Sea Surface Salinity Response to Tropical Cyclones based on Satellite Observations

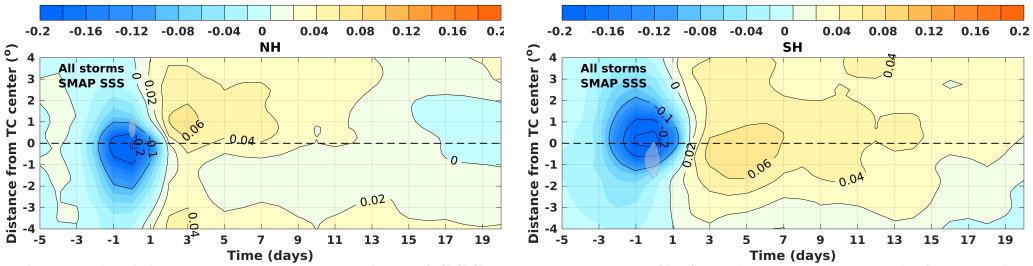

Figure 1. Along-track composite of SSS response to TCs for the Northern (left panel) and Southern (right panel) Hemisphere.

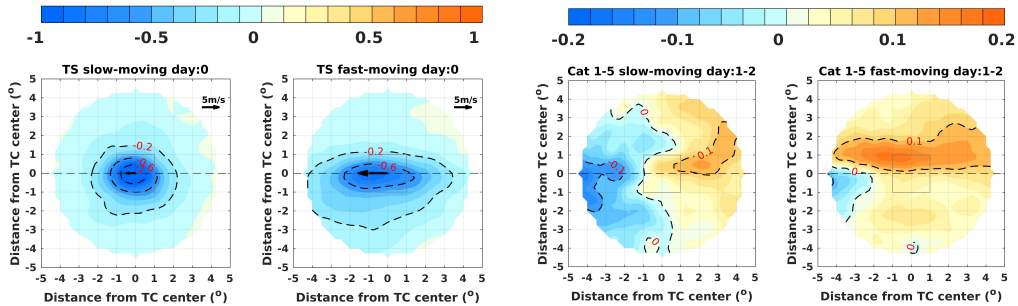

Figure 2. Distribution of SSS response on day 0 and days 1-2 to slow-moving and fast-moving TCs .

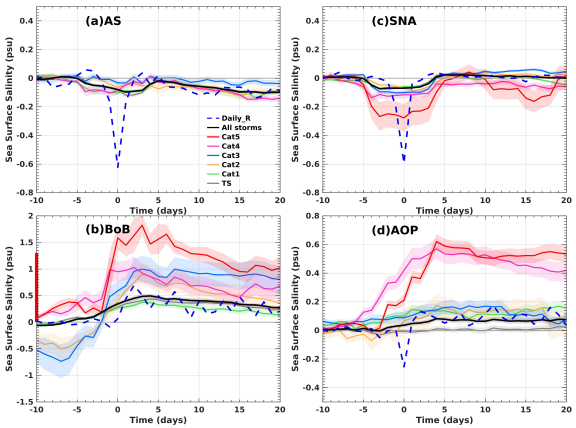

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Figure 3. Lagrangian composites of SSS response to TCs in different basins.

Problem: Due to strong winds and intense heat, momentum and freshwater fluxes, Tropical Cyclones (TCs) can have a profound impact on the thermal and salinity structure of the upper ocean. In particular, the present study tries to answer the following questions: 1. What is the typical impact of TC rainfall, evaporation and winds on sea surface salinity (SSS) in terms of climate characteristics at global scale? 2. How do TC intensity, translation speed and preexisting ocean conditions affect the ocean response?

Main Datasets : IBTrACS TC center locations and intensity; SMAP, SMOS and Aquarius salinity; OISST; GPM precipitation; ERA5 evaporation; Argo.

Finding: Global storm-centered composites indicate that TCs act to initially freshen the ocean surface (due to precipitation), and subsequently salinify the surface, largely through vertical ocean processes (mixing and upwelling; Figure 1). Faster moving TCs are found to have slightly weaker freshening with larger area coverage during the passage, but comparable salinification after the passage (Figure 2). The ocean haline response in four basins with different climatological salinity stratification reveals a significant impact of vertical stratification on the salinity response during and after the passage of TCs (Figure 3).

Significance: Multi-year records of satellite remote sensing of SSS open the possibility to systematically explore the climatology of the SSS response to TCs, which provides insights into the climatological ocean haline response to TCs and complements previous case studies.