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Volume eddy-driven heat and freshwater fluxes across 47°N in the Atlantic Ocean

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The western subpolar North Atlantic between 45°N and 50°N is characterized by the presence of a large amount of eddies and other mesoscale events that play an important role in the local exchange and horizontal mixing of water masses. Eddies trap water with distinguished properties like temperature, salinity, oxygen and nutrients, from the region of their formation. The properties/tracers are then transported with the eddy over longer distances until the eddy gradually dissipates or abruptly decays. Thanks to eddy detection algorithms it has been possible to study the meridional transport of cold and warm water trapped within eddies as they cross 47°N and calculate the temperature fluxes across this line. In order to extend these calculations to full volume fluxes by including a vertical component, high spatial resolution temperature and salinity observations are needed. With the onset of the Argo program the number of salinity and temperature profiles dramatically increased. Although the subpolar North Atlantic is one of the most densest sampled regions in order to cope with the large seasonal to interannual variability and strong mesoscale features, the spatial and temporal coverage is not sufficient to combine each detected eddy with a respective temperature and salinity profile. However a promising method to infer high-resolution salinity and temperature data is the Gravest Empirical Mode (GEM) technique. This technique combined Argo and altimeter data to exploit the relationship between T/S profiles and dynamic height in the North Atlantic. Thanks to this method salinity and temperature time series can be determined from 1993 until nowadays with the same resolution as the altimeter data, that is daily projections onto a 1/4° Cartesian grid. The GEM method in combination with three-dimensional detection of eddies in high resolution models could help to understand the connection between eddy surface signals and the corresponding vertical structure. It also allows to assess how much heat flux is achieved by actual eddies compared to the total heat flux at a given latitude and the so-called eddy-component of the heat flux.