How close to the ice edge can we retrieve sea surface salinity from SMAP?

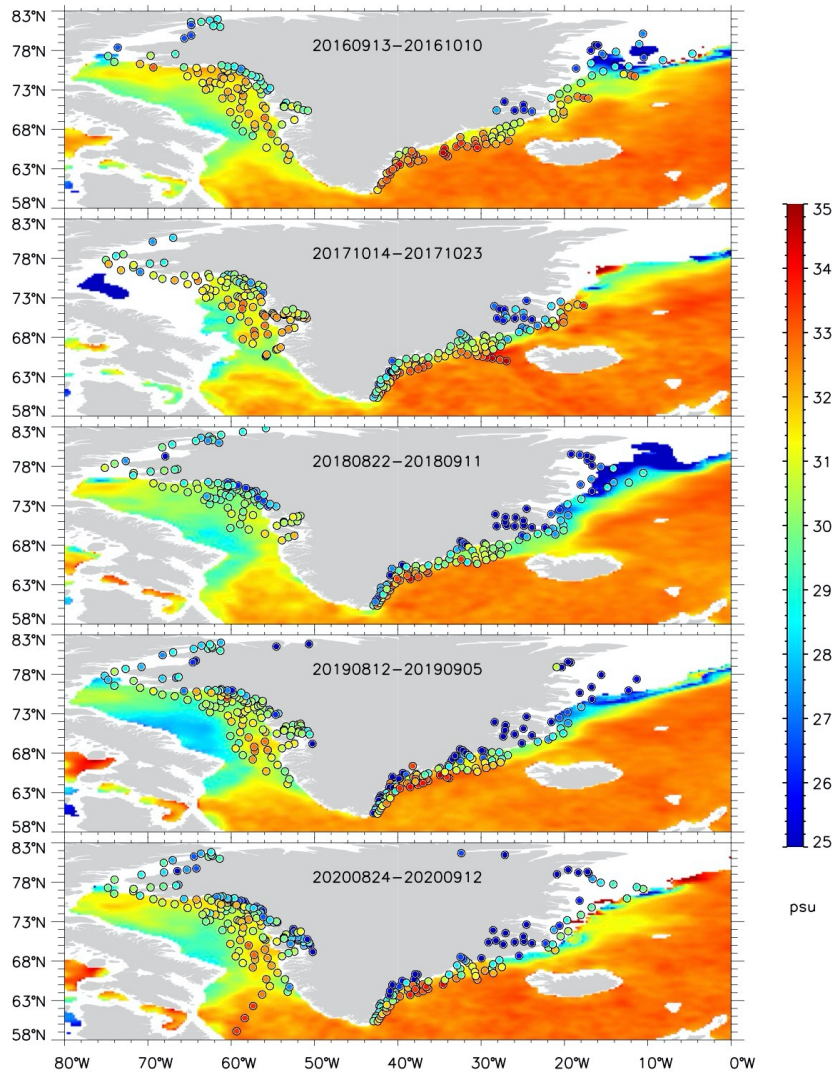## Tang, Yueh, Fore, Hayashi, Steele, IEEE JSTARS, 2021

Figure 1 SMAP SSS averaged over the period of OMG campaign for each year from 2016 to 2020 (background color), and solid dots are OMG/AXCTD salinity at a depth of 0.72 m.

Science or Technology Question: SMAP L-band measurements in areas mixed with ice and water cannot be used directly for sea surface salinity (SSS) retrieval, resulting in a large SSS data gap near the ice edge. To what degree can we mitigate the ice effect and deliver SSS retrieval near ice, where SSS is a critical parameter for monitoring climate change in the Arctic Seas?

Results: We developed a data-driven ice correction (IC) algorithm which is applied to SMAP brightness temperature (TB) and integrated with the standard JPL CAP processing system for SSS retrieval. We found the algorithm is most effective near the ice edge, thereby increasing the threshold for SSS retrieval to 15% sea ice concentration from the current 3%. SMAP SSS are validated with AXCTD in situ salinity collected by NASA's Ocean Melting Greenland (OMG) from 2016 to 2020 along the Greenland coast. The bias-adjusted SMAP SSS depicts salinity patterns and gradients around Greenland consistent with OMG measurements (Figure 1). The number of collocations between OMG and SMAP daily gridded data increased by more than 30% with IC, and similar retrieval accuracy obtained with or without IC (~1.4 psu standard deviation of difference between SMAP and OMG).

Significance: With the proposed sea ice correction algorithm, we can obtain SMAP L-band sea surface salinity with improved coverage near the sea ice edge to facilitate the understanding of ice melt/formation processes and their impact on the ocean.

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Data Sources:
1. SMAP brightness temperature data provided by SMAP project can be found at https://nsidc.org/data/SPL1BTB
2. SMAP sea surface salinity retrieved by the JPL CAP processing system can be found at https://podaac.jpl.nasa.gov
3. Sea ice concentration (SIC) data from NCEP can be found at https://polar.ncep.noaa.gov/seaice/index.html; and SIC from the Ocean and Sea Ice Satellite Application Facility (OSISAF) of the European operational satellite agency EUMETSAT can be found at http://www.osi-saf.org/?q=content/global-sea-ice-concentration-ssmis.
4. Salinity profiles from AXCTD of the NASA mission Ocean Melting Greenland (OMG) can be found at https://podaac.jpl.nasa.gov/dataset/OMG_L2_AXCTD

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