

Effects of Dynamical Variability in the Mesosphere and Lower Thermosphere on Energetics and Constituents

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Waves of all scales play a significant role in the large scale flows and variability in the mesosphere and lower thermosphere (MLT). While the large scale flows can be reasonably well modelled through parameterizations of scales below the model resolution, the effects of this variability on the energetics and constituent profiles in this region requires careful consideration of the physics of this region at these smaller scales. Of particular importance is chemical heating, CO₂ cooling, and atomic oxygen chemistry all of which depend non-linearly on the local environment (density, temperature, and atomic oxygen mixing ratio).

In this paper, the nature of this dynamical variability is reviewed. The motion field of the Canadian Middle Atmosphere Model (CMAM) is used to simulate this variability and the nature of the non-linear dependence of these processes is described. Differences exist between the energetics and constituent profiles when this variability is included as opposed to when zonally and temporally averaged profiles are used. This analysis, in combination with superposition effects associated with tides and planetary waves, points to the importance of this variability in understanding and characterizing the spatial and temporal structuring of the MLT.

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