WESTERN BOUNDARY CURRENT TRANSPORT AS A CLIMATE INDEX

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ABSTRACT

Western boundary currents (WBC) are highly variable swift meandering jets of large vertical extent flanked by recirculation gyres and mesoscale eddies. Observational arrays specifically designed to study WBCs are expensive, sparse in space and time, and present systematic limitations. New observational studies are required for a better understanding of volume transport in WBC systems.

WBCs are regions of intense air---sea interaction, where the ocean loses heat and moisture to the atmosphere and absorbs carbon dioxide. Modeling and data analysis studies have stressed the leading role played by WBCs in the distribution of heat, mass, and fresh water in the shallow Meridional Overturning circulation (MOC). Changes in WBC transport could have significant impact on the ocean capacity to buffer and regulate climate change. A better understanding of how climate change is affecting Earth's water cycle calls for significant improvement in WBC transport estimates.

This study will focus on the Kuroshio, East Australian Current, Gulf Stream, Brazil Current, and Agulhas Current. Our strategy is to combine complementary modern datasets to improve estimates of WBC transport. We aim to produce an ocean climate indicator from WBC transport anomalies at interannual and decadal time scales. High---resolution expendable bathythermograph (HRX) transects will be merged with Argo float profiles and trajectories to expand HRX shear estimates to 2000---m and assess absolute geostrophic velocity. HRX/Argo data will be combined with altimetric datasets to correct for uncertainties generated by unresolved mesoscale activity in HRX measurements. WBC transport variability prior to the 2004---2012 Argo era will be addressed using combined Altimetry/HRX data. This new ocean climate indicator will allow us to appraise our conceptualization of WBCs as key components of the heat transport in the MOC.

Relevance to competition: The proposed research will be a contribution to the Climate Observations and Monitoring (COM) Data Sets and Indicators program of NOAA focused on developing new Ocean Climate Indicators. Proposed research will aim to define a new set of ocean climate indicators to track variability in WBC transport. Our objectives are to reduce uncertainties in WBC transport, determine the atmospheric forcings governing WBC time---variability, and seek a relationship between WBC transport and climate change. This research will improve the simulation and prediction of meridional heat transport from the tropics to mid---latitudes in the shallow MOC. Results from our project will further our understanding of air---sea flux variability and storm track evolution along the path of WBCs. This will help assess the socio---economic vulnerabilities to climate driven storm genesis in WBC regions. Our priority is to make this new ocean climate indicator available to the scientific community and to the public.