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MARINE HEATWAVES AT HIGH RESOLUTION IN FJORD ECOSYSTEM

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Abstract: Marine heatwaves (MHWs) are anomalous extreme temperature events that can persist from a few days to several months. They have been observed worldwide, however their study in coastal ecosystem at high resolution remains limited. Coastal environments are characterised by complex topography due to the presence of islands, channels, gulfs, or fjords, which complicates the detection and analysis of such events.
The detection of MHWs in coastal regions presents a significant challenge because they are traditionally identified using satellite datasets with long temporal coverage (>20 years), often at the expense of high spatial and temporal resolution. Consequently, capturing the fine-scale spatial variability of MHWs in complex coastal systems remains difficult.
In this study, we investigated the development of MHWs within the fjord ecosystems of Chilean Patagonia using a high-resolution approach designed to capture the complexity of coastal MHWs. Three decades of in situ observations were combined with satellite product to generate high-resolution (900 m) temperature fields for Northern Patagonia. This approach enabled the detection of extreme events and the assessment of their spatial and temporal variability, even within the intricated fjords and basins.
The high-resolution results revealed that MHWs dynamics vary according to the characteristics of individual basins. Across most of the study area, MHWs occur with a frequency of 1.5 to 2.5 events per year, while their intensity is generally higher in enclosed basins such as gulfs and fjords. Analysis of long-term trends indicates that MHWs intensity has decreased over time in enclosed environments, while increasing in the open ocean. In addition, MHWs frequency has generally increase throughout the region, except in basins characterised by faster ocean dynamics.

Keywords: Marine heatwave, temperature anomaly, in situ observation, satellite product, Patagonia

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