Involving Ocean Vector Wind Products in Undergraduate Education

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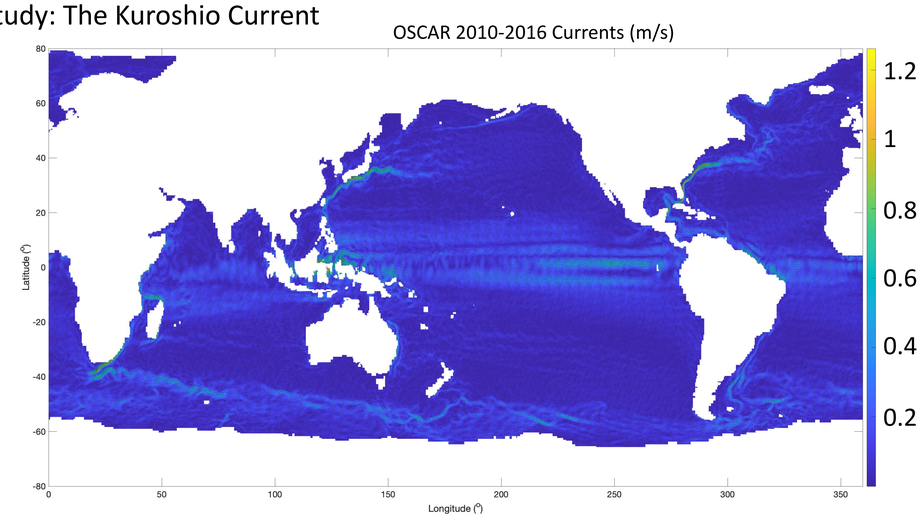
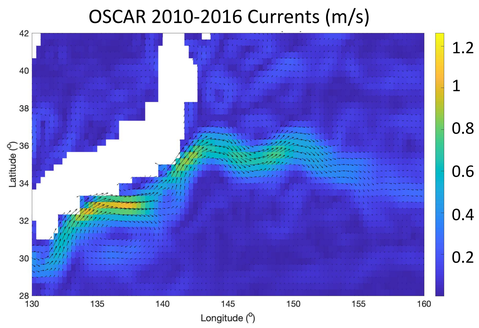
Decades of effort have produced quality Ocean Vector Wind (OVW) products that are largely used to research physical properties and processes of the atmosphere near ocean surface. Aging OVW products do not need to be relegated to archived; they can be used in teaching for physics, chemistry, atmospheric sciences, meteorology, oceanography, and engineering. This presentation covers recent efforts in developing small and manageable datasets to teach principles related to OVW, satellite remote sensing, and related topics for undergraduate education. Case studies include applications for convergence and divergence, vorticity, and Ekman transport.

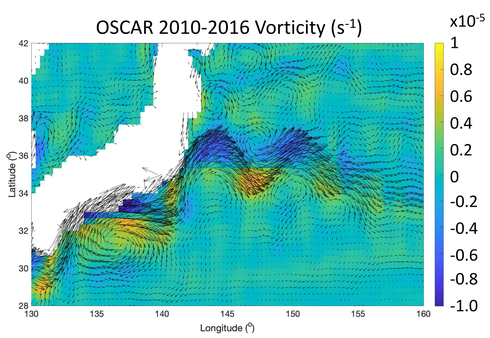
OSCAR data come from NASA-PODAAC and CCMP data come from Remote Sensing Systems.

