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The role of surface and advective heat and salt fluxes in the variability of North Sea temperature and salinity

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The objective of this study is to understand the various roles played by the local air-sea exchange processes and the oceanic advection for changes in temperature and salinity of the North Sea. The results are obtained from a three-dimensional model with a resolution of approximately 3 km of the North Sea over the period 1952 – 2001. The simulation is validated by means of observed hydrography and volume fluxes and demonstrated that the model is able to reproduce reasonable results.

Oceanic advection shows different effects on temperature and salinity changes. The seasonal surface heat flux (Qsur) is larger than advective heat flux (Qadv) over much of the North Sea, except in the region of the Norwegian Trench. In winter and spring, Qadv warms the North Sea through the northern entrance and the English Channel, where in summer and autumn. Qadv shows advective cooling Surface salt flux is much smaller than advective salt flux in the whole North Sea. This indicates that changes in salinity are controlled more by advection than by the precipitation-evaporation balance in the North Sea. In most parts of the North Sea, the seasonal variation of Qsur is much larger than that of Qadv, while the interannual variabilities of Qsur and Qadv have the same magnitude.

We investigate the roles of on different time scales. Qsur and Qadv for the temperature variations The study shows that the seasonal variation of temperature in the North Sea is determined by scale, Qsur. On interannual time scale, Qsur plays an important role on temperature variation in most parts of the North Sea. However, in the main pathways of the circulation in the North Sea, Qadv also plays a role on temperature interannual variability, especially in the northwest inow region, where the North Atlantic water enters through Fair Isle Passage and from east of the Shetland.