

ANALYSIS OF THE PERFORMANCE OF WAM-IPE MODEL DURING NOVEMBER 2003 SUPER GEOMAGNETIC STORM

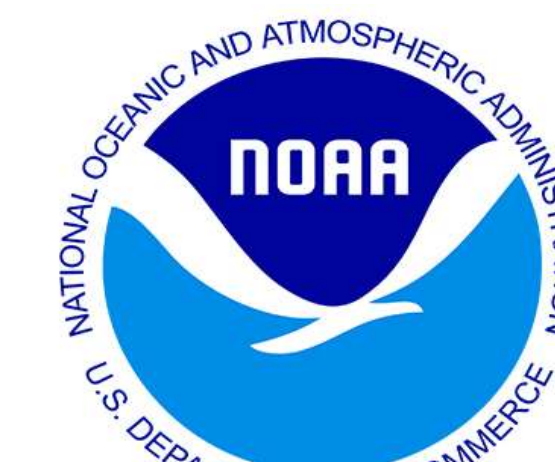
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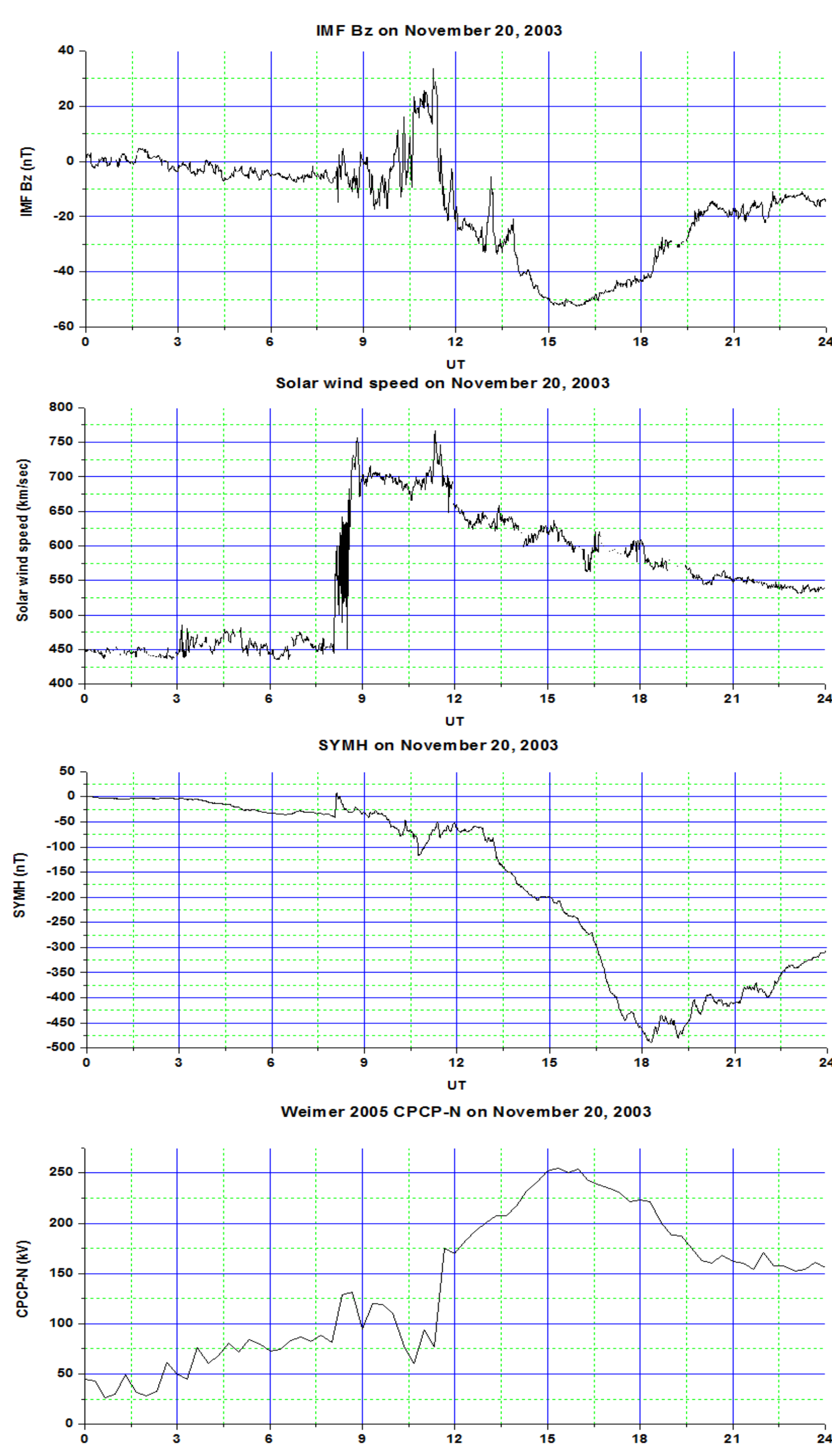
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Brief description of Whole Atmospheric Model (WAM) - Ionosphere Plasmasphere Electrodynamics (IPE) model

