Energetics of internal motion at periods of hours to years at the western boundary of the subtropical North Atlantic

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At the western boundary of the Atlantic, the 26°N moored array provides sustained and subsurface sampling of density and velocity that enables detailed investigation of internal motion at periods of hours to years. Many waves and wave processes that contribute to ocean circulation, whether to its mean state or to its adjustment, occur in this location but are poorly characterized from direct observations. Unknowns include the fate of westward-propagating Rossby waves upon hitting the western boundary, the impact of fast boundary waves such as Kelvin waves and whether they are locally or remotely generated, and the seasonal modulation of tidal and near-inertial internal waves that dissipate against the boundary.

We present initial results from this recently started project. The most basic consideration is to compare levels of potential energy, kinetic energy, and energy flux at the 4 western boundary moorings. Insofar as a specific wave is expected at all moorings — for instance westward propagating Rossby waves — differences in energy allow inferences about input, transfer, or dissipation of wave energy between moorings. Though the total variance of depth-integrated potential energy is similar in magnitude at moorings from 15 to 490 km from the boundary, depth-integrated kinetic energy is larger 40–100 km offshore than it is inshore. The near-shore moorings, however, have a greater fraction of their energy at higher frequencies and higher baroclinic modes, which suggests a different type of wave regime at the boundary. To further classify the motion, vertical modes and frequency spectra are applied to provide additional ways to partition energy, ways that subsequently allow application of theoretical conditions such as polarization or dispersion relations to identify specific wave classes (Rossby waves, Kelvin waves, internal tides, inertial waves).