Storm-Time Neutral Density Perturbations at Multiple Temporal- and Spatial-Scales: Data-Model Comparisons

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Introduction & Motivation

Introduction:

- The dependence and distribution of mesoscales neutral density perturbation (NDP) are not known well
- Knowledge of the dominant temporal & spatial scales of mesoscale NDP is insufficient

Motivations:

- Single satellite suffers from temporal and spatial ambiguity
- GRACE-A & -B satellites make it possible to separate
- GRACEs (separation ~30s / 250km) can't study other scales
- Fly 6 virtual satellites with different separation in GITM



• Result-(1): Data-Model Comparisons of duskside $\rho \& \Delta \rho$



o In general, GITM simulations reproduce the most salient temporal and spatial perturbations

• Mesoscale perturbations can distribute at all latitudes, and has finer structures in polar regions

Result-(2): temporal variations of virtual satellites

#1 - #5 satellites fly-over the same location over different times ٠



• Result-(3): spatial variations of virtual satellites

• #1 - #4 satellites fly-over different location at the same time



 $\Delta \rho$ increases with distance; $\Delta \rho / \Delta km$ decreases with distance

Spatial variation (12°) is more static than temporal variation (187s)

• Result-(4): GDC orbit – multi-satellite applications



• *Result-(4): GDC orbit – multi-satellite applications*

Summary

- Mesoscale $\Delta \rho$ can distribute at all the latitudes, and has finer structures in polar regions
 - By combing 6 satellites, time-space can be separated:
- I. $\Delta \rho$ increases with time and distance, but $\Delta \rho / \Delta t$ and $\Delta \rho / \Delta km$ decrease
 - Spatial variation (~12°) is more static than temporal variation (~187s)
 - More comprehensive global map can be obtained, and more diverse scales can be investigated (~2xseparation) with more satellites

Better global map, e.g., IAD structure with more satellites

90

60

30

-30

-60

-90

90

60

30

-30

-60

-90

Ι.

GLAT (deg)

00

3LAT (deg)

The closer, the finer ρ can be investigated

00:0

(100s)10

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