Study of the spatio-temporal evolution of Marine Heat Waves in the southern North Sea using medium and high spatial resolution satellite data.

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Marine Heat Waves (MHWs) are defined as discrete periods of anomalously warm water temperature at a given location. MHWs can have a huge impact on marine ecosystems, already under stress because of the effects of a warming ocean under climate change and high anthropogenic pressure. This work will assess the spatio-temporal evolution of MHWs in the southern North Sea, with an emphasis on the summer 2022 events. Studying the impact of MHWs on coastal marine ecosystems is currently hampered by the resolution mismatch between traditional satellite data (typically 1 km spatial resolution for sea surface temperature, SST) and species habitat/substrate. In the southern North Sea, a multitude of shallow sandbanks, sand, mud and coarser sediment substrats are present, offering a multitude of habitats to different species. Fine spatial resolution data are required for accurate analysis of the spatio-temporal evolution of MHWs on the ecosystem. The Thermal InfraRed Sensor (TIRS) onboard the Landsat constellation provides SST at a spatial resolution of 30 m with an accuracy of 0.1 to 0.2K, and can allow the study of the evolution of small-scale dynamics in coastal regions, including the development of MHWs. However, Landsat data have a very low revisit time (7-9 days), not optimal to study specific MHW events, which can evolve on a daily or sub-daily basis. Another source of high spatial resolution SST data is the ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS), with a spatial resolution of 70m, which can be used to complement Landsat data. This work will assess the synergy between high-spatial resolution satellite data and daily, mid-spatial resolution SST data to analyse the evolution of MHWs in coastal regions. DINEOF (Data Interpolating Empirical Orthogonal Functions) will be used to reconstruct missing data, merge these data sources and provide a high spatial and temporal resolution SST dataset. This work is a first attempt at linking MHW variability and their consequences on marine ecosystems at very fine spatio-temporal scales, and is part of the North-Heat project. We aim at providing key insights for our comprehension of MHWs in the southern North Sea, a region where marine ecosystems are already under high anthropogenic pressure.