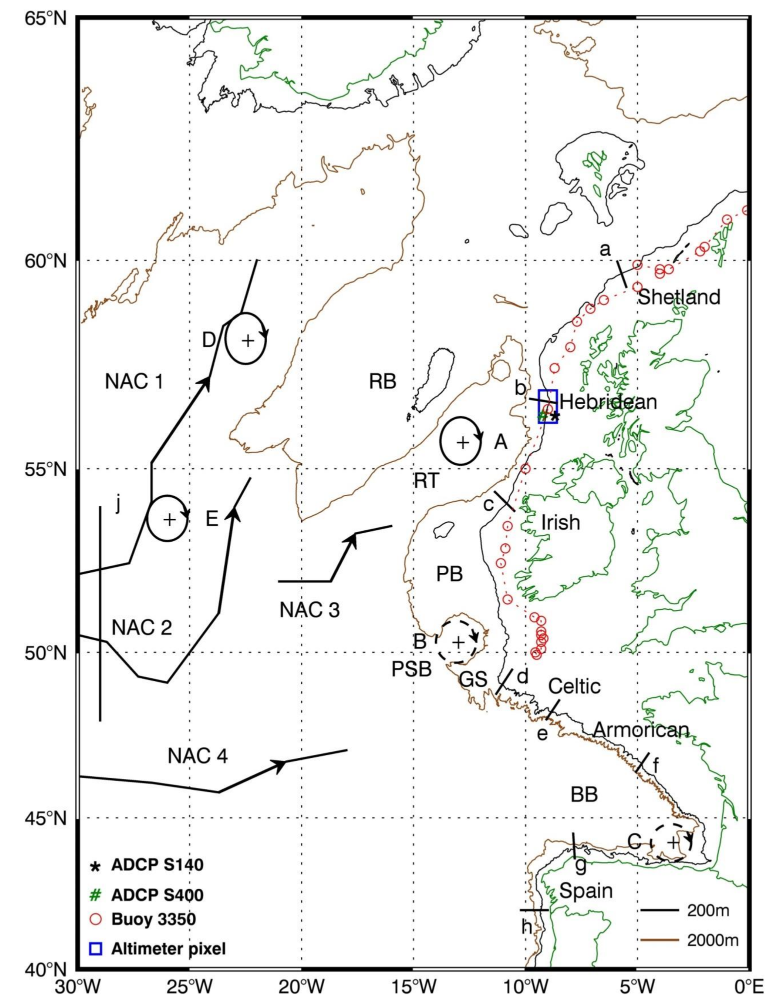


Manifestations of the European Slope Current in satellite temperature data: a) Winter ocean front frequency (1996-2012); b) SST (Jan 1996).

Data used for study

1. 20 years' weekly Map of Absolute Dynamic Topography (MADT) satellite data from AVISO (1992-2012);
2. 22 years' surface drifter data;
3. 16 months' ADCP;
4. 8 months' buoy;
5. 20 years' winter NAO index;
6. 20 years' SST.



