BOSTON UNIVERSITY

Boston University College of Arts & Sciences
Center for Space Physics

2018 - 2019 SPACE PHYSICS SEMINAR SERIES

Observing the Weather in Earth's Thermosphere

The uppermost layer of Earth's atmosphere extends from roughly 90 - 600 km in altitude, and is known as the thermosphere. Because Low Earth Orbit spacecraft operate in this region, space-faring nations like the USA have spent decades studying its climatology and its response to dynamic forcing - which is imposed both from above by the Sun and solar wind, and from below by upward propagating waves and tides.

Unfortunately however, previous techniques for measuring basic parameters like temperature, density, and wind have provided only point measurements at sparse locations. Such measurements are inadequate to describe the four-dimensional (longitude, latitude, altitude, and time) structure of the fields that appear in the equations that govern the thermospheric response to the drivers that are imposed upon it. To address this, the University of Alaska has developed ground-based all-sky Doppler spectrometers that resolve the sky scene into (typically) 115 simultaneous look directions, and derive independent measurements of temperature and line-of-sight wind speed from each one.

The field of view maps to a circle roughly 1000 km in diameter at F-region heights of around 240 km, whereas the time resolution varies from 1 -10 minutes depending on airglow/auroral signal levels. Because the instruments are only sensitive to a single (line-of-sight) wind component, deriving vector wind fields from one observatory location requires substantial assumptions that are frequently violated in the real atmosphere. Thus, recent work has focused on combining data from several geographically separated instruments to obtain assumption-free measurements of the true vector flow field. Even then, most work has been restricted to measurements from only one height, based on the 630-nm emission from atomic oxygen at roughly 240 km altitude. Here I will describe how our very latest work is combining observations at two wavelengths and exploiting height variations in the aurora to resolve all three wind components over all four spatio-temporal dimensions.

Thursday, February 14th
4:00 - 5:00 p.m.
725 Commonwealth Avenue | Room 502

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