- The objective of the paper is to observe the performance of Weimer driven Whole Atmosphere Model with Ionosphere Plasmasphere Electrodynamics (WAM-IPE) during the super geomagnetic storm on November 20, 2003.
- The WAM predicts the circulation of the neutral wind on global scale (Akmaev, 2011). WAM is coupled with IPE in order to predict ionospheric parameters considering effects from solar wind and upper atmosphere model (Fuller-Rowell et al., 1996; Sun et al., 2015).
- Weimer 2005: This model provides high-latitude electric potentials using solar wind inputs (Weimer, 2005). This model is used to drive WAM-IPE.

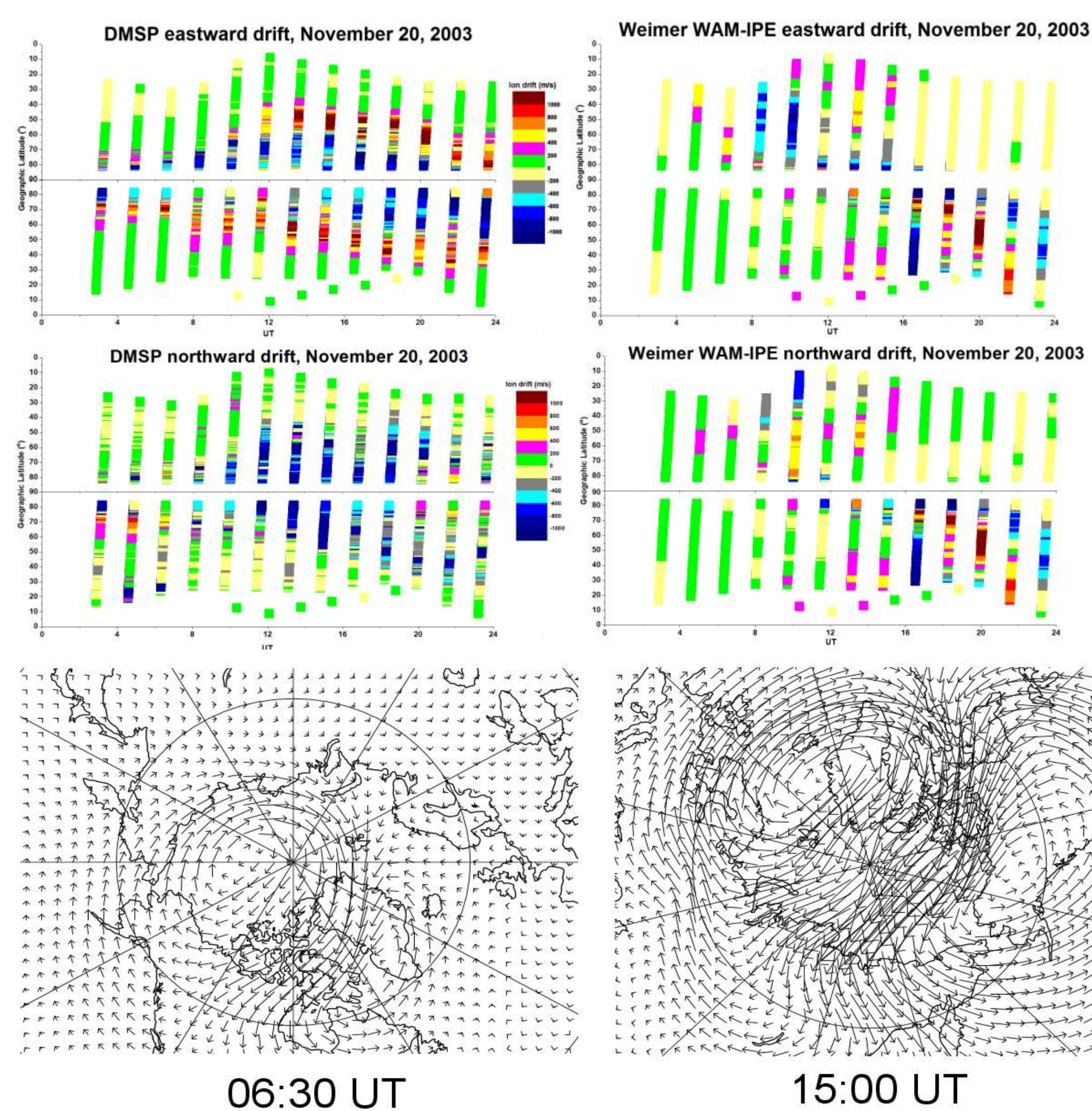
Solar and geomagnetic parameters on November 20, 2003



