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Neutral thermosphere interactions with space vehicles are a persistent challenge to space operations in low earth orbit (LEO). Space-weather in the thermosphere remains one of the biggest sources of uncertainty in satellite orbit forecasting affecting active satellites along with a sizeable debris population residing in LEO. This is the result of a complex chain of events which begin at the Sun, transfer energy to the Earth's Magnetosphere-Ionosphere-Thermosphere (MIT) system, and culminate in a degradation of orbit prediction accuracy and a worsening of uncertainty realism in day-to-day operations. To better understand the interactions that result in LEO impacts, we must first understand how and why the problem scales the way it does. How sensitive are satellite orbits to external drivers and conditions like solar wind and EUV parameters, orbital characteristics, and thermospheric response spatial scales? We can then review the various physical aspects of a process broadly referred to as satellite drag, including energy dissipation rates, gas-surface interactions, and various sources of uncertainty. Finally, we review a few of the practical aspects of and recent progress in the critical components that make up solutions to this problem including thermospheric modeling, data assimilation, and forecasting.
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