



Satellite observed decadal change in the Southern Hemisphere Westerlies: Poleward Shifted but not Strengthened

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Recent studies have suggested that, in response to warming of the global climate, the Southern Hemisphere (SH) westerlies have shifted poleward and may have also strengthened. The latitudinal position and the intensity of the SH westerlies have profound impacts on the southern ocean climate system, as the westerlies control the connection between the deep and upper layers of the global overturning circulation and regulate the capacity of the ocean to store and transport heat, carbon, and other properties. A detailed documentation of how the westerlies winds have been changing is, therefore, important; however, wind measurements in the southern ocean are scarce. Most studies so far were drawn from atmospheric reanalyses, climate models, wind time series measurements made at a few islands, and/or wind speed retrievals from microwave passive radiometers that do not have wind vector information.

A high-resolution ocean surface vector wind analysis was recently developed by the OAFlux project at the Woods Hole Oceanographic Institution through synthesis of 12 microwave passive radiometers and scatterometers, with wind directional information added to wind speed retrievals by an objective approach. This new satellite-based vector wind product provides a 25-year continuous coverage of global ocean surface wind circulation from 1987 onward on 0.25 degree grids, offering an opportunity to characterize the change of the westerlies in the recent two decades with great details.

A key finding is that the westerlies have shifted poleward but not intensified. The poleward shift of the band causes westerlies to strengthen south of the core and to weaken north of the core. When averaged over the band, the overall strength of the band shows no sign of increase. Therefore, the stronger westerly winds observed at isolated sites may reflect barely the shift of the westerly band. There is a need to examine the changing westerlies from a broad view point. In this study, we will show the evidence derived from the satellite-derived wind fields and provide analysis of the impacts of the changing westerlies on the SH upper ocean circulation.