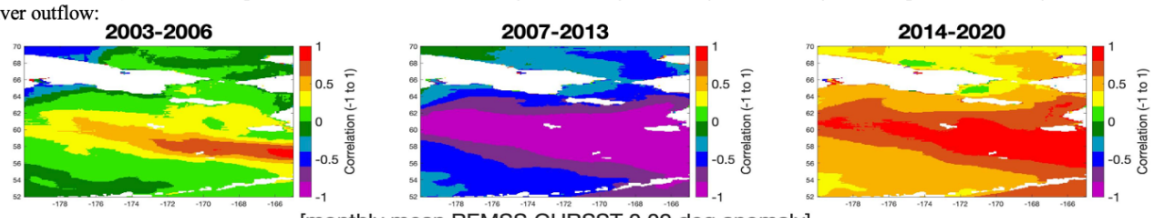
National Aeronautics and Space Administration

Using remote sensing and in situ datasets to distinguish coastal from ocean sea surface temperature forcing over the last 18 years

Author: Rachel Spratt, NASA Postdoctoral Program Fellow (329b)
Co-author and mentor, Jorge Vazquez (329b)

Introduction:

The Arctic study covering (165° West to 180° West, 52° North to 70° North), is meant to highlight the importance of retrieving data from current satellite missions which foster climate change research: The *Remote Sensing System's Group for High-Resolution Sea Surface Temperature* 0.09 degree (***REMSS GHRSST***) global dataset follows coastal sea surface temperature patterns in warm and cool decadal patterns (the Pacific Decadal Oscillation; *PDO*) over the time period 2002-2020 in the Arctic region covering the Bering Strait, Bering Sea, and peninsula hosting the Yukon River outflow:



Methods:

Figure 1. Warm and cool patterns can be seen in the SST *anomaly* (residual after annual cycle removed): 2003-2006 neutral-to-positive PDO phase, 2007-2013 negative PDO phase, 2013-2020 positive PDO phase. A clear warming trend occurs in the third segment of this study, consistent with other evidence of recent warming in the Arctic (Frost et al, 2020; Ballinger et al, 2020; Moon et al., 2020, Frey et al, 2020).

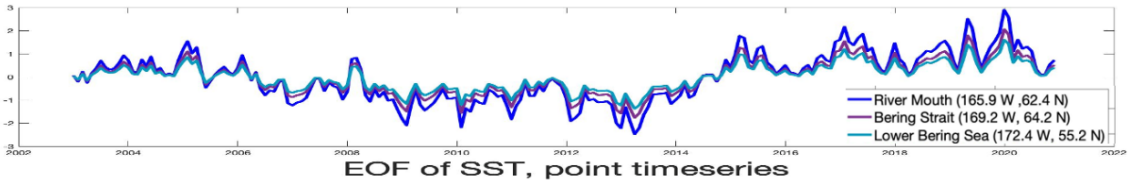


Figure 2 is a statistical analysis of the same data (above) showing the variance in the same time period , in three, 1-d surface temperature points taken across the same study area, at the river mouth (**165.9 W, 62.4 N**), inside the Bering Strait (**169.2 W 64.2 N**), and in the Lower Bering Sea (**172.4 W, 55.2 N**).

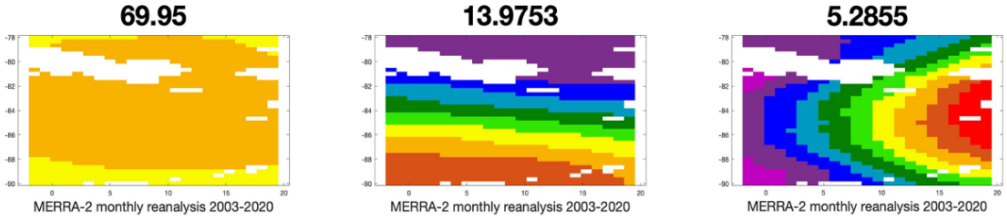


Figure 3. To investigate physical influences of river discharge on sea surface temperature, we inspected three statistical solutions of the variance of precipitable water vapor in empirical orthogonal functions (EOFs) , from the monthly-mean MERRA-2 reanalysis. Water vapor tends to travel northward in the Northern hemisphere and inland (Vihma et al., 2020).

Results/ Conclusions:

The visual solution (EOF) capturing 5% of the spatial variance over the 18 years of the time period is roughly 38,000 square km and is a semi-circular mode of variance sitting directly over the Yukon River Delta, suggesting that modulation of SST over the surface ocean may be governed in part by vapor. The EOF vapor mode which represents approximately 70% of the variance covers the Bering Strait and lower Bering Sea, and includes continental discharge from Asia *and* North America, but is less site-specific and suggests a geographical basin for the vapor to collect. The EOF mode capturing ~14% of the variance [creates a clear division between the Arctic ocean and the lower Bering Sea at the line of maximum wintertime sea ice extent, suggesting that this intermediate mode follows the annual pattern of ice growth and retreat.

Future work will contain model/data comparisons as well as diagrams to trace patterns of water vapor trajectories latitudinally and longitudinally throughout the study.

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Poster Number:

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

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Author Contact Information:
(818-354-2520 and rachel.m.spratt@jpl.nasa.gov)