The vertical structure and temporal variability of the atmospheric tides over South Pole

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Studies of the mesosphere and lower thermosphere (MLT) over the South Pole during the 1990s revealed the existence of an unexpected westward propagating semidiurnal tidal component with zonal wavenumber one. This tidal component was first observed in the austral winter using optical instruments. Observations made later with a meteor radar in the mid 1990s showed that this nonmigrating component of the semidiurnal tide had a much larger amplitude during the austral summer ($\sim$20 m/s) and practically disappeared during the winter. A similar behavior was observed for the migrating diurnal tide but with smaller amplitudes. Initial comparisons of the nonmigrating component of the semidiurnal tide with models like the Global Scale Wave Model (GSWM) showed that the observed amplitudes were significantly larger than the model predictions. However the GSWM only includes nonmigrating tidal components generated via latent heating and it is believed that the nonmigrating semidiurnal tide observed at South Pole is the result of a nonlinear interaction between the migrating semidiurnal tide and the wave one stationary planetary wave. Recently the Middle Atmosphere Circulation Model at Kyushu University (MACMKU) was able to reproduce some of the main temporal variations of the observations, as nonlinear effects are included in this general circulation model. However, the MACMKU maximum amplitudes were larger than the observations.

A new meteor radar was installed at the Amundsen-Scott station at the South Pole in 2001 to further the understanding of the dynamics of the Antarctic region. The current arrangement of data acquisition systems at the South Pole allows the collection of meteors in a configuration similar to the previous meteor radar system and also using an interferometer to accurately determine the meteor positions in the sky. The interferometer has enabled the ability to determine the vertical structure of the waves observed over the South Pole. In this paper the tidal estimates using height resolved and non-height resolved systems are compared to quantify the effect that the lack of altitude resolution can have in the estimation of the tidal components. A 20% increase in the amplitude of the semidiurnal tide with zonal wavenumber one is found while

no significant difference is observed in the phase of this tidal component or in the amplitude and phase of the migrating diurnal tide. The vertical structure, temporal evolution and interannual variability of the tidal components will also be discussed based on the South Pole meteor radar observations from 2001 through 2005.