Solar wind speed, IMF Bz and Solar wind dynamic pressure during November 20, 2003. Solar wind speed started to increase around 8UT (maximum: ~750km/sec). Sharp positive transition of IMF Bz was observed around 10UT and negative transition from 11UT. Solar wind dynamic pressure maximized around 8UT and 11UT. Minimum SYMH observed was -490nT (~18UT). Cross Polar Cap Potential (CPCP) from northern hemisphere from Weimer observed around 15UT (~250kV).

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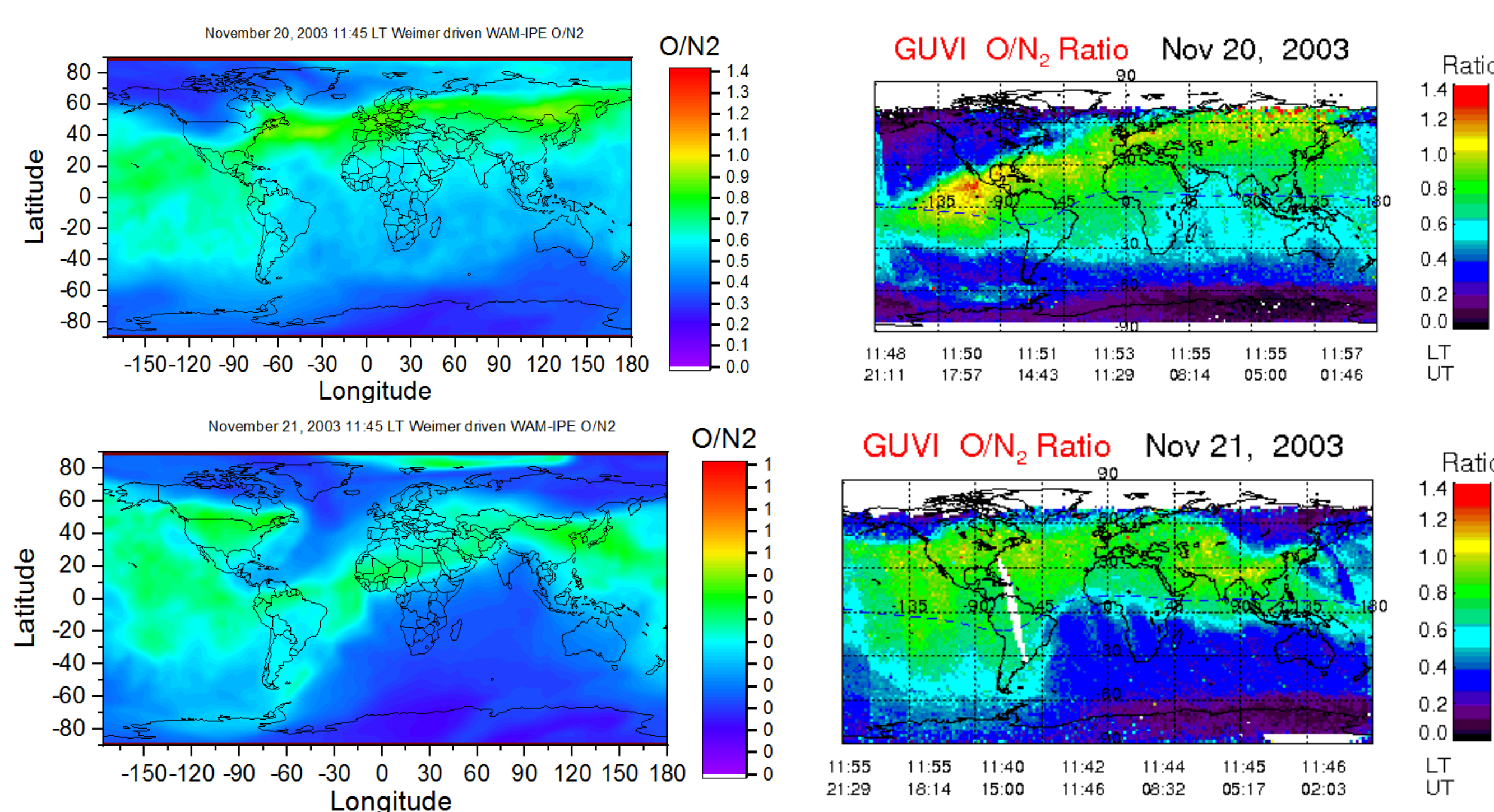
Comparisons of horizontal plasma drift velocities between DMSP and Weimer driven WAM-IPE



The comparisons are conducted at an altitude of 850km for all F15 DMSP satellites on November 20, 2003. This is seen from these comparisons that Weimer driven WAM-IPE underestimates the drifts near the peak velocities (near the higher latitudes) during majority of times.