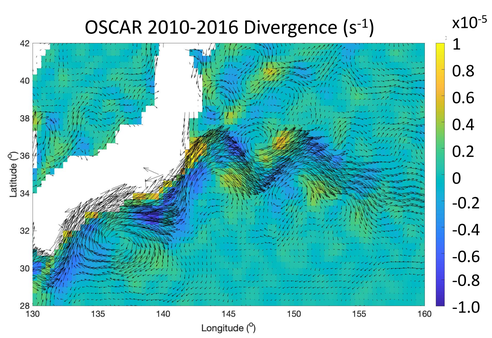
Case Study: The Kuroshio Current



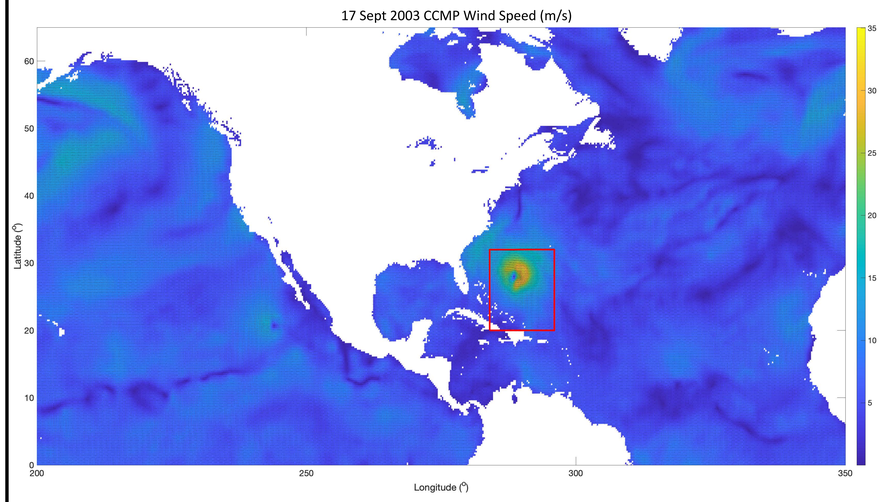


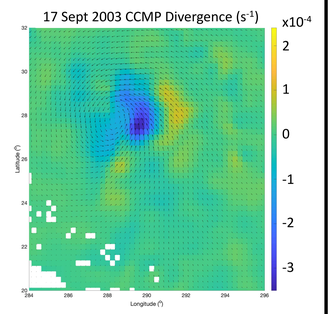
Using the 2010-2016 mean OSCAR currents, the Kuroshio Current off the east coast of Japan shows regions of divergence and vorticity in ocean currents. For the vorticity, counter-clockwise rotation is positive vorticity and clockwise rotation is negative vorticity. For the divergence, regions are also identified as positive and negative. This case study uses the 1/3° OSCAR currents from 2010-2016. Other case studies could be the Gulf of Mexico and the southern tip of Africa and the Antarctic Circumpolar Current (ACC).

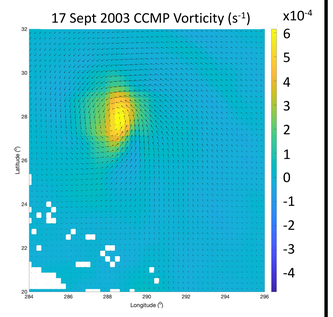




Case Study: Identify the Hurricane

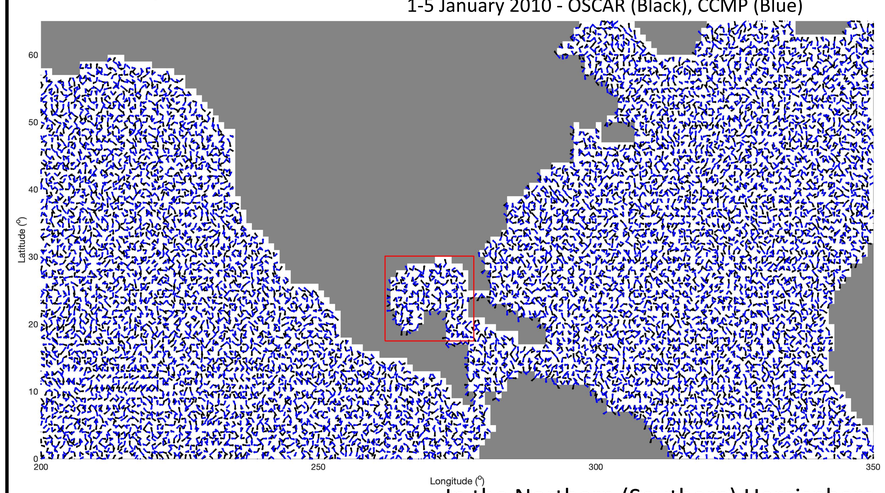


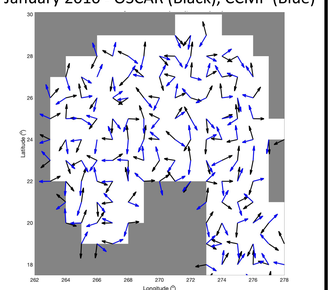


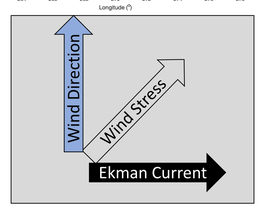


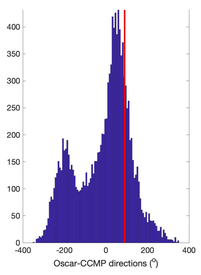
Hurricane Isabel (2003) was a major hurricane on 17 September 2003. The CCMP vector wind fields capture the hurricane in the Atlantic Ocean. The hurricane wind fields can be used as a case study to calculate divergence and vorticity fields. Since hurricanes in the Northern Hemisphere turn counter-clockwise, the vector field shows strong positive vorticity in the region of the hurricane. The wind fields show regions of convergence and divergence for the hurricane as well. This is the CCMP 17 September 2003 00Z wind data.

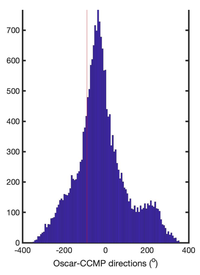
Case Study: Ekman Current











In the Northern (Southern) Hemisphere, the Ekman effect creates an integrated ocean current 90° clockwise (counter-clockwise) to the wind direction. CCMP vector winds and OSCAR vector currents are averaged to 1-degree and 5-day. Wind and current vectors are compared to identify regions where the Ekman current is the dominant current. In the Gulf of Mexico, the majority of the wind-current relationships are clockwise (Black and Blue arrows represent the directions from OSCAR and CCMP, respectively). Histograms denote the prevalence of the relative relationship between the OSCAR current direction and the CCMP wind direction.