A Wake Due to the Maldives Islands in the Eastward Wyrtki Jets

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A wake due to islands in background zonal flow has been observed in the equatorial Pacific Ocean. This study detects a wake due to the Maldives Islands in the eastward Wyrtki jets in the Indian Ocean using in-situ observations and examines its dynamics with numerical models. Observations by acoustic Doppler current profilers deployed east of the Maldives show semiannual variability in cross equatorial velocity, which cannot be explained by prevailing annual wind forcing related to monsoons. Output from a high-resolution ocean general circulation model (OGCM), OFES, shows that the semiannual variability is a part of a wavelike structure that appears east of the Maldives (Fig.1a) in concurrent with the eastward Wyrtki jets. The meridional momentum budget estimated from OFES output shows a significant contribution from momentum advection, indicating nonlinearity of the wake. An experiment is conducted using a 1.5-layer model, in which islands that are similar to the Maldives in shape are imposed, and an equatorial zonal jet is driven by idealized wind forcing. Results show that the 1.5-layer model is able to reproduce the wake with a similar spatial structure to the OGCM results. (Fig.1b) The 1.5-layer model is further linearized about the mean zonal current, and available wave modes are examined by solving the dispersion relation. Results show that two shortwave modes are available in the mean equatorial eastward current, whose zonal wavelength and ray paths agree well with the spatial structure of the simulated wake. These wave modes can be interpreted as the short Rossby wave modified by the background eastward flow.

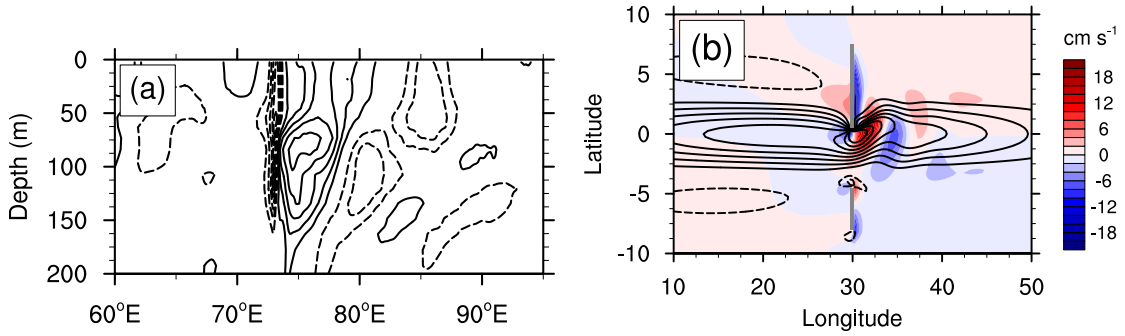

Fig.1: (a) Climatological meridional velocity along the equator in April obtained from OFES. A wavelike structure is observed east of the Maldives at about 73°E. (b) A snapshot of zonal (contours) and meridional (colors) velocity obtained from a numerical experiment with a 1.5-layer model. The equatorial zonal jet is driven by prescribed zonal wind forcing and hits the islands at x = 30° (grey shades). The wake is observed again east of the islands as meridional velocity disturbances.