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Bispectra and Cross-Bispectra of Temperature, Salinity, Sound Velocity and Density Fluctuations with Depth off Northeastern Japan

Gunnar I. Roden and Donna J. Bendiner

Dept. of Oceanography, University of Washington, Seattle 98195

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ABSTRACT

Off northeastern Japan, depth profiles of temperature, salinity, sound velocity and density show considerable structure between 30 and 240 m. The structure is asymmetric with respect to the mean and the amplitudes are 10 times larger here than in similar latitudes in the mid-Pacific. By partitioning the observed series into mean and perturbation series, it is possible to compute the bispectrum and the bicoherence for each variable, as well as the cross-bispectrum and the cross-bicoherence for different variables. The computations were carried out for the wavenumber plane bounded by $|k_1| \leq 167$ cpkm, cycles per kilometer (cpkm), $|k_2| \leq 167$ cpkm, $|k_1 + k_2| \leq 167$ cpkm, with an areal resolution of 48.2 $(\text{cpkm})^2$.

The "third-power density" of the bispectra decreases toward the Nyquist wavenumber by about three orders of magnitude. The rate of decrease is not constant, but depends upon both wavenumber and direction. There is no statistically significant structure superimposed upon the slopes. The absence of prominent structural features suggests that the bispectra arise from continuum interactions rather than from line in interactions. Significant bicoherence is limited to wavenumber pairs that sum to less than 40 cpkm. Significant cross-bicoherence for the sound velocity-temperature-salinity perturbation triplet occurs at low and intermediate wavenumbers.

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Headquarters: 45 Beacon Street Boston, MA 02108-3693
DC Office: 1120 G Street, NW, Suite 800 Washington DC, 20005-3826
amsinfo@ametsoc.org Phone: 617-227-2425 Fax: 617-742-8718
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