A First Look at the Vertical Structure of the Atmospheric Pressure Tide Above Hawaii

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A network of ten atmospheric pressure/temperature/humidity data loggers has been operating for 1 year on the windward slope of Mauna Loa volcano between sea level and 3400 m. These data are used to calculate the harmonic components of the atmospheric pressure tide that is forced by the daily cycle of heat input to the atmosphere via radiation absorption, sensible heating of the surface/convection, and latent heat release in convective clouds (Figure 1). Variations in the tidal components over time (daily to seasonal) and space (elevation, land/ocean, windward/leeward) are compared to measurements of water vapor, ozone, cloudiness, and precipitation to separate the migrating/non-migrating tidal components and study the relative importance of the forcing factors (Figure 2).

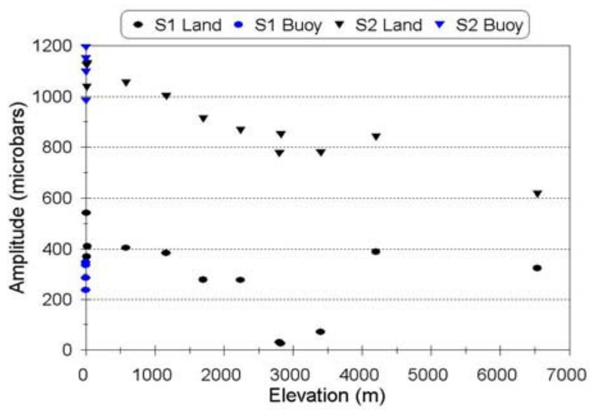

Figure 1. Annual average amplitude of the first two harmonics of the atmospheric tide as a function of elevation. The amplitude of S2 (triangles) decreases with elevation. The amplitude of S1 (circles) is at a minimum at about 2800 meters as described in Figure 2. Data were obtained from the Canada-France-Hawaii Observatory (4200 m on Mauna Kea) and Hardy et al., *Bull. Am. Meteorol. Soc.*, *79*, 1899-1913, [1998] (6542 m on Nevado Sajama at 18˚S latitude in the Andes). Data from four buoys located within 300 km of Hawaii (blue symbols) were obtained from the NOAA National Buoy Data Center.

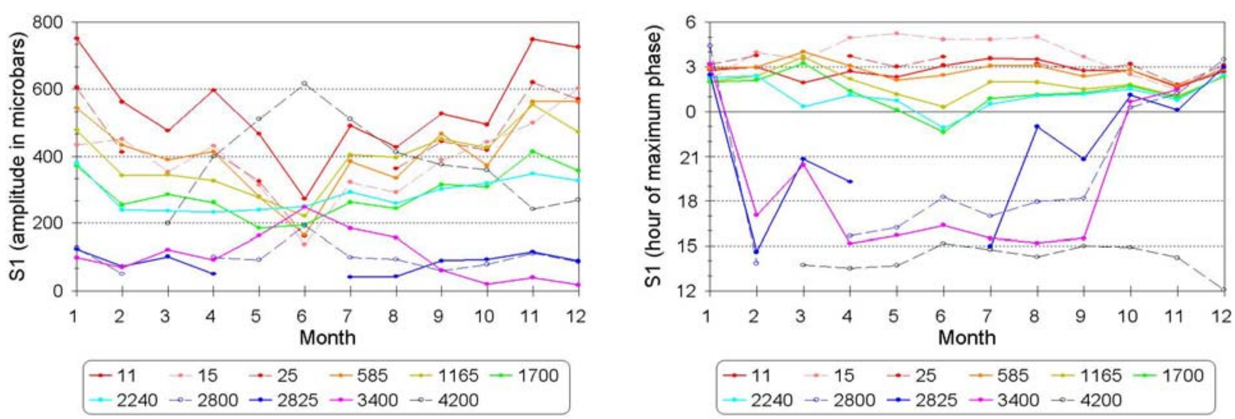

Figure 2. Monthly average amplitude (left) and phase (right) of the first harmonic (S1) of the atmospheric tide. The seasonal cycle in the amplitude of S1 is reversed above and below 2800 m. The phase of S1 shifts by about 12 hours above 2240 m in the spring and summer and above 3400 m in the fall and winter. The legend gives the altitude of each site in meters. Data were taken between March 2004 and February 2005. Data for 4200 m courtesy of the Canada-France-Hawaii Observatory.