A Dynamic Persistent Sea Level Prediction System

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Seasonal sea-level forecasts that are fast, low-cost, and actionable—leveraging the ocean's long memory via the Estimating the Circulation and Climate of the Ocean (ECCO) state-estimation framework.

Motivation

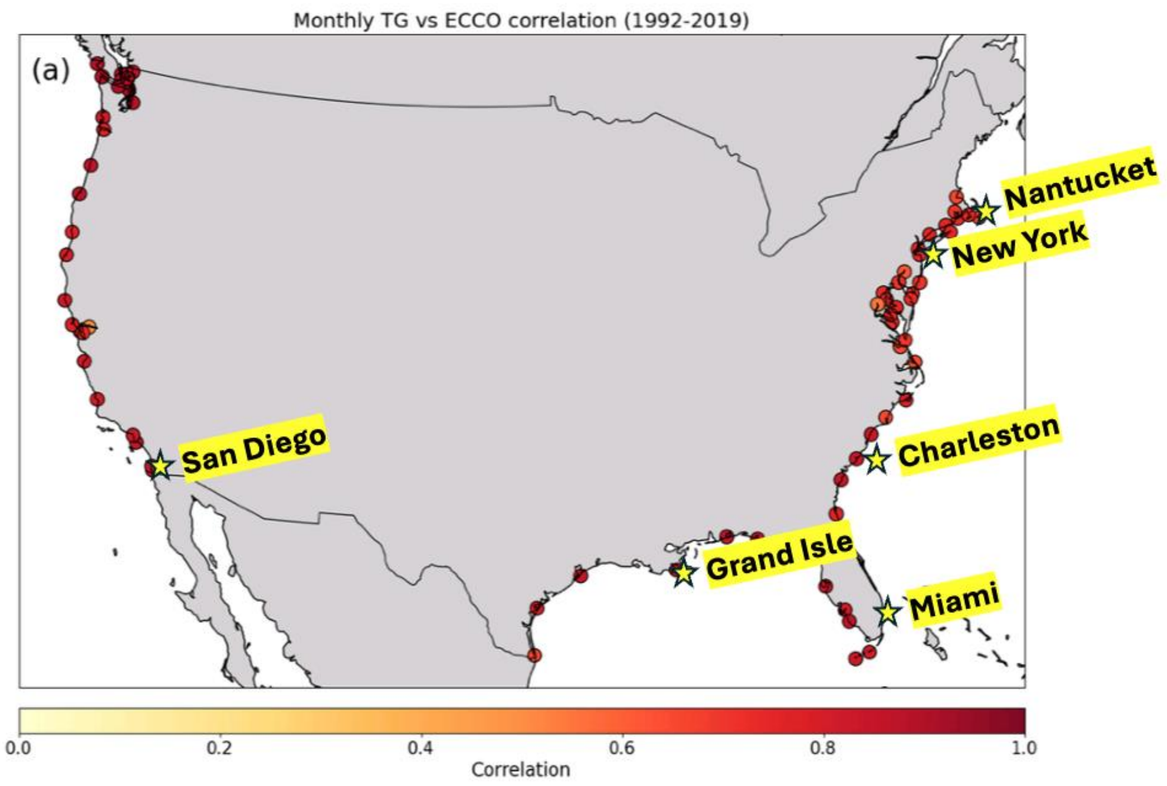
- Nuisance flooding is becoming more frequent in coastal communities.
- Skillful seasonal prediction of sea-level anomalies is increasingly crucial for planning and response.

