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Vertical coupling in Titan's upper atmosphere

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Abstract

After nearly a decade of in–situ and remote observations of Titan by the Cassini spacecraft and Huygens probe, our understanding of the upper atmosphere (mesosphere/thermosphere) remains mostly enigmatic. While pre–Cassini studies suggested solar radiation as the main energy input into Titan's thermosphere, this could not be confirmed by Cassini observations. In particular, in–situ density observations by the Ion Neutral Mass Spectrometer (INMS) show a great deal of variability with time and location on the planet that is inconsistent with the simple solar-driven picture.

Using our Titan Thermosphere General Circulation Model in combination with time–dependent forcing at mesospheric heights from the Titan Weather Research and Forecasting (TitanWRF) model, we examine the importance of vertical coupling in Titan's upper atmosphere, and thereby the possibility of driving some of the observed structures and variability from the lower atmosphere. Equally, we examine the origin of long term trends in observed INMS densities and the role of vertical coupling in driving these.