Meso-scale forcing in the upper atmosphere: sources and impacts

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We present a systematical study crossing both data analysis and model simulation to improve the specification of the energy and momentum inputs into the ionosphere-thermosphere (IT) system, especially at the meso-scale, and the system response. Our results are organized in two parts. First, two-years of Swarm satellite field-aligned current (FAC) data have been analyzed in order to study the distributions of mean pattern and variability of FACs on different scales (small scale: <150 km; mesoscale: 100~500 km; large scale: >500 km). The FAC distributions are then implemented in the Global Ionosphere-Thermosphere Model (GITM) to assess relative contributions of FACs at different scales to Joule heating. To enhance our capability to directly simulate the meso- and small-scale structures, GITM has been improved with a local patch grid refinement capability. Utilizing GITM with the new grid structure, the meso- and small-scale gravity wave perturbations have been included at the lower boundary of GITM to simulate the influence of meso- and small-scale gravity waves on the upper atmosphere.

Keywords: Meso-scale forcing , upper atmosphere, Joule heating, Gravity waves

