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Internal Nonlinear Tides on the Mexican Pacific Shelf

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Dynamics of semidiurnal internal tides on the Mexican Pacific shelf are discussed using data obtained from moored instruments and vessel transects. Observations were conducted in Navidad Bay, on the Pacific Mexican shelf from 17-28 May, 2010. Time series of temperature and water-currents were collected from moorings instrumented with thermistors and acoustic Doppler current profilers (ADCPs). Two acoustic Doppler velocimeters (ADVs), a CTD, and a self-contained autonomous turbulence profiler provided high-frequency velocity and temperature fluctuations for estimation of turbulence parameters. Temperature, salinity, and current transects were performed with a towed CTD profiler and ADCP. Tides in the study area are predominantly semidiurnal with heights < 1 m. Observations in past years showed that nearer to the shore, these waves are transformed into groups of nonlinear solitary waves (Filonov and Konyaev, 2006). Traces of temperature measurements about 500 m off the coast revealed indeed a ”chaotic” set of high frequency, modulated by lower frequency, fluctuations - presumed remnants of internal tides. Temperature transects further revealed the existence of homogeneous layers that occupied regions with vertical extents of 20-30 m and horizontal scales of 5-6 km. This homogeneity corresponds to strong mixing, most likely resulting from local overturning and breaking of internal waves. Spectral analysis of temperature and velocity fluctuations revealed a -5/3 slope, consistent with the existence of an inertial subrange in the turbulence spectra. Our preliminary analysis indicates that inclined semidiurnal internal tides propagating upward and onshore dominate on the narrow shelf and adjacent continental slope. These waves undergo nonlinear transformation in two ways: 1). Overturning of wave crests producing strong mixing and resulting in the formation of homogeneous layers up to 20 m thick and with horizontal extents of a few kilometers. 2). Formation of groups of near-bottom solitones.