COUPLED MAGNETOSPHERE-IONOSPHERE-THERMOSPHERE SIMULATION OF THE SYSTEM RESPONSE TO A SUDDEN REVERSAL IN THE INTERPLANETARY MAGNETIC FIELD B_Y COMPONENT

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WHAT WE SAW: There is an unexpected delay in the ionosphere’s response to a new IMF orientation.

WHY WE THINK IT HAPPENED: Dayside magnetopause reconnection needs time to catch up.
Ionosphere Response to IMF $B_y$ Reversal

Image credit: Eriksson et al., 2017
1. **Bow Shock**
2. Open field lines
3. Closed field lines
4. IMF lines
5. Dayside
6. Magnetotail
7. Magnetopause
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RECONNECTION BASICS

- Change of topology
- Separator line
- Energy transfer
- Outward jets

Image credit: ESA
MAGNETOSPHERE RECONNECTION

- Dayside reconnection
- Magnetotail reconnection

Image credit: NASA
IONOSPHERIC CONVECTION PATTERN

- Anti-sunward flow across the pole
- Return flow at lower latitudes
B_Y IMF COMPONENT CHANGES PATTERN SLIGHTLY
POLAR OPEN-CLOSED BOUNDARY
Ionosphere Response to IMF B_y Reversal

Image credit: Eriksson et al., 2017
ENERGY DISSIPATION IN THE IONOSPHERE
ENERGY DISSIPATION IN THE IONOSPHERE
CROSS POLAR CAP ELECTRIC POTENTIAL
SASH AND SEPARATOR: BEFORE REVERSAL
SASH AND SEPARATOR: BEGINNING OF REVERSAL
SASH AND SEPARATOR: TEN MINUTES INTO REVERSAL
SASH AND SEPARATOR: PATTERN STABILIZED
FLUX ROPES
THE CULPRIT: A DUSK SIDE FLUX ROPE
DIFFERENT TOPOLOGIES INSIDE THE FLUX ROPE

Image credit: Wilder et al., 2013
FLUX ROPE PROGRESSES BACK AND NORTHWARDS
FLUX ROPE EVENTUALLY CLEARS
PATTERN REVERSE CONFIRMATION FROM OPPOSITE HEMISPHERE
CONCLUSION

The finite rate of magnetic reconnection can delay changes in the ionospheric ExB drift.

• The ionosphere showed that there was circulation on closed field lines.
• We discovered a buildup in the form of a flux rope on the dusk side of the magnetopause.
• The ionospheric pattern couldn’t fully reverse until the flux rope cleared.

QUESTIONS?