OCEAN STRIATIONS

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Accumulation of large, high-quality satellite and in situ data led to significant improvements in the description of the mean dynamic ocean topography (MDOT) [6]. The new models of MDOT, with the resolution improved to 50-100 km, have not only revealed important details in the complex mesoscale structure of circulation systems such as the Gulf Stream, Kuroshio Extension, and Antarctic Circumpolar Current, but also led to the discovery of new anisotropic jet-like features in ocean circulation referred to as "striations" [3,4,5].

While somewhat similar features -- alternating zonal jets, are predicted by a number of theories inspired by the banded cloud patterns in the atmospheres of Jupiter and Saturn [2], preliminary analysis of satellite and high-resolution ocean models reveal that striations (at least at the sea surface) are inconsistent with the two-dimensional, geophysical turbulence, which produces jets through the combination of processes commonly known as the "Rhines mechanism" [7]. Equally unlikely is the role of the PV staircases that could be formed by breaking Rossby waves [1]. The uniqueness of the ocean dynamics comes from the existence of the continents and culminates in the generation of large gyres associated with essentially meridional flows. To remain time-invariant in such a flow, striations behave as waves rather than as inertial jets. Once detected, the striations, both stationary and periodic in time, are found to be common throughout the ocean, although their properties varying to different degrees both geographically and interannually.

This paper outlines the main challenges of the striation study, both observational and theoretical. It discusses hypotheses of the forcing and dynamics of these features, interaction between striations and mesoscale eddies, and presents evidence that striations play an important role in regularizing the otherwise random eddy field. The striations are shown to be not just an artifact of misinterpreted moving eddies, but a structure retaining its coherence on spatiotemporal scales significantly exceeding the eddy scales (in some reported cases, up to thousands of kilometers and 15 years). Also

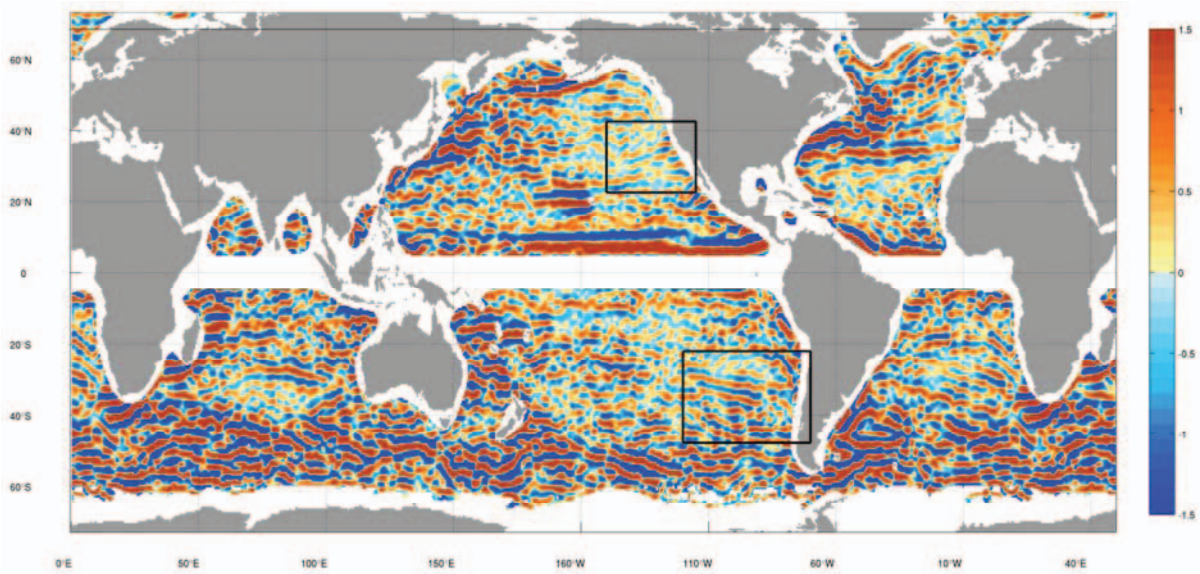

Figure. 1993-2002 mean zonal surface geostrophic velocity calculated from the MDOT of [4] high-pass filtered with a two-dimensional Hanning filter of 4° half-width. Rectangles in outline two study domains where striations are validated by historical XBT data [5]. Units are cm/s.

discussed is the impact of striations on the climate system, both through the ocean dynamics and air-sea interaction, and possible differences between the circulation regimes in the upper and intermediate-depth ocean. It is also noted that techniques currently employed to map the sea level anomaly, derived from the along-track satellite altimetry, may tend to convert the signal from striations into the one from a train of eddies. We demonstrate the importance of the combined use of data of satellite and in situ observations, and realistic high-resolution global ocean general circulation model along with theoretical analysis and numerical experimenting with the regional ocean model system.

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