To clarify the mesoscale variability in the deep ocean, we conducted high-resolution mooring observations around Site R (30°N, 147°E) during 2014–2016 and analyzed obtained velocity data with past mooring observations in the Northwest Pacific Basin. We also analyzed outputs of ocean general circulation model (OGCM). Around Site R, the variability of zonal and meridional velocities is prominent at periods of six and two months, respectively. The estimated wavenumbers at two months satisfy the dispersion relation of the barotropic topographic Rossby waves (TRWs), whose variability is almost uniform from the surface to the bottom. Backward ray tracing of the barotropic TRWs from Site R suggests that the energy propagates from the Kuroshio Extension region. The estimated wavenumbers at six months satisfy the dispersion relation of TRWs, and the velocity data obtained at sloping bottom topography indicate bottomward intensification. The direction of prominent variability tends to be parallel to the f/H contours in the Northwest Pacific Basin. Backward ray tracing of TRWs at six months from Site R indicates that the energy propagates from the Shatsky Rise along f/H contours, which is consistent to the direction of prominent variability.