Recently, prominent jet-like features of the oceanic circulation, called striations, with meridional scale of O(300-500 km) and extending for thousands of kilometers in length, have been detected in satellite and in situ observations and high-resolution numerical models. In the present study, we analyze quasi-stationary striations, which are best seen when substantial time-averaging is applied. In particular, analysis of the 1992-2002 mean dynamic ocean topography (MDOT) revealed that eastern parts of practically all oceans, in their subtropics, are populated with these anisotropic features whose orientation is not strictly aligned with the zonal or meridional direction. The features are slightly tilted relative to the east-west direction with the sign and the angle of the tilt, considerably, being in accord with the sign and the strength of the meridional component of the large-scale flow. Analysis of more than 20 years of the high-resolution satellite surface temperature and historical hydrographic data shows that the quasi-stationary striations are persistent features of the basin-scale oceanic circulation.

To understand dynamics of the quasi-stationary striations we analyze the data of the Ocean General Circulation Model for the Earth Simulator (OFES) in the eastern parts of the subtropical North and South Pacific, where the striations are well pronounced both in the model and in observations. Internal dynamics of the striations is evaluated by assessing individual terms in the local vorticity balance. On the spatial scale of the striations, the dominant terms in the time-averaged vorticity equation are the local advection of flow by the large-scale flow, vertical advection and advection of planetary vorticity by the striations. The estimated balance agrees with one, anticipated for the stationary Rossby waves whose propagation tendency is balanced by the large-scale advection. Analysis of the model data also suggests that quasi-stationary meanders of the eastern boundary currents may induce the formation of the striations.

Validation of the striations in the eastern part of the subtropical gyre in the South Pacific (not shown) are very similar and lead to the same conclusion. The quasi-stationary striations are persistent features of the basin-scale oceanic circulation.

Ocean Model: The OGCM for the Earth Simulator (OFES), based on the Modular Ocean Model (MOM3), was jointly developed by the Earth Simulator Center and Frontier Research Center for Global Change (Japan). The computational domain is near-global (75S-75N, 54 vertical levels, horizontal grid spacing is 0.5°). A Skyray spin-up was conducted by modulating the large-scale circulation (NCEP/NCAR reanalysis data, starting from the western boundary current fields without motion). A hindcast simulation from 1992 to 2007 was forced by daily mean NCEP/NCAR reanalysis data, starting from the last output of the spin-up simulation (Sasaki et al., 2008). Additional simulation from July 1999 to 2007 was forced by daily mean QuikSCAT wind stress (Sasaki et al., 2006).

Hypothesis: The characteristic tilt of the quasi-stationary striations in the eastern parts of the subtropical gyres seems to depend on the strength of the large-scale flow. The relative amplitude of the striations, suggest the dynamics driven by the large-scale flow reflect the quasi-stationary striations. The dominant terms in the east-west vorticity equation for the boundary currents may provide a source of vorticity, which produces a Rossby wave with the quasi-stationary striations. The permanent striations in the eastern boundary currents may provide a source of vorticity, which produces a Rossby wave with the quasi-stationary striations. This hypothesis is supported by the fact that, the large-scale flow and the striations are governed by different dynamics. The large-scale flow is controlled by the wind-land forcing, so the vorticity budget equation for the boundary currents is available. Ri et al. (2008) and Maximenko et al. (2008) have shown that the large-scale flow and the striations are governed by different dynamics. The large-scale flow is controlled by the wind-land forcing, so the vorticity budget equation for the boundary currents is available. The striations may be a result of the internal dynamics due to the boundary currents.

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