

# Driver and Response Characteristics for Improved Physics-Based Simulation of the Thermosphere

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The neutral density of the thermosphere directly impacts satellites that reside within or traverse Low-Earth Orbit (LEO) over a wide range of timescales. At shorter time scales—minutes to days—variations in density impede the operational imperative to track satellites and objects and to avoid collisions. At longer time scales—a solar cycle and beyond—variations in density control the size and distribution of the LEO population of objects. As the number of SmallSat missions and the resulting debris objects population increase at unprecedented rates, monitoring and modeling the LEO environment become ever more important. The challenges of this are compounded by the relatively few direct data sources currently available with which to monitor the thermosphere over these pertinent timescales. In this talk, we will discuss efforts to use precision orbit determination (POD) from GNSS-equipped SmallSats to fill in the sparsely observed thermosphere. We will also provide an update on efforts to create a civilian thermosphere monitoring system, blending available data sources with a physical model of the coupled thermosphere-ionosphere system in the context of a data assimilative framework.

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