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Zonal jets in the eastern North Pacific in an ensemble of eddy-resolving ocean general circulation model runs

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It has been known for some time that the ocean basins are populated by what is known as “zonal jets”, “deep zonal jets”, or “striations”. Since the oceanic flow is, at least weakly, chaotic, it is not known whether the positions of the jets are “deterministic”, that is, entirely determined by external parameters. A number of theories have been proposed to explain them, some of them predicting zonal jets at fixed latitudes and others implying that the positions of the jets are random. To investigate how deterministic the zonal jets are in the eastern North Pacific, a ten-member ensemble of long-term integrations of a semi-global, eddy-resolving ocean general circulation model is analyzed.

The positions of the equatorial jets, even their variability, seem to obey deterministic dynamics and some of the jets in the tropics (5°–15°N) migrate poleward coherently (similarly between ensemble members). The jets in the subtropics (15°–45°N) systematically migrate equatorward but their positions are less coherent; the jets in the subpolar region (45°N–) are random and without systematic migration. Jets near the coast of North and South America tend to have shorter meridional wavelengths than interior ones and those in the northern hemisphere are fairly coherent whereas those in the southern hemisphere seem more random. There are a few quasi-barotropic jets which are anchored to steep bottom topographic features and which also appear to trap shallower counter-flows on their poleward and equatorward flanks.