Remote sensing of sea surface salinity variability in the South China Sea

Newly available satellite observations of Sea Surface Salinity (SSS) from Aquarius and SMAP satellites are used to characterize SSS variability in the South China Sea (SCS, Figure 1). The results depict the SCS as a very dynamic region exhibiting variability over a broad range of time scales, from intra-seasonal to inter-annual, with the seasonal cycle dominating. The latter is closely related to the SCS monsoon system. The most active inter-annual SSS variability is observed in the northeastern and eastern parts of the SCS and is dominated by the recent El Niño event. A significant basin-wide salinification began in summer of 2015, peaked in spring of 2016 with the averaged amplitude of up to 0.5 psu, and continued until the fall of 2016 (Figure 2). After 2016, the trend is reversed and the SSS becomes fresher. While basin-wide salinification during 2015-2016 can largely be attributed to the El Niño-induced deficit in the surface freshwater flux (evaporation minus precipitation (E-P)), locally, it is often a competition between the surface flux and oceanic processes, including horizontal advection and vertical entrainment.

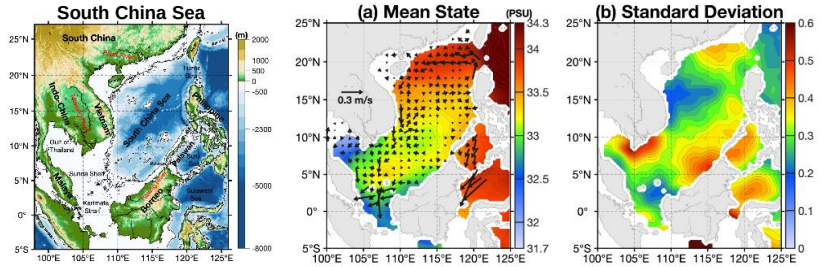

Figure 1. (a) 7-year mean SSS (psu) in the South China Sea (SCS) from Aquarius/SMAP satellite observations. Arrows show 7-year mean currents from OSCAR dataset. (b) The standard deviation of SSS computed from time series of Aquarius/SMAP SSS for the period January 2012 to December 2018.

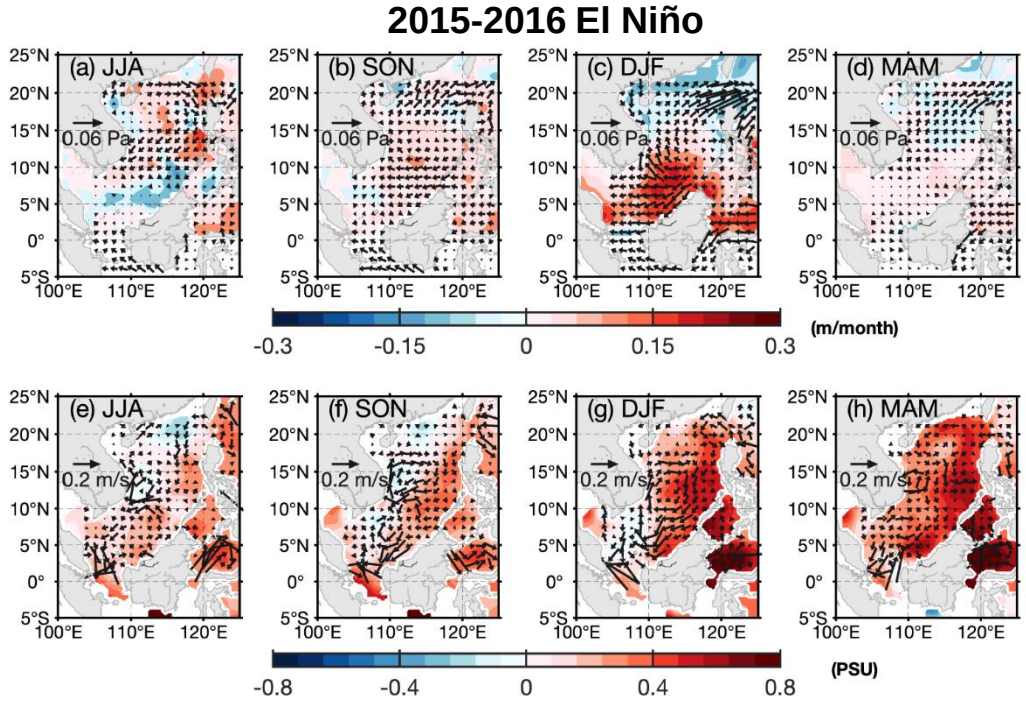

Figure 2. Spatial patterns of seasonal net surface freshwater flux (E-P, color) anomaly and surface wind stress (arrows) anomaly in (a) 2015 JJA, (b) 2015 SON, (c) 2016 DJF and (d) 2016 MAM seasons. The anomalies are computed relative to the monthly mean over 2012-2018. Positive E-P anomalies indicate evaporation exceeds precipitation. The wind stress data used is derived from the ASCAT satellite. The second row (e-h), similarly, shows anomalous SSS (psu; color) and anomalous ocean currents (arrows).

It is also worth emphasizing that a significant part of the SSS variability in the SCS described in the study was made possible solely due to satellite observations of SSS and would be impossible using in situ datasets that have coarser temporal and spatial resolution (e.g., Argo observations cover only the deepest part of the sea and are sparse). Many phenomena, such as the basin-wide response of the SCS SSS to ENSO (Figure 2) is observed for the first time.

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