Toward Improved Forecasts of U.S. East Coast Sea Level: development of a dynamical downscaling framework to simulate North Atlantic circulation and physically inform sub-annual forecast skill

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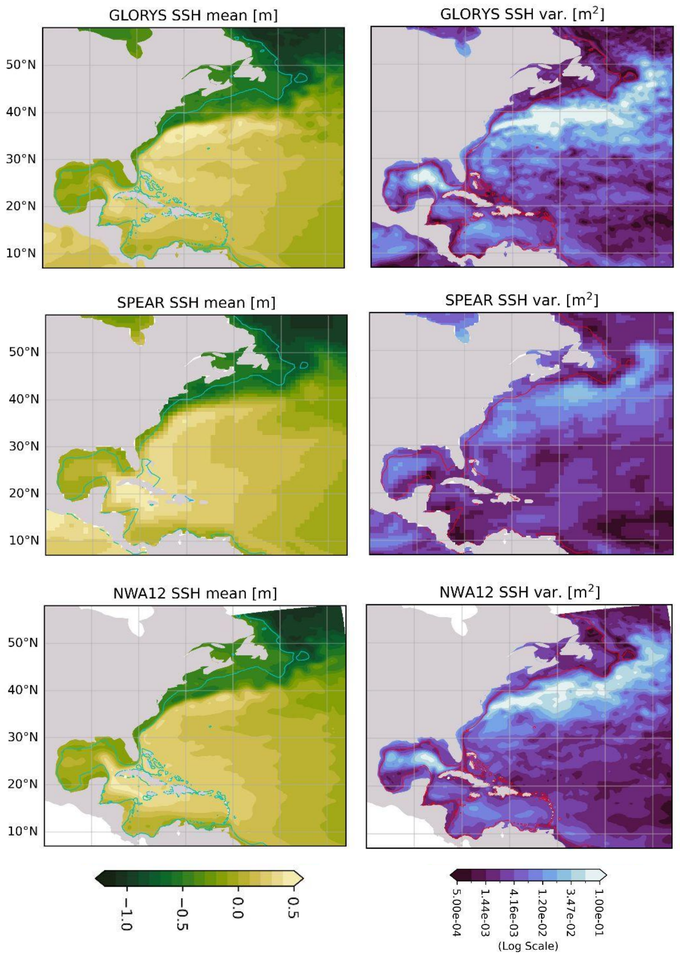
Using GFDL's:

- SPEAR (seamless system for prediction and earth system research) global modeling system [1° ocean resolution]
  Delworth et al. 2020
- NWA12 (northwest atlantic regional ocean model) [1/12° degree ocean resolution]
  Ross et al. 2023,2024

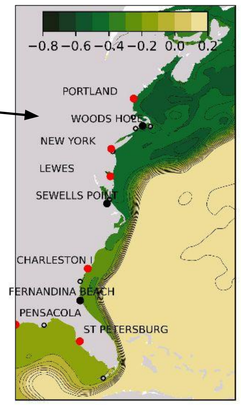
we construct and use a dynamical downscaling framework to assess the simulation and forecast potential of U.S. east coast sea level

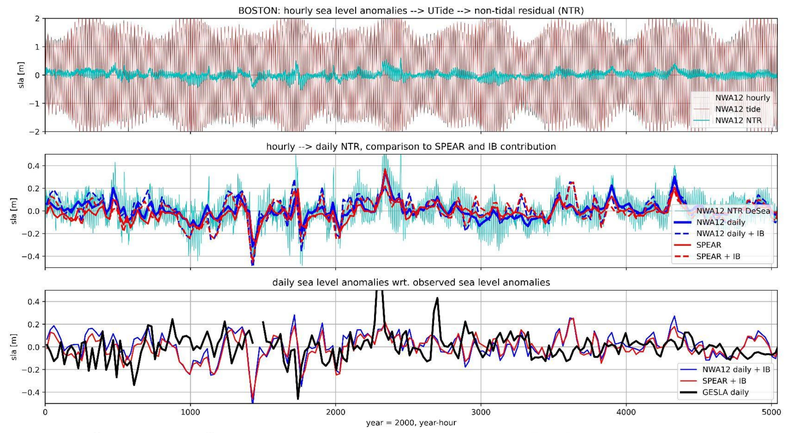
- sub-annual timescales [daily-weekly variability]
- ensemble of 400 1yr retrospective forecasts [1999-2018]

