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Impacts of the assimilation of satellite sea surface temperature data on estimates of the volume and heat budgets of the North Sea

The different mechanisms controlling the heat budget of the North Sea are investigated based on a combination of satellite sea surface temperature measurements and numerical model simulations. Lateral heat fluxes across the shelf edge and into the Baltic Sea are considered, as well as vertical ocean-atmosphere heat exchange. The 3DVAR data assimilation (DA) scheme is applied, which contains assumed model error correlations depending on the mixed layer depth derived from a coupled circulation/ocean wave model. The simulated seawater temperature is improved both at the surface and at greater water depths. DA is shown to change the current velocity field and decrease the lateral advective volume/heat exchanges between the North Sea and the Atlantic, yielding an increased heat flux from the Atlantic into the North Sea and more heat flux from the sea to the atmosphere. The largest DA impact on volume/heat transport is found at the Norwegian Channel, where the dominant process is Eulerian transport, followed by tidal pumping and wind pumping, while other processes, such as Stokes transport, transport driven by the annual mean wind stress, and tide-wind interactions, are negligible. Further analysis reveals the acceleration of the along-shelf current at the northern edge of the North Sea and a decrease in the horizontal pressure gradient from the Atlantic to the North Sea. DA changes the velocity field inside the Norwegian Channel and the instability of the water column, which in turn reduces the Eulerian transport of heat and water outward from the North Sea.

Which theme does your abstract refer to?

Development and assessment of data assimilation in forecasting applications (global and regional)

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