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Neutral viscosity is often treated as a background transport parameter in global ionosphere-thermosphere models, yet it strongly shapes how momentum and thermal structures are redistributed during geomagnetic disturbances. In this study, we investigate how variations in neutral viscosity influence storm-time thermospheric winds and temperature structure using the Global Ionosphere Thermosphere Model. The analysis focuses on the sensitivity of modeled responses across latitude, local time, and storm phase, with particular attention to the development of temperature and wind features that affect the coupled ionosphere thermosphere system.

By comparing simulations across different viscosity settings, this work isolates how internal model physics modifies the large-scale response to external forcing. The results show that viscosity changes not only the magnitude of the thermospheric response, but also its spatial morphology, including the structure of winds and temperature enhancements during disturbed periods. These differences matter because they affect how well physics-based models reproduce the timing and pattern of storm driven energy redistribution, which in turn influences confidence in space weather specification and prediction.

This work contributes to the broader effort to improve physically consistent modeling of the upper atmosphere during active conditions. It is especially relevant to cross disciplinary questions linking solar forcing, geospace response, and space weather risk. By clarifying the role of neutral viscosity in storm time dynamics, the study helps identify which aspects of modeled variability are controlled by forcing and which are controlled by internal transport physics, an important step toward more reliable interpretation of observations and more mission ready space weather tools.
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