

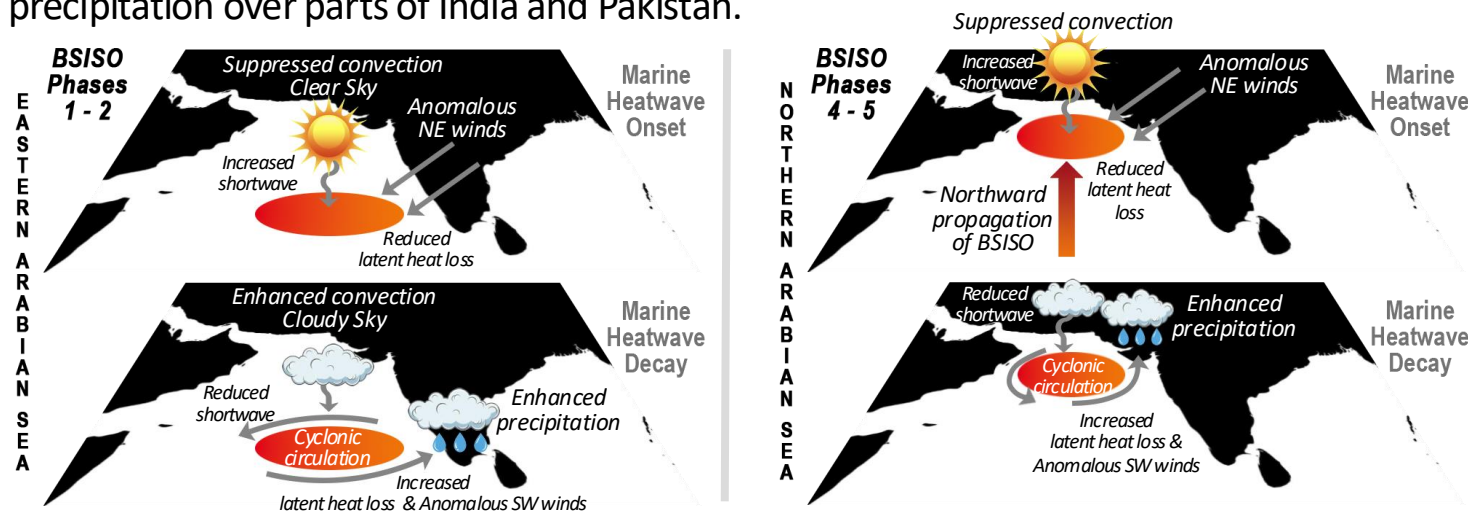
Marine Heatwaves as Drivers of Extreme Precipitation



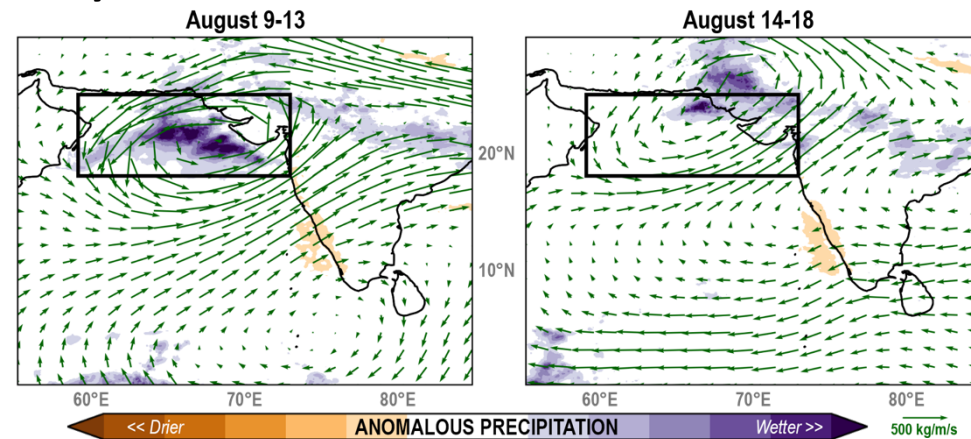
Air-sea fluxes from atmospheric intraseasonal oscillations trigger Arabian Sea marine heatwaves, which feed back onto the atmosphere to amplify extreme rainfall over India and Pakistan.

What We Found

- **Drivers:** Suppressed convection during *Boreal Summer Intraseasonal Oscillation (BSISO)* – phases 1-2 in the eastern (below left) and phases 4-5 in the northern Arabian Sea (below right) – enhances shortwave radiation and reduces latent heat loss, raising sea surface temperature and thus can initiate marine heatwaves (MHWs).
- **Impacts:** Warm sea surface temperature anomalies from MHWs induce a low-level cyclonic wind response and drive moisture convergence, increasing the risk of extreme precipitation over parts of India and Pakistan.



Why we care



Anomalous precipitation (color) and vertically integrated water vapor flux (vectors) during the August 2022 floods in Pakistan. A MHW occurred in the northern Arabian Sea (black box), reaching its peak on August 8, 2022.

A northern Arabian Sea MHW induced a low-level cyclonic anomaly that subsequently propagated inland, driving heavy precipitation and catastrophic flooding across Pakistan in August 2022, **affecting over 33 million people.**

This study employs a heat budget from *Estimating the Circulation and Climate of the Ocean (ECCO)* to highlight the two-way interaction between the atmosphere and ocean during MHWs. We also link MHWs with extreme rainfall in the region. These findings advance our understanding of Arabian Sea MHWs, supporting efforts to predict extreme events and assess associated risks, with important socioeconomic and ecological implications.