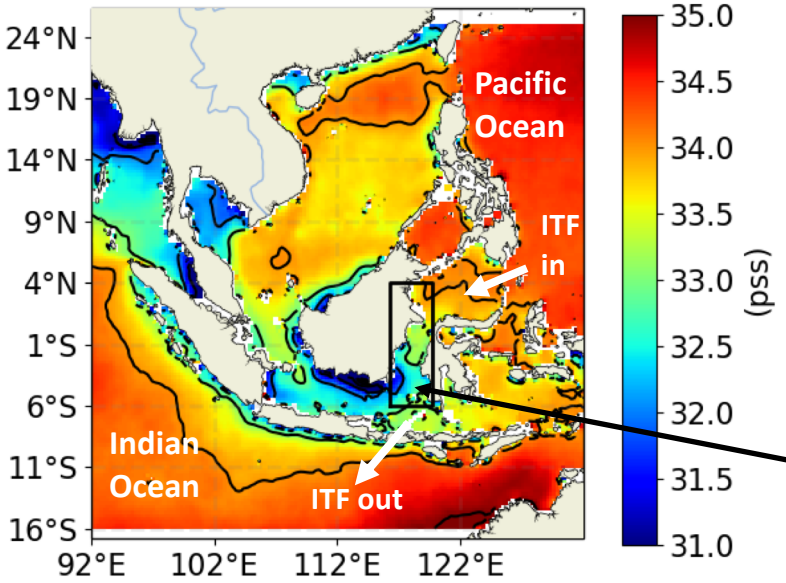
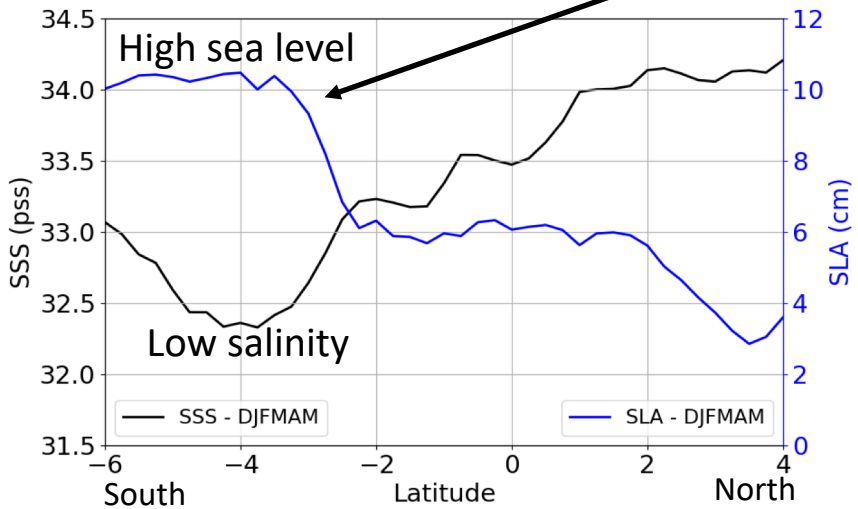
SMAP data reveal critical effect of Maritime Continent (MC) water cycle on tropical chokepoint of global ocean circulation

SMAP salinity during NW monsoon (DJF/MAM)



S-to-N distribution of salinity & sea level anomaly along the main ITF channel (black rectangular above)



Problem: The Indonesian throughflow (ITF) is the tropical chokepoint of global ocean circulation, affecting ocean heat/freshwater distribution, sea level, marine BGC, and climate variability. Monsoonal water cycle causes ~3 m of rain in the MC (DJF to MAM). But its effect on the ITF is poorly understood.

Main Datasets: SMAP salinity & soil moisture; TRMM/GMP precipitation; Jason-2/3 sea level anomaly & surface currents; MODIS ocean color.

Key findings:

- Monsoonal rain & rain-induced runoff dilute seawaters in the main channel of the ITF.
- This raises local sea level, opposing pressure from the Pacific that drives the ITF.
- Seasonal freshening explains seasonal change of sea level gradient along the ITF pathway, exemplifying monsoon-rain effect on the ITF.
- SMAP & other NASA satellites are fundamental to enabling the insight.

Implications:

- The MC is under the ascending (wet) branch of the atmospheric ”Walker Circulation”, which is projected to weaken under climate change scenario.
- Changes in the Walker Circulation affects MC precipitation – its effects on the ITF and phenomena affected by the ITF need to be investigated.

Lee, T., **S. Fournier**, A. L. Gordon, J. Sprintall, 2019: Maritime continent water cycle regulates low-latitude chokepoint of global ocean circulation. *Nature Comm.*, DOI:10.1038/s41467-019-10109-z.

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