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Climate change in the coastal Ocean: Trends and processes from the middle Atlantic bight of the U.S.

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Statement of the Problem: There has been increasing attention on changes in the circulation and ecosystems of continental shelves in various regions of the world. A region that is changing rapidly is the Middle Atlantic Bight of the northeastern U.S., where a recent warming trend has been identified and there have been significant impacts on the seasonal movements and spatial distributions of fish. An important question is what types of forcing result in warming events, specifically whether atmospheric forcing via Jet Stream motions or offshore forcing via Gulf Stream interactions have primarily caused large temperature anomalies.

Methodology and Theoretical Orientation: Recent observations have been used to determine the warming trend of temperature over the continental shelf off New Jersey over a 37 year period. The extreme warming event in 2012 has been investigated using both observations and numerical models of ocean circulation. Data collected by fishermen in early 2017 show Gulf Stream water extending across much of the continental shelf.

Findings: Average shelf-wide temperature has been increasing off New Jersey in recent decades although with significant interannual variability. The more recent trend from 2003-2013 is much larger than the trend from 1977-2013. It appears that warm water is encroaching more frequently from the edge of the continental shelf, indicating more influence from Gulf Stream forcing. The extreme warming in 2012 resulted from a northward shift in the position of the Jet Stream that reduced cooling of the coastal ocean by 50 per cent during the winter. During early 2017, warm Gulf Stream water extended across much of the continental shelf south of New England resulting in warm anomalies of 5-6 Deg. C.

Conclusions and Significance: Recent warming has had significant impacts on the continental shelf ecosystem and commercial fisheries. More observations are needed to establish causes and processes affected by this warming. Coastal ocean observatories will be helpful in this regard.

Biography

Glen Gawarkiewicz is a Senior Scientist in the Physical Oceanography Department of the Woods Hole Oceanographic Institution. He is a sea-going oceanographer whose research interests include shelfbreak exchange processes, coastal ocean circulation, coastal ocean observatories, and inter-disciplinary science in the coastal ocean.

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