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## The role of heatwave events on the occurrence and persistence of thermal stratification in the southern North Sea

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Extremes in temperatures not only directly affect the marine environment and ecosystems but also have indirect impacts on hydrodynamics and marine life. The role of heatwave events responsible for the occurrence and persistence of thermal stratification was analysed using a fully coupled hydrodynamic and wave model within the framework of the Geesthacht Coupled cOASTal model SysTem (GCOAST) for the North Sea. The model results were assessed against satellite reprocessed data and in situ observations from field campaigns and fixed MARNET stations. To quantify the degree of stratification, a potential energy anomaly over the water column was calculated. A linear correlation existed between the air temperatures and the potential energy anomaly in the North Sea excluding the Norwegian Trench and the area south of 54°N latitude. Contrary to the northern part of the North Sea, where the water column is stratified in the warming season each year, the southern North Sea is seasonally stratified in years when a heatwave occurs. The influences of heatwaves on the occurrence of summer stratification in the southern North Sea are mainly in the form of two aspects, i.e., a rapid rise in sea surface temperature at the early stage of the heatwave period and a relatively higher water temperature during summer than the multiyear mean. Another factor that enhances the thermal stratification in summer is the memory of the water column to cold spells earlier in the year. Differences between the seasonally stratified northern North Sea and the heatwave-induced stratified southern North Sea were attributed to changes in water depth.