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Florida Current dynamics and sea-level variability along the east United States coast

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(A) The Florida Current is the western boundary current that feeds into the Gulf Stream, closing the subtropical gyre circulation in the North Atlantic

(B) The physics of the Florida Current imply that changes in its flow are associated with sea level changes along the east coast of U.S.: a weak (strong) Florida Current flow is associated with higher (lower) sea level than usual along the U.S. coast

(C) The Florida Current flow has been continuously monitored in the Florida Straits by NOAA/AOML since 1982, showing variability on different timescales

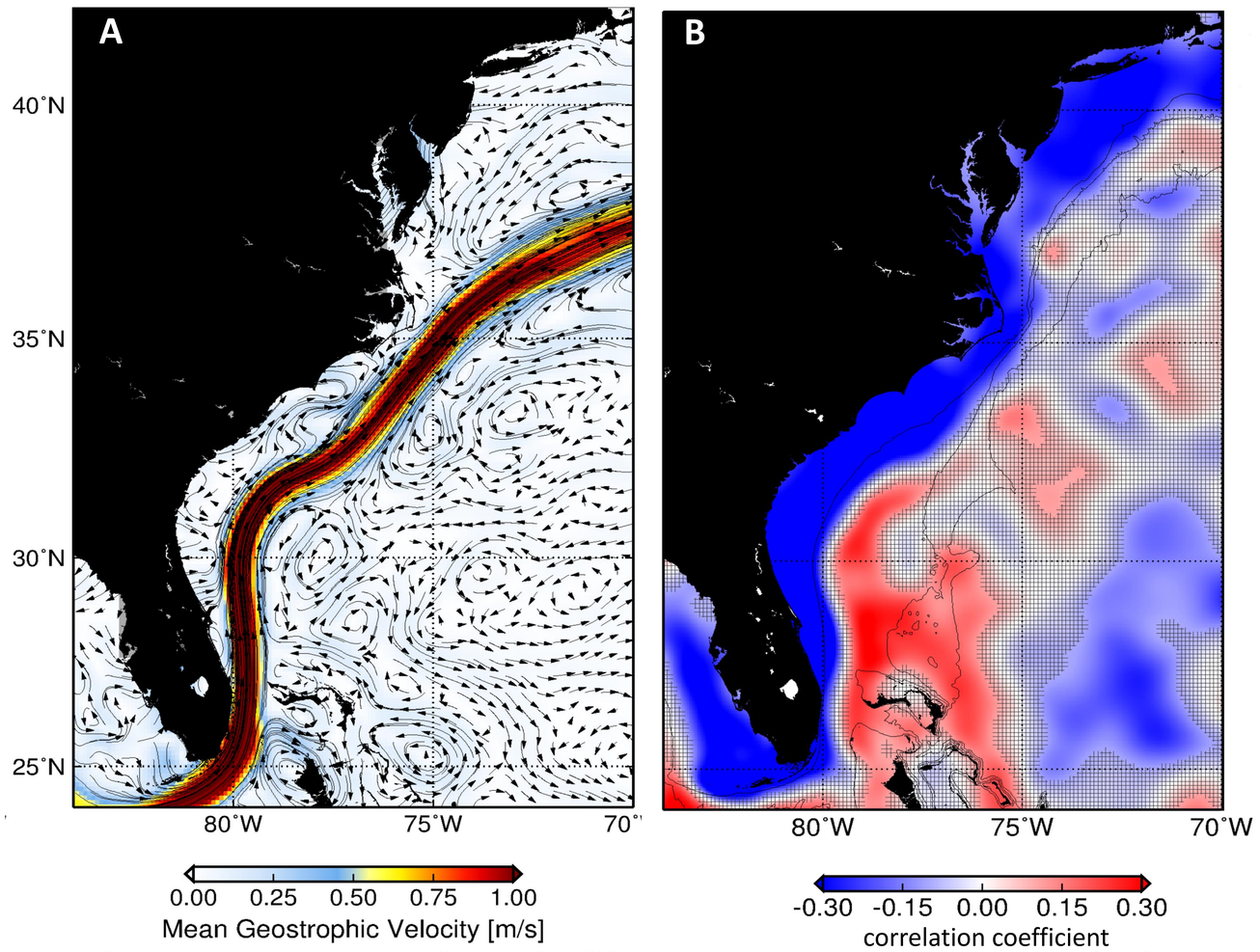
(D) On seasonal timescales, the Florida Current flow shows an annual cycle (black line) characterized by stronger flow during July-September, and weaker flow during December-February. The seasonality of the Florida Current flow, however, changes remarkably from one year to the next (colored lines)

(E) Year to year changes in the Florida Current seasonality are largely associated with westward propagating signals originated in the open ocean

