Geophysical Research Abstracts, Vol. 7, 04162, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04162

Observations of near-inertial motions in sea ice and the upper ocean mixed layer in Marguerite Bay, western Antarctic Peninsula shelf

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Two years of moored oceanographic and automatic weather station data which cover the winter ice seasons of 2001-2003 are used to investigate the coupled ice-ocean response in the near-inertial band within Marguerite Bay on the western Antarctic Peninsula shelf. These data were collected as part of the U.S. GLOBEC Southern Ocean Program. This coastal shelf region exhibits very little tidal energy in the semidiurnal band, with the dominant semidiurnal component M2 having mid-shelf current amplitudes of only ~ 2 cm/s. However, complex demodulation and rotary spectra show strong motions in the near-inertial band (rms amplitudes up to ~ 30 cm/s) in both the sea ice and upper ocean mixed layer. This large difference in energy allows a clear separation between the semidiurnal band (centered at 12.42 hr) and the near-inertial band (centered near the local inertial period at 12.92 hr). Therefore, it provides an excellent environment in which to investigate the near-inertial band, which at high latitudes falls very close to the semidiurnal.

More of the high frequency ice motion is explained by near-inertial demodulation than that of the upper ocean at all moorings. Interannual differences are small between the two years sampled. In general, the larger the internal ice stresses, the weaker the observed near-inertial response. Implications for wind-induced mixing of the upper ocean mixed layer beneath sea ice are discussed.