Challenge

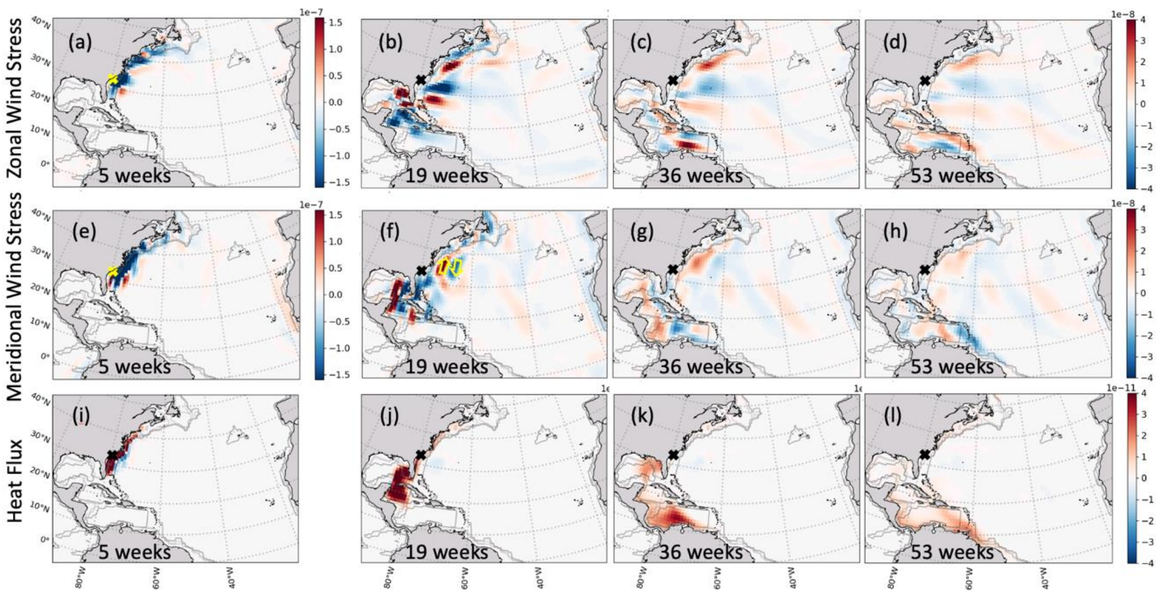
- State-of-the-art Earth system models often struggle at seasonal lead times due to initialization shocks and model biases.
- Decision makers need low-latency, near–real-time updates for short-fuse operational and policy choices.

Locations and Adjoint Sensitivities

- Multiple locations along the U.S. Coastline



- Adjoint sensitivity reflecting ocean surface forcing affecting sea level at Charleston at different lead time