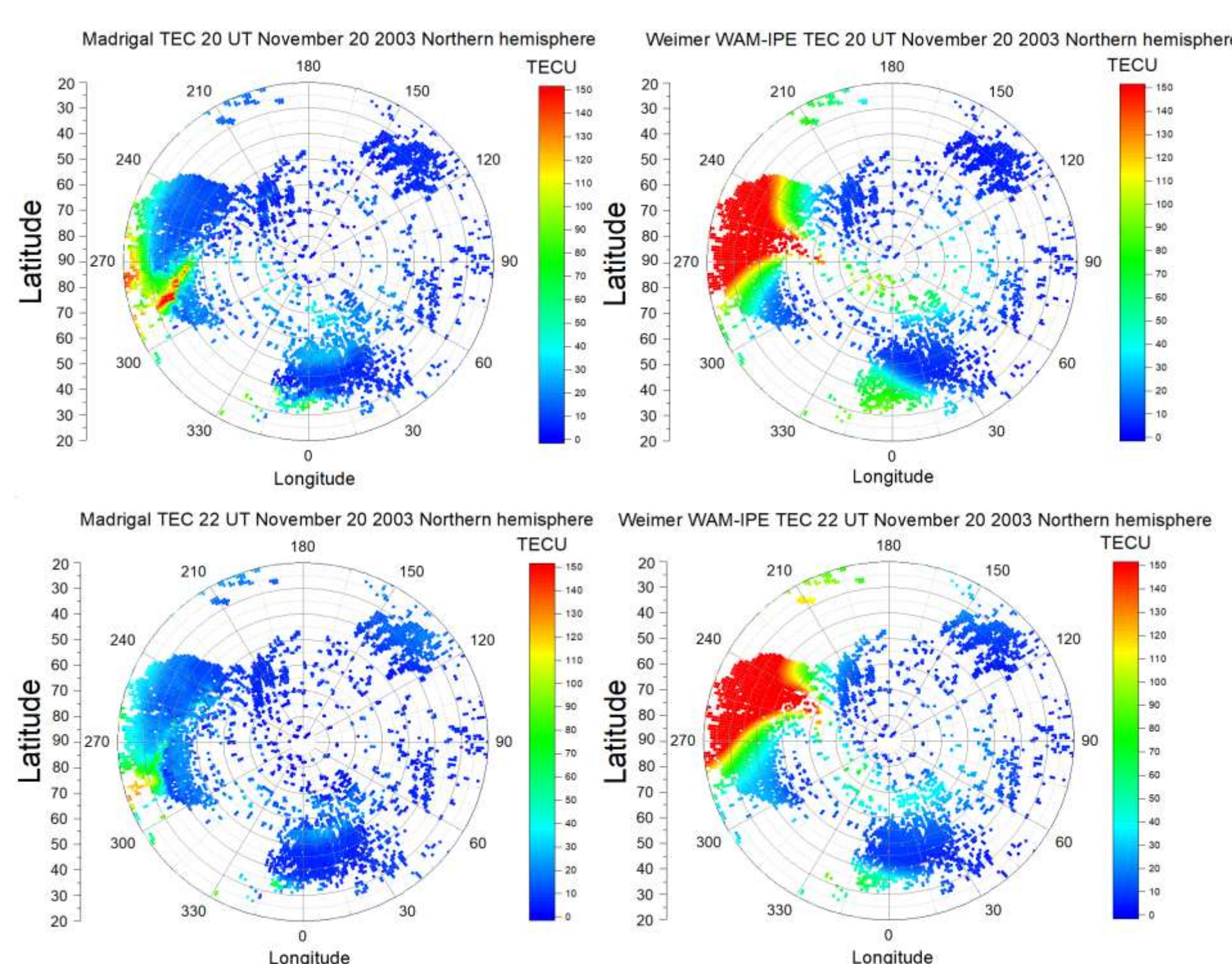
The plots below are showing the Weimer WAM-IPE horizontal plasma drifts during different hours of November 20, 2003. This is found that the drifts intensified during 15UT which is correlated with most negative IMF Bz and higher CPCP.

Comparisons of O/N₂ from TIMED GUVI instruments and Weimer WAM-IPE during November 20-21, 2003



