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Port Alfred upwelling: A numerical modelling approach

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Port Alfred upwelling, located on the southeast African shelf, lies on the inshore edge of a western boundary current, the Agulhas Current. It is a semi-permanent upwelling covering a width of 15-100 km. The mechanisms responsible for these cold water events have not been studied in depth due to the poor sampling of Port Alfred. Previous studies have relied on *in situ* measurements and remote sensing datasets and suggested that this upwelling was current-driven while other studies claimed that it could be wind-driven. Recently, it was also argued that it could be due to a combination of the current and wind forcing.

In this study we aimed at identifying the dominant forcing drivers triggering this upwelling. Using the daily simulations of a CROCO model of a horizontal spatial resolution of ~2.5km, we explored its spatial and temporal characteristics. Building up from previous studies, we investigated several potential hypotheses from a modelling perspective. Some of these forcing mechanisms included the strength of the current, wind, the meandering of the current and the eddy. By performing a combined principal component analysis, we tested each hypothesis and found that a combination of current strength, meander and wind would lead to a stronger upwelling event, while some of the forcing mechanisms could trigger a weaker cold event individually.

This phenomenon is known to cause an increase of nutrients at the surface, setting the ideal conditions for primary production, a significant oceanographic process for biodiversity. Shedding more light on these cold water events and the main drivers allows oceanographers to focus more attention on Port Alfred in the future. It will also reinforce policymakers to consider Port Alfred as a marine protected zone.