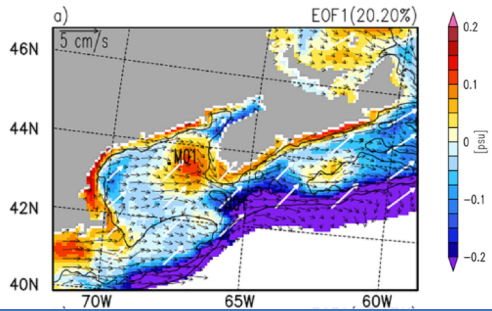
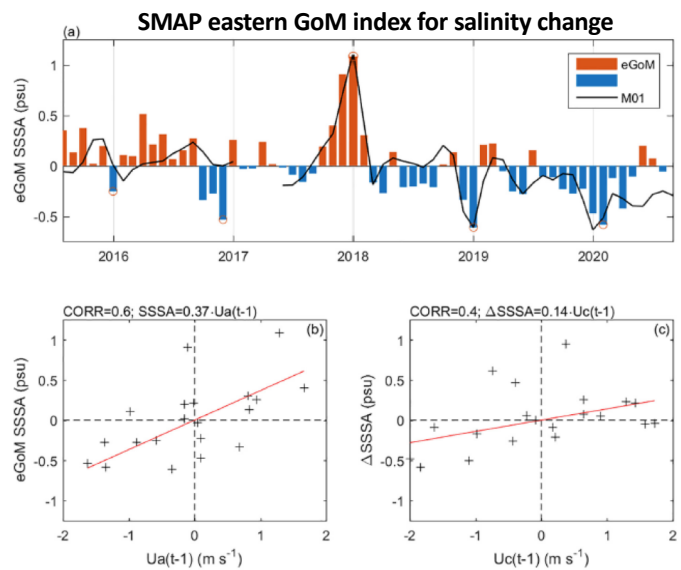
Does the strength of winter winds change salinity in the Gulf of Maine?

Winter Gulf of Maine salinity anomaly associated with stronger along shore wind in CESM 0.1 deg global model





Index change with increased or decreased winter winds (along-shore winds on left, cross-shore winds on right)

Background:

- SMAP salinity data show that the wintertime eastern Gulf of Maine has swung between unusually large freshwater and saltwater anomalies from 2016 to 2020.
- Regional nutrient and biochemistry often accompany these changes because they also indicate variable inflow of arctic vs. local shelf sea waters.
- Past studies suggest Scotian shelf wind forcing may control most of these interannual transport variations, and larger atmospheric patterns may also matter.

Method: We use a combination of satellite wind, sea level anomaly, SST, and sea surface salinity anomaly data along with a high-resolution circulation model to examine wind impacts on SSSA. The primary objective is to determine if changes in regional winter wind patterns can explain most of the recently observed GoM SSS change.

Key findings: The interannual change in local wind fields does control perhaps 30-40% of the observations. But the clearest wind-driven changes are associated with Gulf of Maine freshening, not with salty events. We also show that local Scotian shelf US winter-time wind variations correlate with a basic sale NAO-like atmospheric pressure pattern on the broader Atlantic.

Broader implications: This work should help to refine how regional monitoring and ocean prediction systems are designed to assess Gulf of Maine ecosystem variability.

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