Two Decades of Current Measurements off the Jersey Shore

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INTRODUCTION

- This study examines the spatial structure of the surface circulation in the central region of the Mid-Atlantic Bight (New Jersey Shelf) using a comprehensive dataset spanning two decades (2002–2023) of CODAR long-range HF radar data.

METHODS

1. High Frequency radar stations (Figure 1) were operated along the coast of New Jersey collecting radial surface currents and wave data.
2. The radial data was aggregated and used to produce total vector maps on a 6 km grid. (Figure 2)
3. Maps of the means were generated for time periods 1999 – 2000 (Figure 3), 2002 – 2007 (Figure 4) and 2007 – 2023 (Figure 5)
4. The annual alongshelf and cross shelf mean current was calculated at 73.5° W and 39.5° N

RESULTS

1. The mean from 2002-2007 showed similar spatial structure as the mean from 2007-2023. There is a low velocity zone near the bight apex and the presence of the shelf break front is an area of higher velocities towards the southwest.
2. The alongshelf current displays a cyclical pattern oscillating between -2 and -5 cm/s (Figure 6).
3. The cross shelf flow was steady at 3 cm/s from 2002 to 2009 then has been slowly increasing to 5 cm/s in 2023 (Figure 7).

DISCUSSION

- The alongshelf current appears to correlate with the North Atlantic Oscillation index (Figure 8).

Twenty years of surface currents indicate a cyclical alongshelf flow with a cross shelf flow that is increasing.

Figure 1: Photo of HFR antenna installed at Seaside Park, NJ.

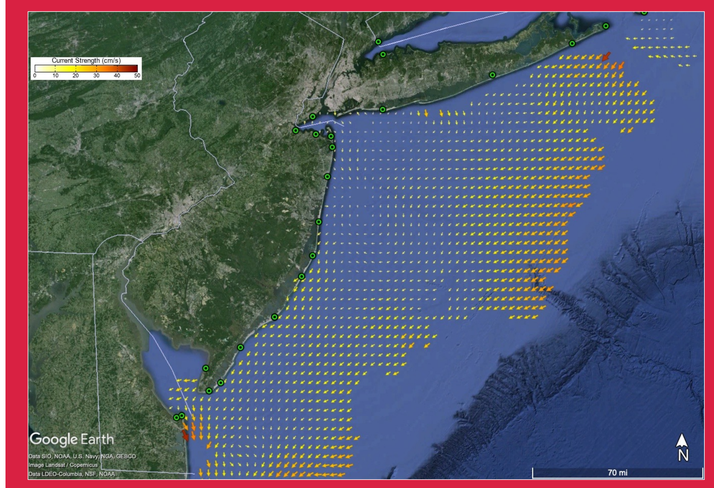

Figure 2: Map of the continental United States showing the locations of High Frequency radar stations (green dots) along with hourly map of surface currents.

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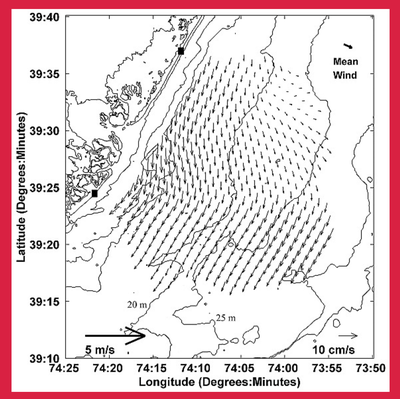

Figure 3: Annual mean currents from May 1999 to May 2000 (Kohut et al. 2004)

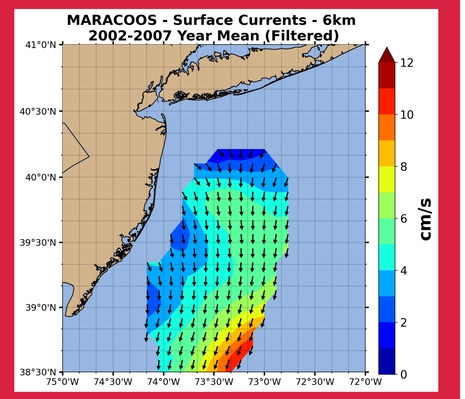

Figure 4: Annual mean currents from 2002 to 2007 (Gong et al. 2010)