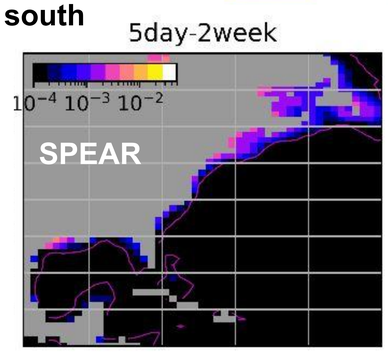


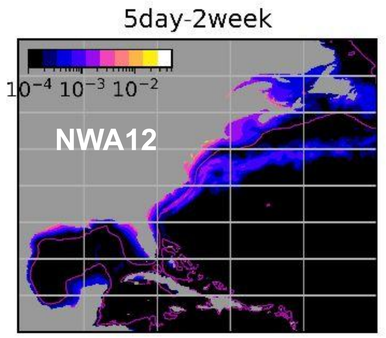
Analyses:

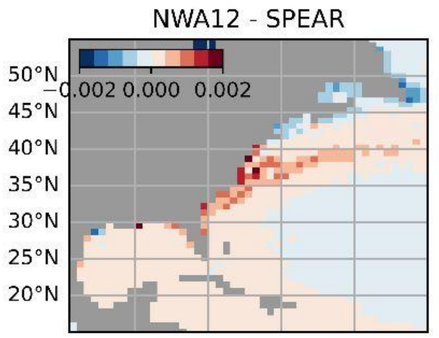
- extract hourly time series of sea level at key U.S. east coast tide gauges
- remove tides + compute daily means
- comparison of NWA12 and SPEAR, OBS
- partition variance as a function of frequency
  - **enhanced variability along the continental shelf with NWA12-SPEAR gap widening moving north to south**

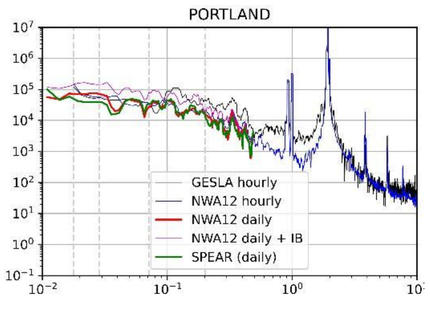


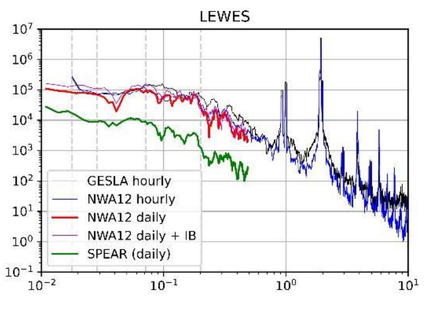


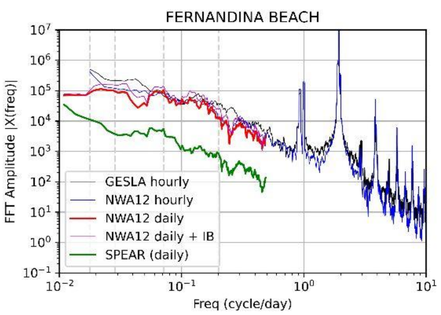




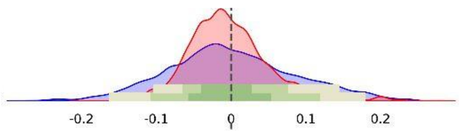


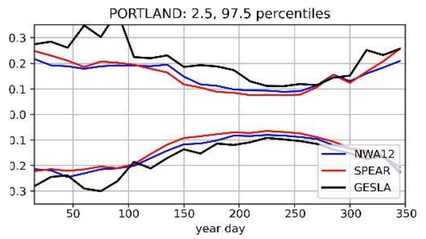


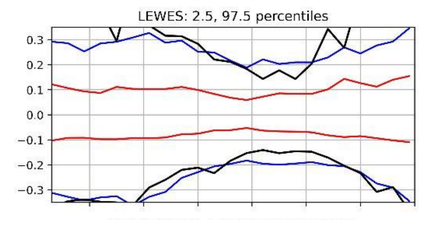


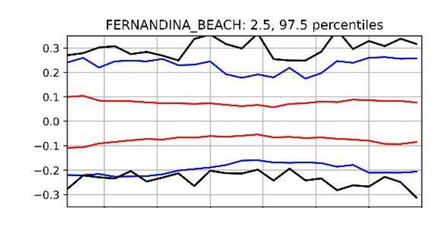


- daily distributions as a function of forecast lead time [2.5 - 97.5 percentiles]









Conclusions:

- downscaling enhances near coast variance across daily-monthly timescales
  - But this increase, is a strong function of position along the US east coast (reveals spatio-temporal patterns of resolved/unresolved variance)
- Extreme sea level events vary seasonally and downscaling reveals where this variability is largely ocean-influenced (south of Cape Hatteras)