Geophysical Research Abstracts
Vol. 21, EGU2019-11744-1, 2019
EGU General Assembly 2019

Nonlinear interaction between internal waves of inertial and semidiurnal frequency

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We revisit observations and analyses of data from discrete current meters in light of new evidence obtained from high vertical-resolution 75kHz Acoustic Doppler Current Profilers (ADCPs). Both the new and old observations are over the rough topography associated with the Endeavour segment of the Juan de Fuca Ridge. The region of the observations has a large-scale topography (100 km) associated with the Juan de Fuca Ridge itself and nearby seamounts generated by tectonic action of the spreading centre. At a finer scale (1 km), the Endeavour segment has vigorous hydrothermal venting generating buoyancy fluxes which drive the mean circulation within the sheltered rift valley. Above the rift valley, the currents are intensified by both tidal and inertial waves interacting with the bathymetry. This rough bathymetry generates a strong internal semidiurnal wavefield which can then interact with the seasonally modulated inertial wavefield to produce wave energy at their sum frequency. We denote the resultant band at the sum frequency as the fM2 frequency band.

The new data from Ocean Networks Canada's NEPTUNE Observatory allows us to follow the evolution of wave energy at these frequencies from 500 m above the seafloor into the 100m deep valley. Analyzing the characteristics of internal waves using rotary spectra and bispectral techniques we address the partition of energy between forced and evanescent (freely propagating) at the sum frequency, as well as potential sources of the forcing waves. This gives us insight into the cascade of energy from large-scale low-frequency internal waves through the internal wave spectrum to the mixing scales and implies that the internal wave spectrum is not smooth.