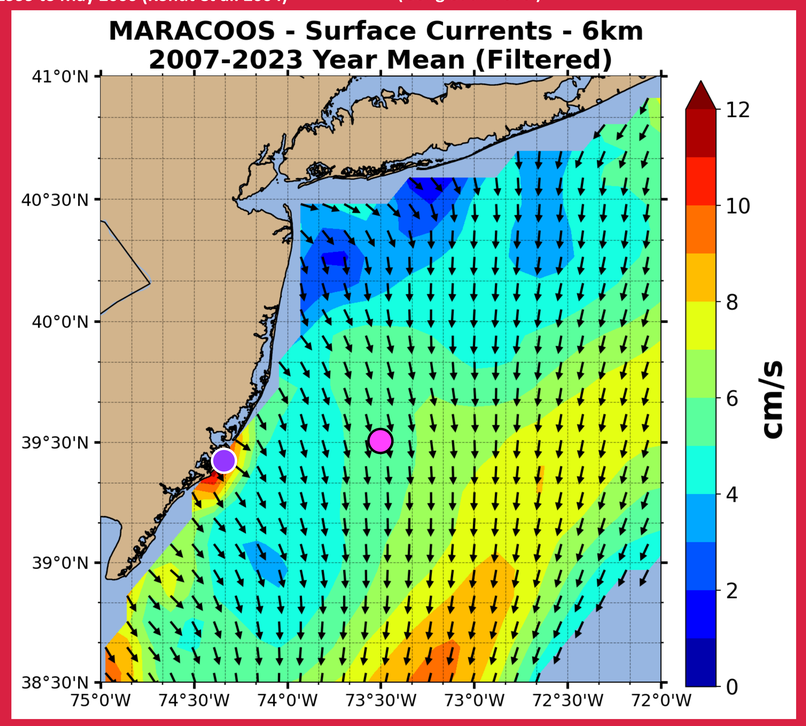

Figure 5: Mean surface current map from 2007 to 2023. The 2007 – 2016 dataset was published previously (Roarty et al. 2020). The location of the water level measurement (purple) and velocity time series (magenta) are shown.

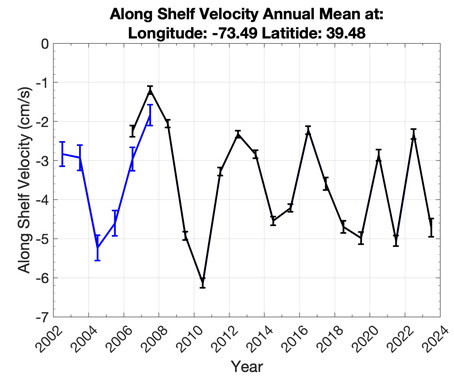

Figure 6: Alongshelf velocity at midshelf point from Figure 5. The Gong et al. (2010) dataset is shown in blue. The current dataset is in black. Negative alongshelf flow is towards the southwest.

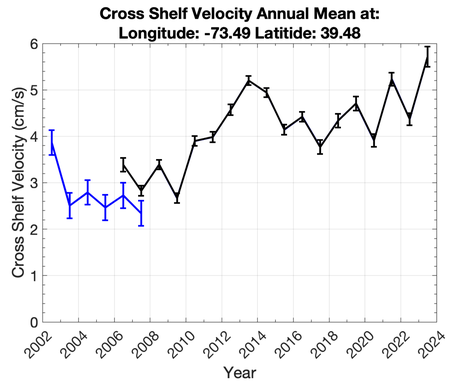

Figure 7: Cross shelf velocity at midshelf point from Figure 5. The Gong et al. (2010) dataset is shown in blue. The current dataset is in black. Positive cross shelf flow is towards the southeast.

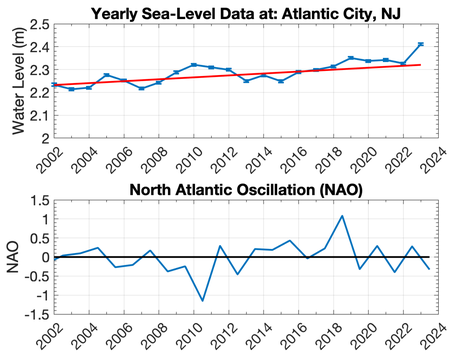

Figure 8: Time series plot of annual average water level at NOAA station 8534720 Atlantic City, NJ. The trend line estimates 11 cm of sea level rise over 28 years or 4 mm/yr. (top). Time series plot of the North Atlantic Oscillation index from NOAA (bottom).

REFERENCES

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