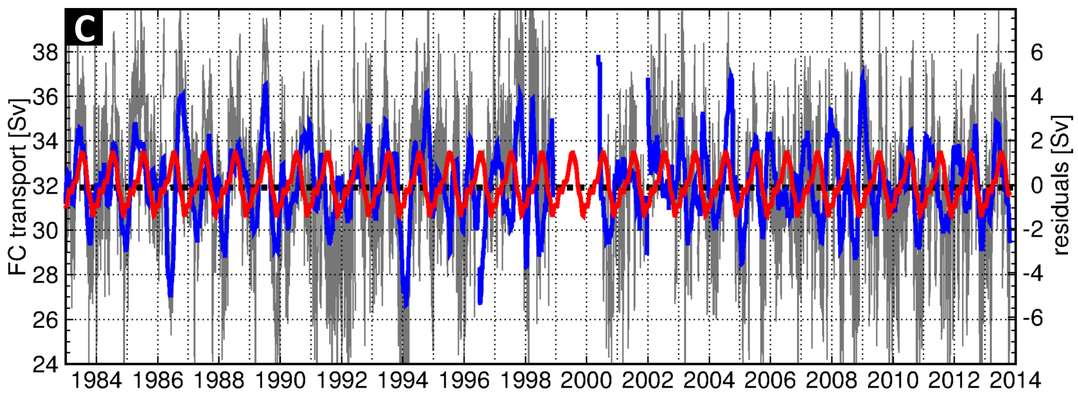
(F) Westward propagating signals behave approximately like first mode Rossby waves, taking years to cross the entire basin

(G) As these signals reach the North Atlantic western boundary, they can cause sea level changes ranging between -10 cm and 10 cm associated with changes in the seasonality of the Florida Current flow (blue line, C)

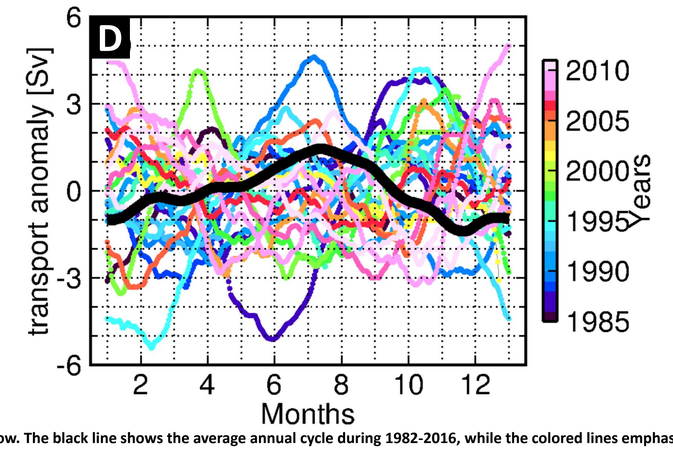
(H) Because these signals propagate approximately at a known rate, knowledge about this mechanism can be used to produce a seasonal outlook forecast of tidal range corrected due to Rossby waves



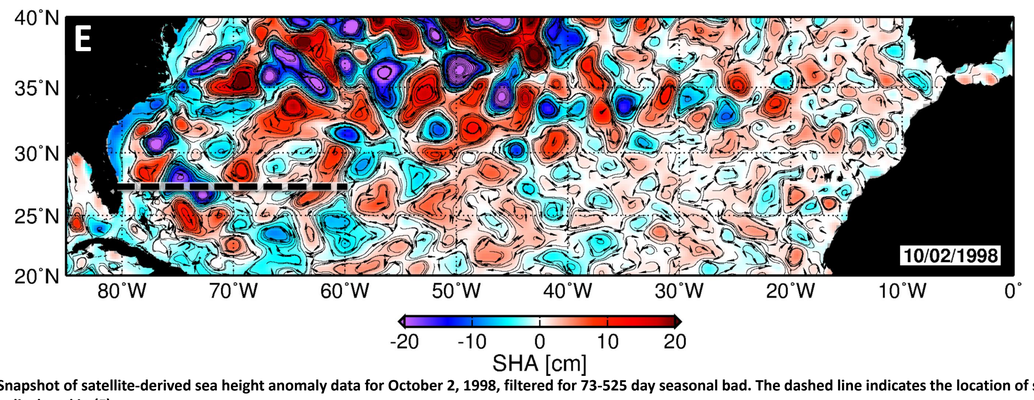
(A) Satellite-derived mean geostrophic velocity for the North Atlantic Ocean. (B) Spatial correlation between satellite-derived sea height anomaly and the Florida Current transport displayed in (C)



