Marine Heatwaves in coastal area: example of the Sea of Chiloé, Chile

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Marine heatwaves (MHWs) are phenomenon of temporarily anomalously warm water events that can be induced by both oceanic and atmospheric factors and that have been observed in every ocean. They have drawn researchers' interest during the last decade, and it has been observed that their frequency and intensity are increasing in connection to human-induced global warming. Although MHWs have been subject to numerous studies in the open ocean, their formation and impacts on coastal environments remains understudied. Indeed, MHWs detection requires a long-term climatology to compare to local temperatures, both generally obtained using satellite data; but in coastal areas, satellite data might be unavailable due to too coarse resolution or can be altered by interferences with land. In this study, we propose to analyse MHWs in a fjord-like environment: the Inner Sea of Chiloé, in Chilean Patagonia. Chiloé Inner Sea has the particularity to have a very complex bathymetry, with numerous micro-basins, fjords and channels. Therefore, the use of satellite data is not relevant since high spatial resolution satellite products do not have a sufficient temporal resolution for MHWs detection. Moreover, the region is particularly cloudy and rainy, hindering satellite measurements. Here, instead of a climatology based on satellite data as it is conventionally used, we propose to analyse MHWs using a climatology based on in situ data. The Inner Sea of Chiloé has been well sampled during the last 3 decades, totalling more than 3 million of samples; we used those data to build a climatology of the temperature of the sea. In this purpose, we used "Data-Interpolating Variational Analysis in n dimensions" (DIVAnd) tool to interpolate the scattered data onto a regular grid using optimal interpolation, taking advantage of the information in the 4 dimensions in order to have a continuous field. Hence, it results with a 4-dimensional climatology, with a resolution of 900m and a non regular vertical resolution at 32 different depths from surface to 400m. Using this climatology, we were able to detect MHWs in the different areas of the Sea. The Inner Sea of Chiloé experienced MHWs in most of its regions during summers 2016 and 2021 and more regionally during summers 2017 and 2022. Here we will show more in detail the example of the Reloncavi Sound, which experienced very intense MHWs during summer 2021 with two successive and intense MHWs with a temperature of 3 degrees above the mean.