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Variability and trends of the observed Rossby wave spectra in the global oceans

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We analysed the spectral variability of the filtered sea surface height (SSH) fields associated to first mode baroclinic Rossby waves using wavelet analysis. The multi-satellite mission along-track gridded SSH "Reference Series" data distributed by Aviso is regridded on regular $0.25^\circ \times 0.25^\circ$ maps at 7-day intervals, starting in October 1993 through February 2010. The signal associated to the westward propagating Rossby waves is obtained applying bi-dimensional FIR filters to the SSH maps. The wavelet power spectrum is calculated at each location and averaged within scale-selected equivalent Fourier period ranges, which are centered at 3, 6, 12 and 24 months. Our results show that the spatial and temporal distribution of the Rossby wave power and power trends is not homogeneous. We observe westward propagation in the wavelet spectra at these bands, which indicate non-dispersive wave behaviour. The spectrum is annualy modulated for all ranges. The average global contribution of the Rossby wave signal to the total SSH variance is 49.7%, where 5.3%, 11.7%, 18.7% and 14.0% correspond respectively to each of the selected period ranges. These contributions tend to be zonally distributed. The 3-month variability occurs mostly between 20° and 30° latitude in both hemispheres, while the 6-month variability is present in all latitudes but the equatorial region. Both annual and bi-annual variability are present in all latitudes. Trends in the spectra indicate increase or decrease in eddy kinetic energy fields. Trends are particularly strong at all wave periods near the regions of the western boundary currents. In average, the spatial distribution of the spectral trends for each period range is (1.4, 3.4, 2.4, 4.9) $\mathrm{mm^2 \cdot yr^{-1}}$, globally. Therefore, Rossby waves are responsible for almost half of the variance and, in three out of four period bands, their power has increased between 1992 and 2010.