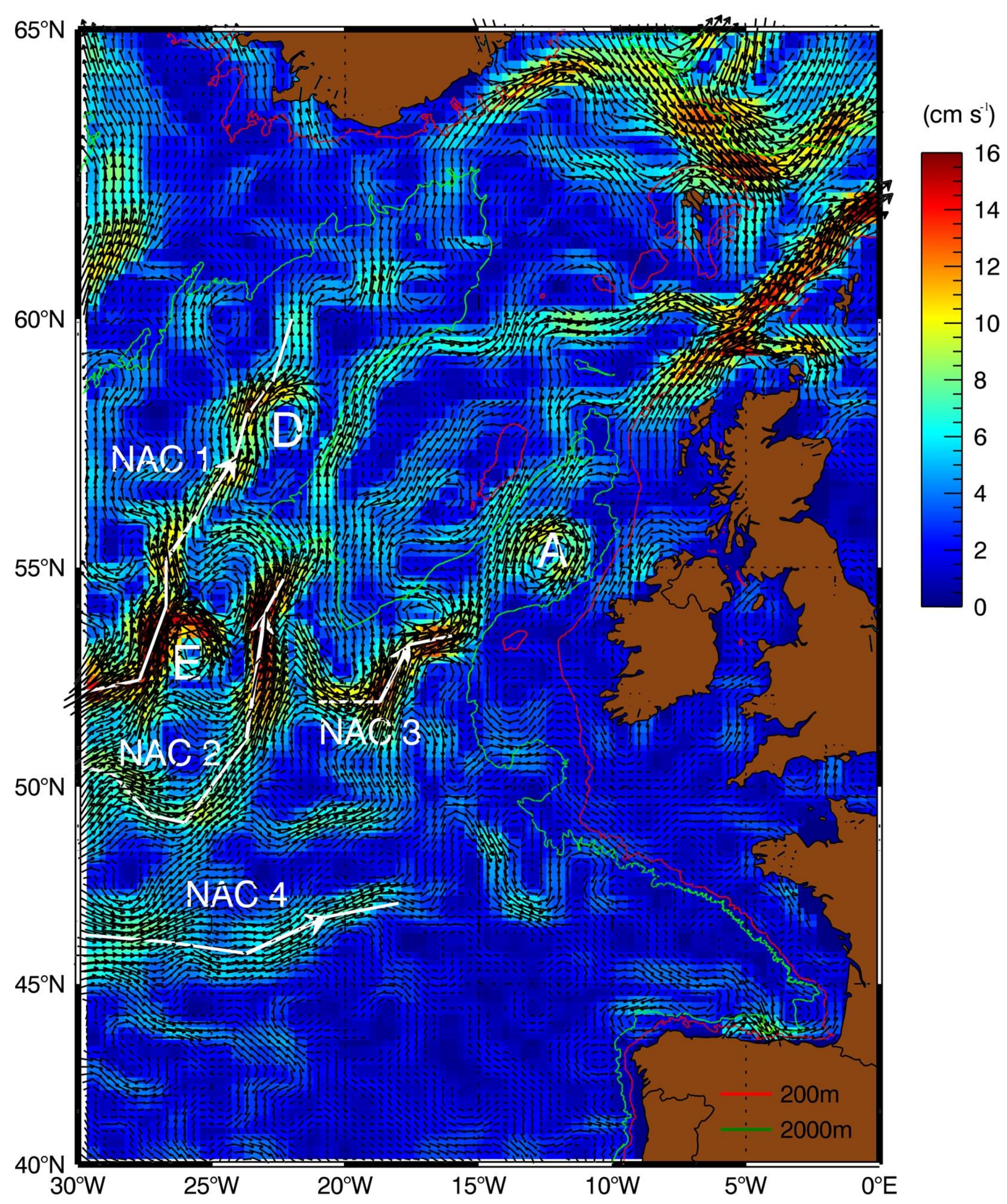


Map of study area and locations of in-situ data. Seasonality and interannual variability derived at normal sections a-h. NAC mean annual current climate series at section j.

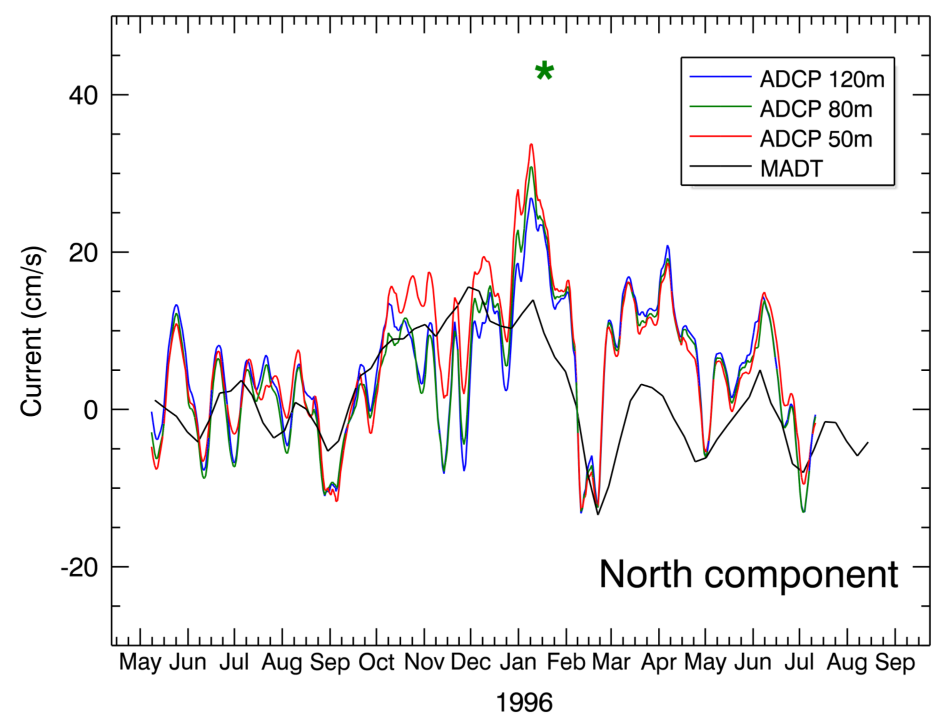
Mean ocean currents from altimetry

The four main North Atlantic Current (NAC) branches are clearly visible from the 20-years mean altimetry data:

