BOSTON UNIVERSITY

SPACE PHYSICS SEMINAR

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The Lunar Atmospheric Tide as Viewed by Multiple Satellites

Thursday, February 27, 2014
725 Commonwealth Ave.
Refreshments at 3:30pm in CAS 500
Talk begins at 4:00pm in CAS 502

Abstract:
The moon's gravity exerts forces on the solid earth, oceans and atmosphere that produce periodic oscillations referred to as lunar tides. Study of the lunar tide in the ionosphere has a long history, and new discoveries are still being made, e.g., in connection with sudden stratosphere warmings and the equatorial electrojet, for instance. However, only recently have sufficient observations been available to delineate the neutral-atmosphere lunar tide and its variability on a global scale. In this paper we discuss extraction of the lunar tide from accelerometer measurements on the GOCE, CHAMP and GRACE satellites at nominal altitudes of 260, 350 and 450 km, respectively, from both climatological and space weather perspectives. Despite near-constant forcing, the weather aspects of the lunar tide arise from its sensitivity to background atmosphere conditions, which change in response to meteorological conditions and variable solar and magnetospheric inputs. There are significant challenges in separating the lunar tide from density variability due to changing geomagnetic conditions, especially recurrent geomagnetic activity with a period of 13.5 days, which are briefly described. We find that thermosphere density variations attributable to the lunar tide (~4-7%) at 260 km during 2009-2011 are about half those due to the background "weather" due to geomagnetic activity; amplitudes at CHAMP and GRACE altitudes can be twice as large. Lunar tidal wind variations are of order 10-20 m/sec. During sudden stratosphere warnings, lunar tide amplitudes in the thermosphere can be as large as 10-20% and 50 m/sec. Although of sufficient magnitude to be relevant to prediction of satellite ephemerides and inherently predictable in a climatological sense, the lunar tide has not been included in any empirical models to date.