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Long-Range Radiation and Interference Pattern of Multisource M2 Internal Tides in the Philippine Sea

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Long-range radiation and interference of M2 internal tides from multiple sources in the Philippine Sea are examined by driving a high-resolution numerical model. The M2 internal tides are effectively generated around the boundary area, which includes the Luzon Strait, Ryukyu Island chain, Bonin Ridge, Mariana Arc, and Izu Ridge, favoring the occurrence of complex interference patterns. The local sources (mainly Daito Islands and Palau Ridge) inside the basin contribute to a small portion (∼5%) of total energy but enhance the geographical inhomogeneity of the baroclinic field. The mode-1 and mode-2 M2 tidal beams from boundary sources radiate a long distance into the basin but exhibit different interference-modulated geography variations. A 2-D line source model characterizing interference can reproduce the general baroclinic field. Two notable interference cases are investigated: (1) the superposition of internal tides from Luzon Strait and Miyako Strait bifurcates into several southeastward beams, consistent with previous numerical simulations and altimeter measurements, and (2) the interference between Tokara Strait and Bonin Ridge exhibits a multiscale spatial pattern, which is modulated by the local generated energy and bathymetry features. Energetic dissipation occurs both near the boundary sources and in the basin. A locally dissipated fraction q of ∼0.4 is estimated at the Luzon Strait and Bonin Ridge with continuous bathymetry features, while q of ∼0.6 is estimated at the Ryukyu Island chain and Mariana Arc with discrete topographic variability. A lower locally dissipated fraction indicates a stronger energy flux radiating into the basin, where enhanced dissipation coincides closely with the interference-modulated flux field.