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Diurnal and Semidiurnal Sun-Synchronous Tides in Exosphere Temperature from CHAMP and GRACE Density Measurements

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The global variability of the diurnal and semidiurnal components of exosphere temperature with respect to season, latitude and solar activity are examined in this paper, with emphasis on the sun-synchronous or "migrating" components. Exosphere temperatures are derived from accelerometer-measured densities on the CHAMP and GRACE satellites at altitudes of order 350-500 km under quiet (Kp < 3) geomagnetic conditions. Combined with the relative local time precession rates of these satellites and the types of local time sampling that they provide, several perspectives on migrating tides in exosphere temperature are achieved: The complete variability of the exosphere temperature diurnal tide is revealed by the combined CHAMP and GRACE accelerometer data, including long-term (72-day mean) solar cycle variations, seasonal-latitudinal variations, and day-to-day variations associated with solar activity. The seasonal-latitudinal variability of the semidiurnal tide is also revealed for moderate to high solar activity conditions. Variability of the semidiurnal tide with respect to short-term and long-term solar flux changes has not been determined, due to inadequacies in local time sampling and coverage. The salient features of semidiurnal and diurnal migrating tide variability are captured by NRLMSISe00, although differences exist in the details of seasonal-latitudinal structures and amplitudes.