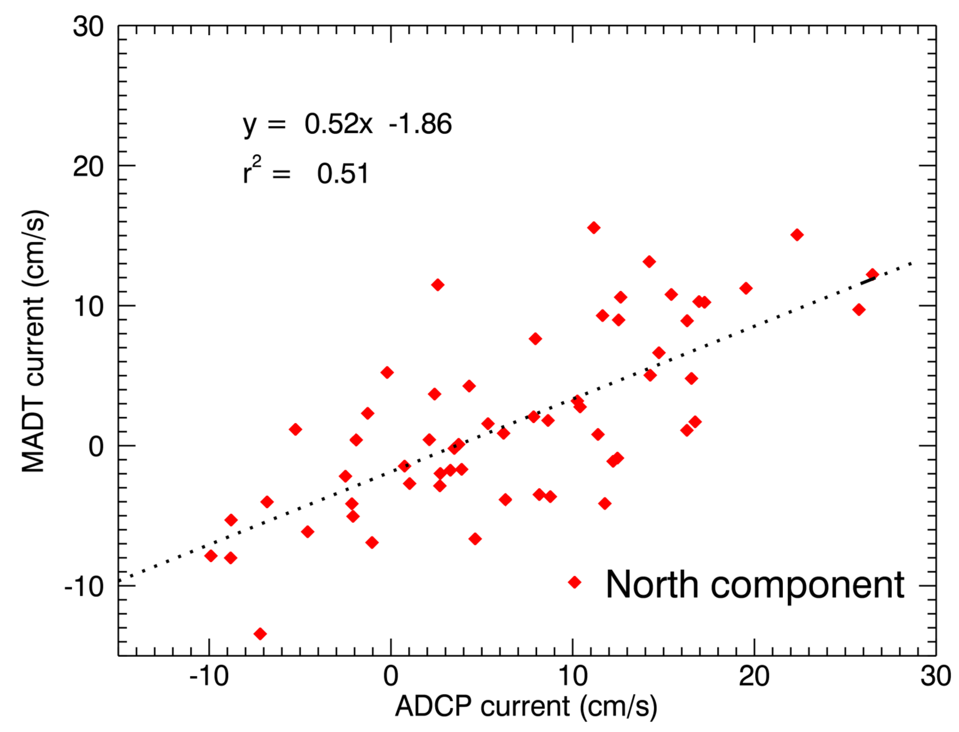
1. Branch 1, through the Iceland Basin, instability of this branch forms two eddies (D, E on figure):
2. Branch 2, through the Hatton-Rockall Basin;
3. Branch 3 flows through the Rockall Channel, where the instability of this branch forms an eddy A;
4. Branch 4, to the south, west of the Bay of Biscay.



Comparison between altimetry and ADCP



North component of S140 and MADT.



