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Seasonal along-isobath geostrophic flows on the west Florida shelf with application to *Karenia brevis* red tide blooms in Florida's Big Bend

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Abstract

TOPEX/Poseidon/Jason1 (T/P/J) sea surface height (SSH) measurements along tracks 91 and 15, crossing the wide West Florida continental shelf (WFS), were used to estimate seasonal across-shelf SSH gradients. SSH gradients and the knowledge that geostrophic flow approximately follows the isobaths enable estimation of the seasonal along-isobath geostrophic flows. The calculated along-isobath geostrophic flows are southeastward from December to March and northwestward in June, August, and September. The along-isobath geostrophic component of the flow is most likely small during the remaining months and, thus, not discernable in T/P/J SSH measurements. In

agreement with previous theoretical, modeling, and observational work, the mid-shelf seasonal surface flow appears to be driven largely by the seasonal along-shore wind stress. Theory for flow driven by seasonal heat flux suggests negligible flow near the surface and on the bulk of the shelf away from the shelf break.

Karenia brevis, the Gulf of Mexico â€˜red tideâ€™ organism, usually blooms on the southern/central WFS during late summer/early fall. It is likely that the northwestward along-isobath flow in June, August, and September is capable of transporting *K. brevis* blooms northward to the Big Bend shelf region during these months. *K. brevis* blooms in 2005 and 2006 are used as a case study to examine the northward transport mechanism. Above-average northwestward along-shore wind stress due to hurricane activity in the Gulf of Mexico most likely resulted in the northward transport of *K. brevis* in 2005. Conversely, a *K. brevis* bloom in 2006 most likely remained on the central WFS as a result of below average along-shore wind stress in 2006.

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Keywords

Seasonal currents; West Florida; Red tides; 87Â°Wâ€“81Â°W; 24Â°Nâ€“31Â°N

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