

Measurement of Lower Thermosphere using The Optical Profiling of the Atmospheric Limb (OPAL) CubeSat Experiment

Padmashri Suresh and Charles M. Swenson

Department of Electrical and Computer Engineering, Utah State University,
Logan, Utah, USA

The Earth's lower thermosphere region between 90-140 Km is subjected to episodic energy and momentum forcing from the solar wind in the form of Joule heating and particle precipitation. This is believed to be the largest driver of global thermospheric temperature variability. In addition, this region is also subjected to the periodic and episodic energy and momentum forcing through tides, planetary waves and gravity waves generated in the lower atmosphere. These internal waves affect the temperature structure on many scales as they propagate up from the lower atmosphere into the thermosphere. However, the relative importance of these two coupling processes on the thermospheric temperature structure, on both regional and global-scales is poorly understood.

The Optical Profiling of the Atmospheric Limb (OPAL) is an upcoming CubeSat mission designed to fill this void and to make temperature measurements in this critical "shore-line" region between the atmosphere and space. It will measure the thermospheric temperatures from 90–140 Km altitude by observing the daytime O₂ A-band (near 762nm) emission with a high-sensitivity, hyper-spectral limb imager. The objective of the OPAL mission is to understand the thermospheric temperature signatures of the dynamic solar, geomagnetic and internal atmospheric forcing. In particular, OPAL mission would answer the following two critical science questions:

1. How much do geomagnetic storms alter the temperature structure of the lower thermosphere at low- and mid-latitudes?
2. What are the temperature signatures of internal atmospheric waves in the lower thermosphere?

Within this paper we overview the mission, instrumentation and science objectives of OPAL.