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Sub-decadal Norwegian Coastal Current variability expressed in XRF Ca/Fe content in the SE Norwegian Sea

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The lack of accurately dated marine records has made it difficult to generate a regional reconstruction of high-frequency paleoclimatic variability. This study presents a well-dated high-resolution record, which can be used as a step towards that regional reconstruction. The objectives of this study are to develop a better understanding of the X-ray Fluorescence (XRF) Ca/Fe record and to use this knowledge to reconstruct paleoceanographic variability in the SE Norwegian Sea. The XRF core scanning analyses were preformed on a multi-core (P1-003MC-tubeB) from the upper continental slope (850 m depth) in the SE Norwegian Sea. A precise chronology was established utilizing ^{210}Pb, tephra and a ^{14}C wiggle-match method and the record spanned from 1450 AD to 1994 AD with annual to subdecadal resolution (Sejrup et al., in press). The XRF Ca/Fe results most likely reflect coccolithophorid abundance, which is particularly high in the Norwegian Coastal Current (NCC) waters. We suggest that higher Ca/Fe ratios may reflect NCC water extending over the core site in the spring/summer season, during the coccolithophorid bloom. The westward extension of the NCC is related to atmospheric forcing, where weak northerly winds cause the NCC to shoal and extend further west, increasing the coccolithophorid abundance over the core site. When the northerly winds are anomalously strong, enhanced vertical mixing erodes the vertical stratification of the NCC, which mixes into the underlying Atlantic waters, causing lower coccolithophorid abundance. A pronounced decrease in the Ca/Fe ratio is recorded during the Dalton solar minimum. From our hypothesis, this suggests less NCC water over the core site, possibly due to stronger spring/summer winds. A correlation of the Ca/Fe ratio to the sea surface temperature and the North Atlantic Oscillation were detected; the understanding of these dynamics is work in progress.

Reference:

Sejrup, H. P., S. J. Lehman, H. Haflidason, D. Noone, R. Muscheler, I. M. Berstad, and J. T. Andrews (in press), Response of Norwegian Sea temperature to solar forcing since 1000 A.D., Journal of Geophysical Research, doi:10.1029/2010JC006264