



## **The future regime of Atlantic nutrient supply to the Northwest European Shelf**

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Earth system models consistently project future decreases in subpolar North Atlantic mixed layer depths (MLD) and surface nutrient concentrations as a response to anthropogenic global warming. Accordingly, it is expected that Atlantic nutrient import to the Northwest European Shelf (NWES) decreases. To study the evolution of net primary production on the shelf we downscaled global MPI-ESM climate projections of emission scenarios RCP4.5 and RCP8.5 with a high-resolution regionally coupled ocean-atmosphere climate system model. Our simulations suggest that at the end of the 21st century the shoaling of eastern North Atlantic MLD causes a regime shift in the dynamics of Atlantic nutrient supply to the shelf. Upper ocean nutrient concentrations in the North Atlantic drop substantially, while on the shelf the nutrient decline is weaker due to deep ocean-shelf exchange at the continental margin, inducing a cross-shelf break nutrient front. As a consequence, primary production on the shelf becomes strongly modulated by multidecadal variations of Atlantic sub-mixed layer nutrient concentrations. Moreover, for scenario RCP8.5 shallow Atlantic MLDs reach the shelf edge at about 150-200 m depth, giving rise to enhanced interannual variability due to NAO-induced variations of vertical mixing at the shelf break.