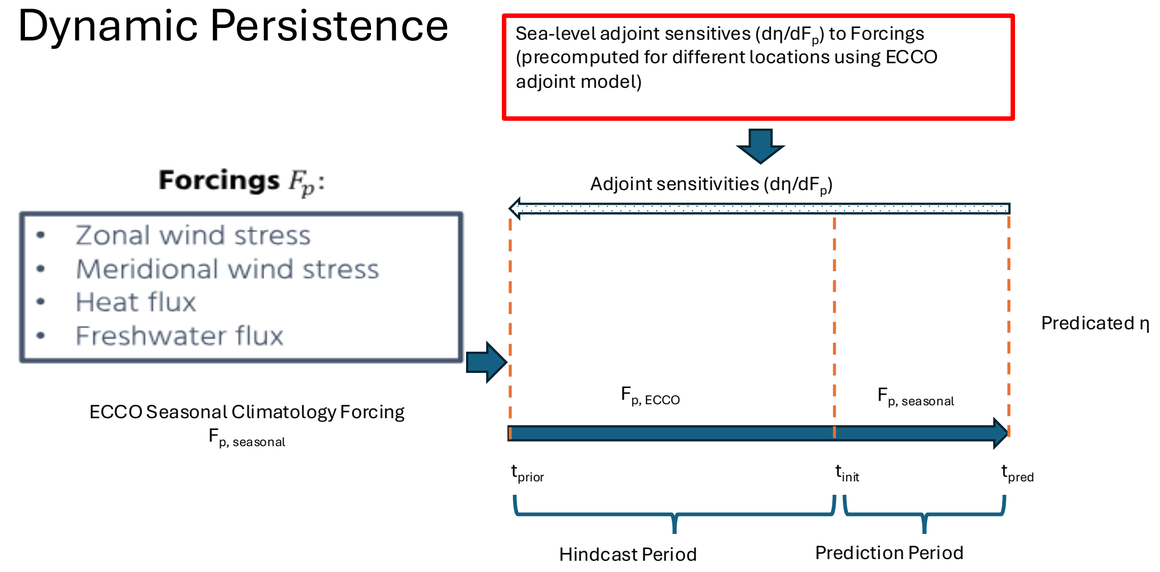


Summary

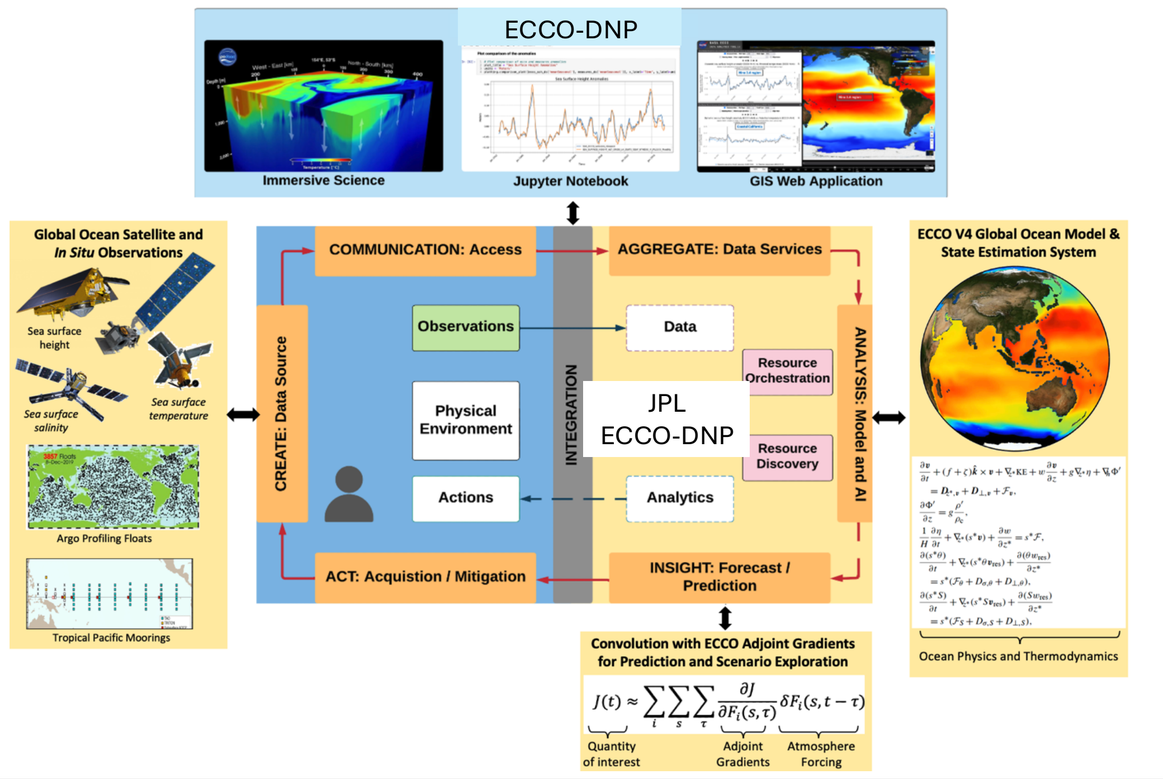
- Dynamic persistence prediction using the ocean's long memory via ECCO's adjoint sensitivities
- Cloud-based, near–real-time, low-cost pipeline with automated data ingestion and forecast production
- Actionable seasonal-outlook guidance for coastal planning and risk management
- Prototype implemented for major U.S. coastal locations

Methodology

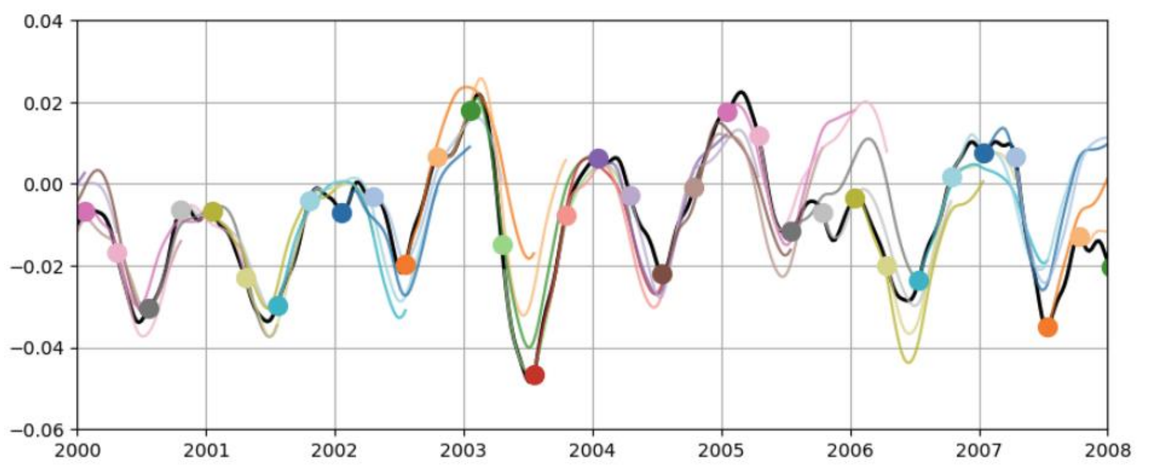
- Dynamic Persistence



Architecture



Sea level at San Diego
ECCO vs. Dynamic Persistence Predictions



References

Frederikse, T., T. Lee, O. Wang et al., (2022). A hybrid dynamical approach for seasonal prediction of sea-level anomalies: a pilot study for Charleston, South Carolina. J. Geophys. Res. 127, e2021JC018137. https://doi.org/10.1029/2021JC018137.

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