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A Sparsely Populated Internal Wave Spectrum?

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I present a simple model of Doppler shifting that demonstrates the effect of advection on the spectral description of sinusoids. The model is purely kinematic, extending Desaubies principle of "reversible finestructure". The concern is that in spectral descriptions, a deformational "kink" developing on a sinusoidal waveform will appear as a "cross-scale cascade of variance". Do reversible distortions have a characteristic signature that can be identified in the spectral domain?

The model is adept at relating power spectra of a motion field as measured in different reference frames. In describing the vertical advection of small-scale features past an Eulerian sensor, the model revisits the "fine structure contamination" problem. In modeling vertical advection by a narrowband (tidal) signal, a set of harmonics is identified that appear in Eulerian measurements but not in their semi-Lagrangian counterparts. Harmonic lines that are observed in both frames presumably have dynamical significance (or are associated with a narrow-band lateral advection process). Both classes of harmonics can have significant bi-coherence.

I conjecture that the wavenumber-frequency spectrum of horizontal shear is a response to just a few distinct classes of motion, each specified by a vertical wavenumber spectrum and an intrinsic frequency or an aspect ratio. Documenting the flow of action through this discretized wavefield is experimentally tractable. Testing the discretized wavefield concept against community-wide data is the present challenge. To-date, model successes *and failures* have yielded useful insight.