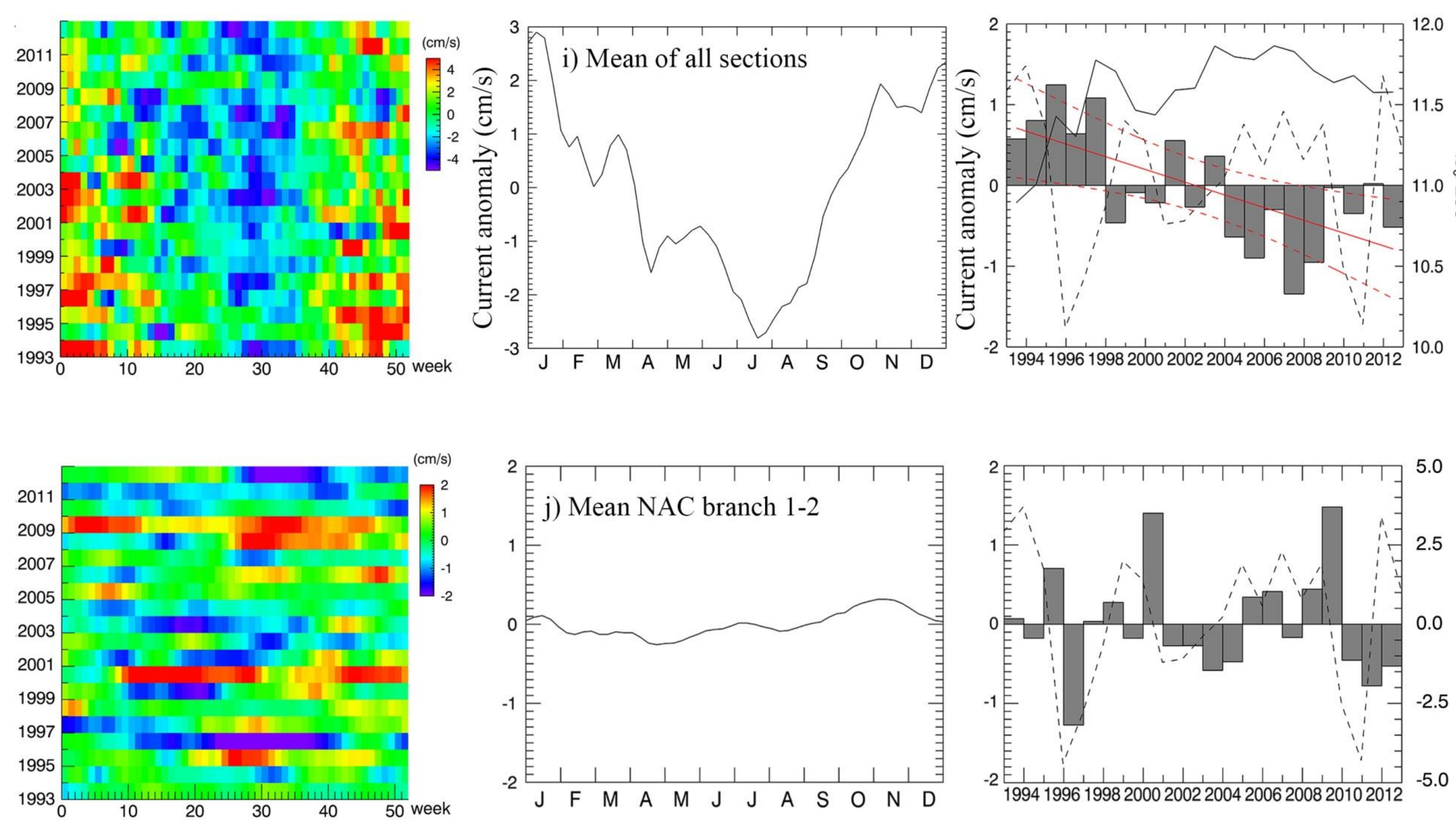
Scatter plot of north component from MADT against S140 at 25m depth.

The time series plot shows the altimeter's geostrophic measurements and those from S140 have a similar magnitude and time scale of variability. A scatter plot of the two time series shows a correlation of r^2=0.51 (p<0.01) The slope of the regression line (= 0.52) reflects a smaller mean altimeter current averaged over 20 km in the across-shelf direction than ADCP velocity at the shelf break.

Seasonality and interannual variability

Consistent seasonality: maximum in winter and minimum in summer.

Interannual variability: a peak poleward flow during 1995-1997. The speed of the SC exhibited a long term decreasing trend of ~1% per year. By contrast the NAC showed no significant trend over the 20-year period.



Conclusions

1. The Slope Current was appraised with an unprecedented 20-year altimeter dataset.

2. The surface geostrophic currents were compared with long-term *in situ* data and showed a correlation of r^2=0.51.

3. The flow seasonality was confirmed with the latest altimeter dataset: maximum in the winter and minimum in the summer.

4. The interannual variability and long-term trend of the SC were derived for the first time.

References

Pingree, R.D., Sinha, B., & Griffiths, C.R. (1999). Seasonality of the European slope current (Goban Spur) and ocean margin exchange. *Continental Shelf Research, 19*, 929-975

Souza, A.J., Simpson, J.H., Harikrishnan, M., & Malarkey, J. (2001). Flow structure and seasonality in the Hebridean slope current. *Oceanologica Acta, 24, Supplement 1*, 63-76

Acknowledgements

This study was funded by UK Natural Environment Research Council project Fluxes Across Sloping Topography of the North East Atlantic (FASTNEt). The altimeter product was produced by SSALTO/DUACS and distributed by AVISO.

Contact us: PML, Prospect Place, The Hoe, Plymouth, PL1 3DH, United Kingdom T +44 (0)1752 633100 W www.pml.ac.uk E forinfo@pml.ac.uk