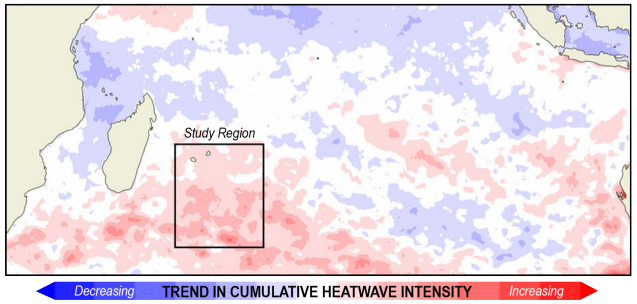
Drivers of marine heatwaves and their decadal suppression in the southwest Indian Ocean

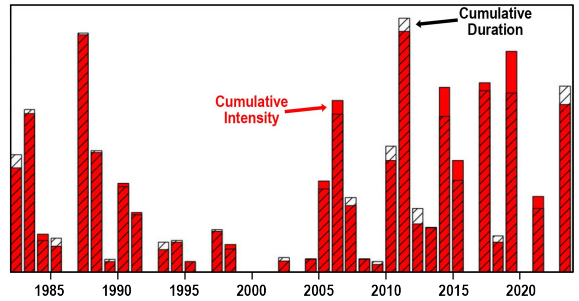
University of Colorado Boulder

- The southwest Indian Ocean has had pronounced marine heatwave activity over four decades with a **marked suppression from 1992 to 2004**.
- Our study uses **satellite observations, reanalysis data, and climate model simulations** from 1982 to 2023.
- An ***Estimating the Circulation and Climate of the Ocean (ECCO)*** mixed-layer heat budget shows the **effect of surface heat flux dominates over entrainment,** contributing roughly three times as much warming. *ECCO budget results associated with air-sea heat fluxes & mixed layer depth are shown at right >>*

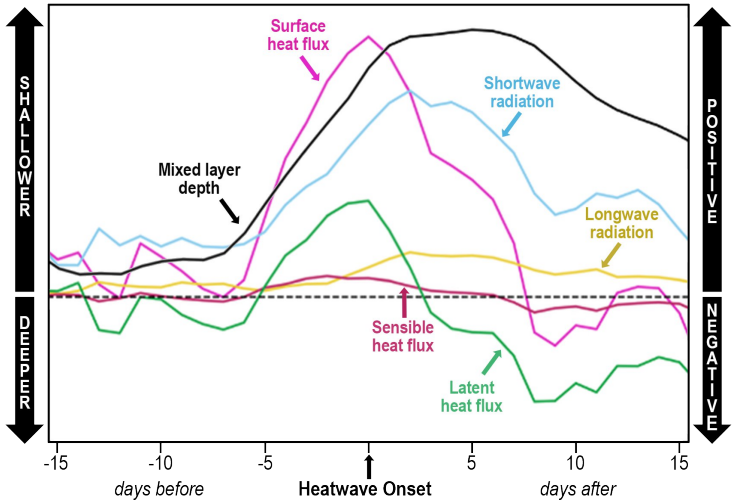
We find that the root cause leading to the onset of marine heatwaves in this region are the intrusion of the broad-scale, midlatitude atmospheric intraseasonal Rossy waves (RWs). In our study region, surface wind anomalies associated with the RWs increase specific humidity through horizontal advection and weaken the mean winds, reduce latent heat loss, shoal the mixed layer and increase shortwave heating. However, external factors such as the eruption of Mt. Pinatubo (1991) and climate variability (e.g., Southern Annual Mode, Subtropical Indian Ocean Dipole) can drive decade-long suppression of marine heatwaves.

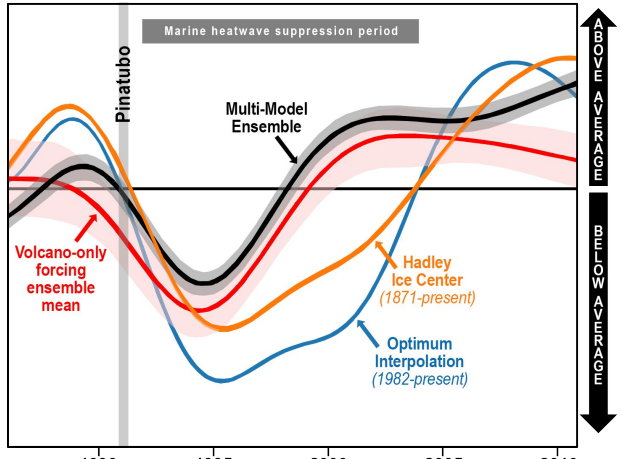
In the southwest Indian Ocean, surface wind anomalies associated with intraseasonal Rossby waves that reach the subtropics ultimately trigger marine heatwave events.





LEFT: Cumulative intensity of marine heatwaves is increasing in our study region, even after removing the linear sea surface temperature trend. RIGHT: Note the suppression in marine heatwave activity from 1992 to 2004.





LEFT: Mixed layer temperature anomalies for the composite of all 47 marine heatwave events in our study region during the ECCO era (1992-2017). RIGHT: Decadal sea surface temperature anomalies based on observations (orange and blue lines) and model data (red and black lines with 95% confidence intervals).

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Our findings highlight the important interplay between external forcing and internal climate variability in shaping regional extremes.