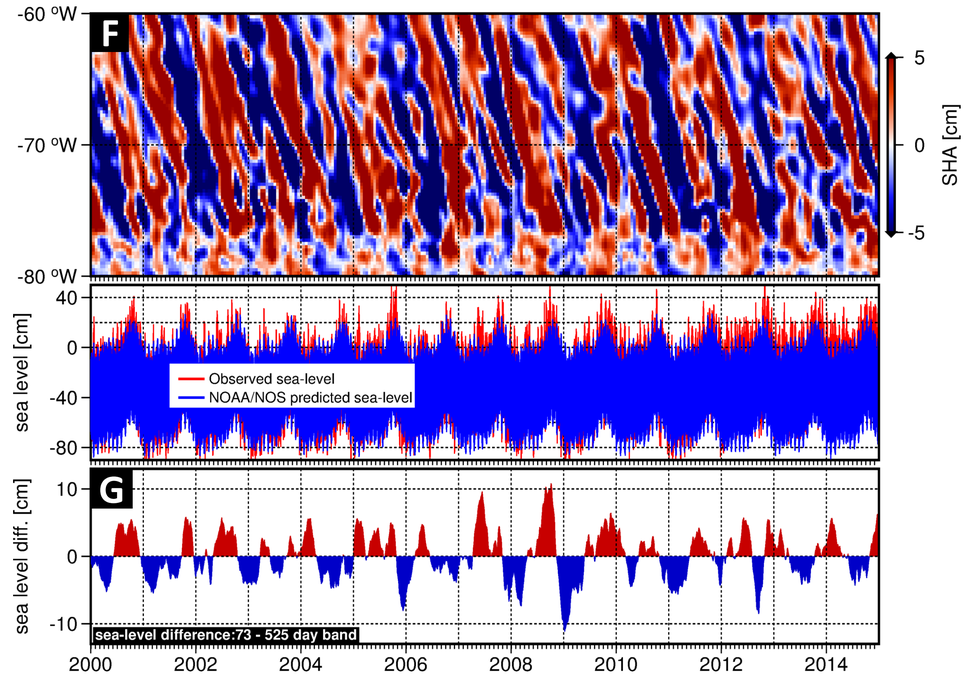
(C) Time series of Florida Current transport derived from measured voltage differences using a telephone cable across the Florida Straits. The red line shows the average Florida Current annual cycle, while the blue line emphasizes year to year changes in the Florida Current seasonality.



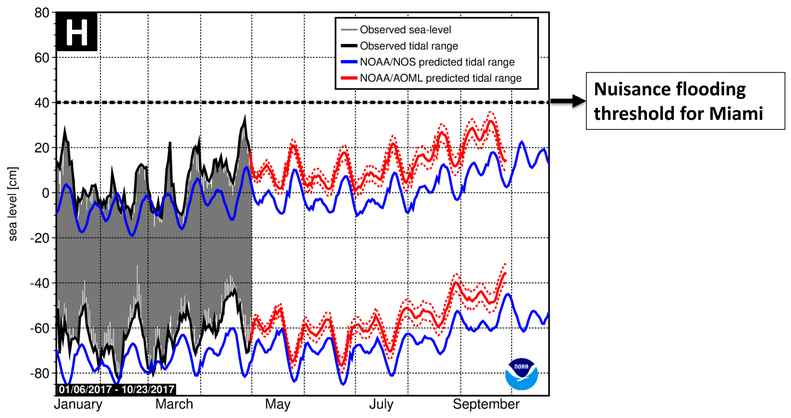
(D) Seasonality of the Florida Current flow. The black line shows the average annual cycle during 1982-2016, while the colored lines emphasize year to year changes in the Florida Current seasonality.



(E) Snapshot of satellite-derived sea height anomaly data for October 2, 1998, filtered for 73-525 day seasonal bad. The dashed line indicates the location of space-time data displayed in (F).



(F) Longitude-time Hovmoller diagram of satellite-derived sea height anomaly data filtered for the 73-525 day seasonal band. The slopped pattern indicates the rate at which signals move westward towards the east coast of U.S.. (G) Difference between the observed and predicted sea level in Virginia Key, Miami FL filtered for the 73-525 day band. On seasonal time scales, differences between the observed and the predicted tidal range are largely due to westward propagating signals.



(H) Preliminary seasonal outlook forecast of tidal range amplitude correction produced by NOAA/AOML (red line) considering current sea level observations (black line), and upcoming seasonal Rossby wave events. The official tidal range prediction provided by NOAA/NOS is shown in blue for comparison. Sea level is plotted referenced to MHHW.

For more information on:

- Slowdown of the Gulf Stream during 1993 – 2013, please refer to **Poster Board 10**, ID 398
- A Proposed Initiative to Use Existing and New Ocean Observing Platforms to Assess Attributions of Sea Level Changes in Southeast Florida, please refer to **Poster Board 52**, ID 265

Acknowledgments

The Florida Current cable and section data are made freely available on the Atlantic Oceanographic and Meteorological Laboratory web page (www.aoml.noaa.gov/phod/floridacurrent/). This research was partly carried out under the auspices of the Cooperative Institute for Marine and Atmospheric Studies (CIMAS), University of Miami, and funded by the Climate Observations Division of the NOAA Climate Program Office and by the NOAA Atlantic Oceanographic and Meteorological Laboratory. Ricardo Domingues acknowledges support from US CLIVAR to attend the WCRP/IOC Sea Level Conference.

Reference

Domingues, R., Baringer, M., & Goni, G. (2016). Remote sources for year-to-year changes in the seasonality of the Florida Current transport. Journal of Geophysical Research: Oceans, 121(10), 7547-7559.

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