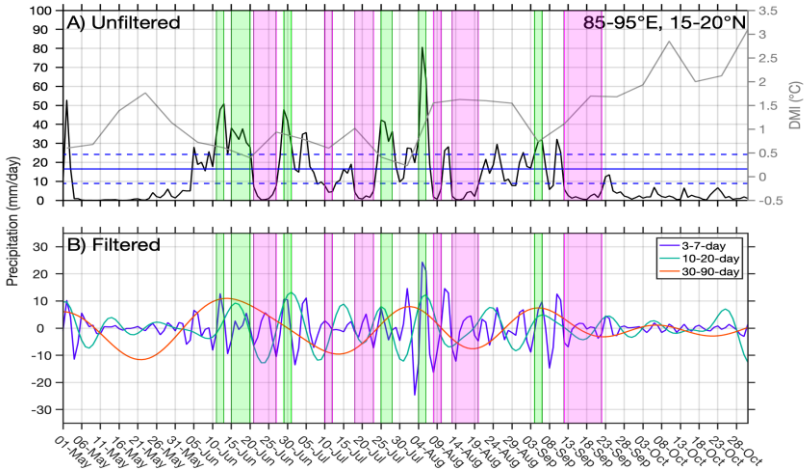
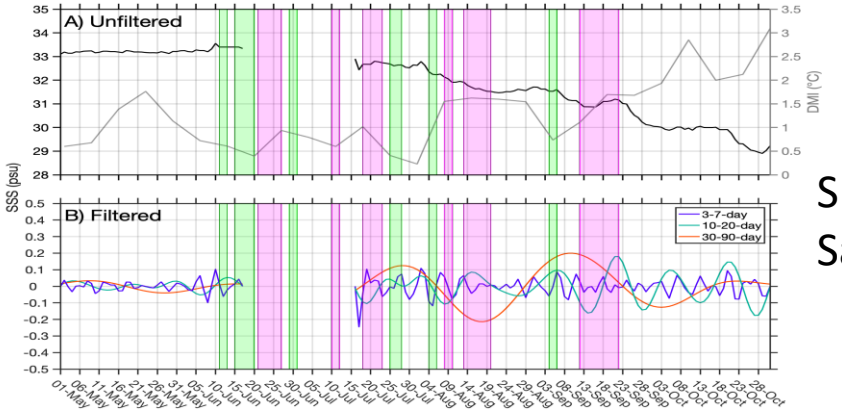
Monitoring 3-7-day Intraseasonal Oscillations using SMAP Salinity in the Bay of Bengal



GPM Rainfall

Box averaged time series of (top) unfiltered GPM precipitation over the northern Bay of Bengal (85-95°E, 15-20°N) (black; mm/day) and Dipole Mode Index (DMI; grey; degrees C) and (bottom) GPM precipitation bandpass filtered for 3-7-day synoptic oscillations (purple; mm/day), the 10-20-day ISO (teal; mm/day), and the 30-90-day ISO (orange; mm/day) in the same northern Bay of Bengal box for the 2019 southwest monsoon season. In the top figure, the solid blue line indicates the mean July/August rainfall over central India and blue dashed lines indicate ±0.5 standard deviation. Weekly DMI values are retrieved from NOAA and are calculated as the difference in OISST anomalies between DMI West (50-70°E, 10°S-10°N) and DMI East (90°E-110°E, 10°S-0°N). Below same as above, but for SMAP salinity (psu).



SMAP Salinity

Problem being address and motivation

Intraseasonal oscillations (ISOs) significantly contribute to monsoon rainfall in the Indian Ocean, especially in the Bay of Bengal (BoB). In 2019 alone, ISOs contributed almost 50% of the monsoon rainfall and strengthened the monsoon such that it became the first strong monsoon in 25 years since 1994. In particular, the 3-7-day mode heavily impacts the active and break cycles of the monsoon which was true in the 2019 monsoon.

Method

Surface salinity derived from NASA's Soil Moisture Active Passive (SMAP) from JPL processed version 4.2 level 3 at a 0.25° grid daily data derived from an 8-day running mean product is used in this study. In addition to salinity, daily precipitation data from the GPM mission is used for the annual rainfall at 0.1° grid.

Key finding

The advent of the SMAP mission has allowed for the observation of SSS at an unprecedented scale. Despite this, SSS has largely been neglected in monsoon studies, and thus this study focused how SMAP salinity can be useful for monitoring weather/synoptic related 3-7-day oscillations and monsoon variability. SSS is more useful for the monitoring of oceanic responses to ISOs rather than their prediction, but more clearly captures the ISO signal due to the wide swath (1000 km) and faster repeat cycle.

Broader significance or implications

The BoB is home to many of the most important air-sea interactions associated with the Indian monsoon system. ISOs contribute to and control the active and break cycles of the monsoon, making their prediction critically important for accurate monsoon prediction. Over a billion people are directly impacted by the monsoon system, with their welfare, agriculture, economy, and national security heavily dependent on monsoon rainfall. The monsoon has further global impacts, influencing shipping routes and the global economy, making our understanding and prediction of this system a necessity.

Publication source

Subrahmanyam, B., H. L. Roman-Stork, V.S.N. Murty (2020). Response of the Bay of Bengal to 3-7-day Synoptic Oscillations during the Southwest monsoon of 2019, JGR-Oceans (in Press).