Wind stress along the U.S. East Coast from Coastal QuikSCAT v4.0 fields

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Scatterometer winds: less used on US East Coast than West Coast (in non-extreme wind conditions)



Mean wind stress in the Middle Atlantic Bight ——

from QuikSCAT during 1999-2009 and NOAA buoys (Lentz)



Flow patterns along US East Coast: a pipeline from high latitudes



Taylor-Proudman theorem: geostrophic flow can't cross isobaths.... so exchange across shelf break is difficult



Fratantoni and Pickart, 2007

Coastal water temperature variability: along-shelf advection is important

- dominant terms in heat balance in Middle Atlantic Bight:
 - on time scales up to months/seasons: **along-shelf advection of T gradients** important
 - on interannual time scales: surface fluxes dominate the anomalies

Lentz, 2010 Shearman and Lentz, 2010 Fewings and Lentz, 2011 Connolly and Lentz, 2014 Chen et al., 2014, 2015

• **T** anomalies are advected downstream from subpolar regions to populous regions and important fisheries

What drives the along-shelf advection?

Along-shelf flow on East Coast shelves is strongly affected by wind



Existing global climatologies show little detail over the shelf



January mean wind stress and curl from QuikSCAT 1999-2007

Risien and Chelton, 2008

The wind is highly variable on time scales of days to seasons

along-shelf wind stress measured at a tower and buoy near Martha's Vineyard, Massachusetts



Fewings and Lentz, 2010

Even the seasonal cycle is not well described observationally except at sparse buoy locations



What are the anomalies relative to this climatology, over the past 10-20 years?

Enhanced chlorophyll sometimes observed at the shelf break: could wind stress curl contribute to upwelling?

chlorophyll from Coastal Zone Color Scanner



Ryan et al., 1999

Goals of new project: (started April 1, 2019)

- climatologies from QuikSCAT v4.0:
 - wind stress,
 - stress curl
 - divergence
- major anomalies, focusing within 200 km of the coast
- differences between scatterometer and reanalysis as detector of small-scale coastal wind features
- check sensitivity of results to satellite look angle as a test for land contamination in LCRES product

Preliminary example of QuikSCAT v3.0 vs v4.0 enhanced coastal coverage



Preliminary result:

There IS positive curl over shelf and shelf break in summer



Summary

Along shelf flows on continental shelves:

- transport important temperature (and freshwater) anomalies
- are poorly correlated with adjacent open-ocean flows
- are substantially affected by wind (especially on synoptic time scales)

Shelf-break upwelling inferred in the Middle Atlantic Bight may be partly driven by wind stress curl

Stay tuned for more! The project is only 7 weeks old

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