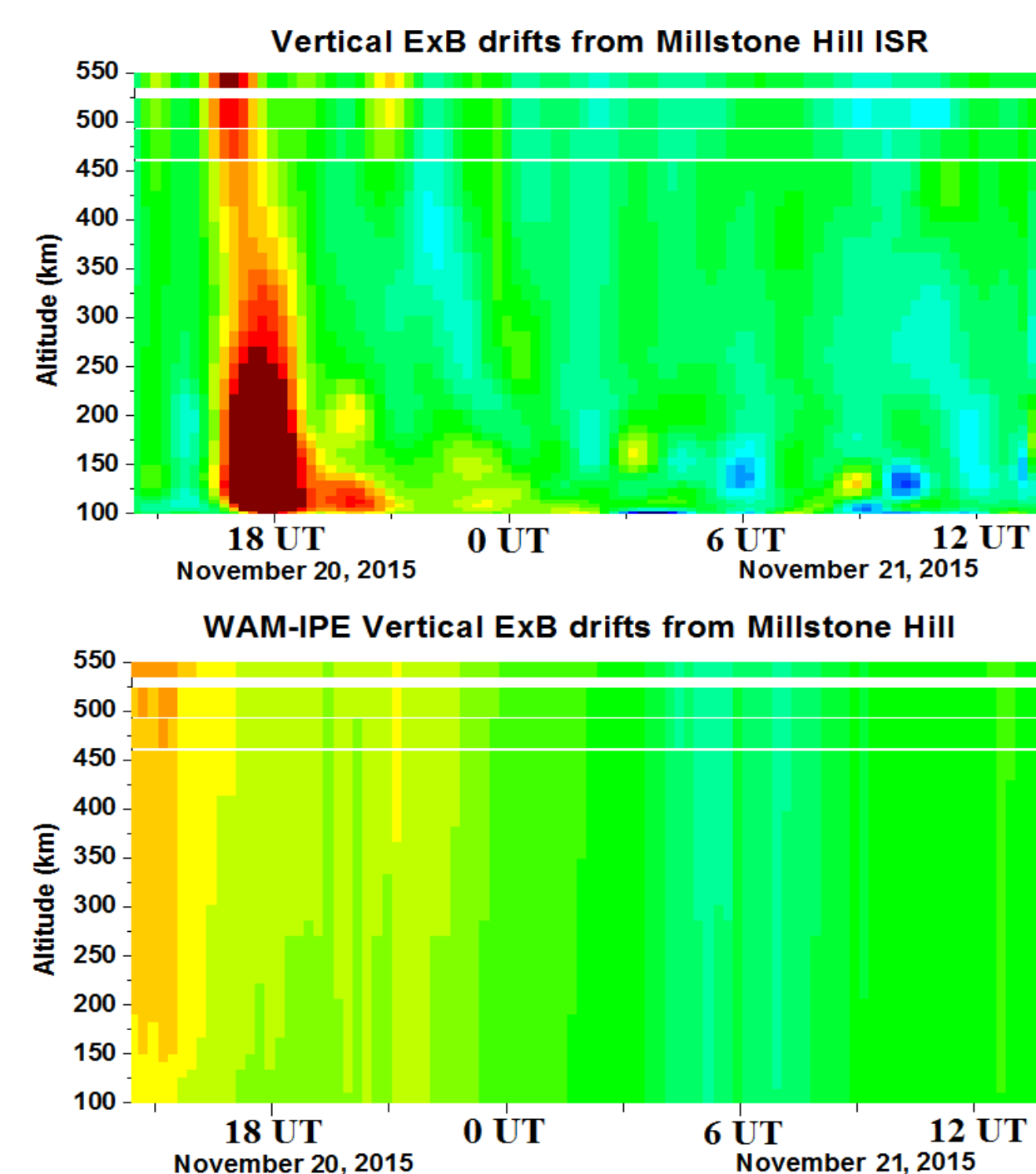
From the O/N₂ comparisons between GUVI and Weimer driven WAM-IPE, correlations can be observed specially from the southern hemisphere.

Global Madrigal MIT-TEC compared with Weimer driven WAM-IPE TEC



Comparisons between MIT-Madrigal Global GNSS TEC and Weimer model driven WAM-IPE TEC during representative disturbed periods (20UT and 22UT, November 20, 2003) are shown. Weimer driven WAM-IPE shows overestimation of TEC mainly near the EIA region. It also shows overestimated tongue of ionization structure extending to the geographic north pole.

Comparison of vertical plasma drift velocities between Millstone Hill ISR and Weimer driven WAM-IPE



The comparisons are conducted for an altitude range of 100-550km between Millstone Hill Incoherent Scatter Radar (ISR) and Weimer driven WAM-IPE. From these comparisons, it is found that the higher vertical ExB plasma drifts from Millstone Hill ISR near 18 UT, November 20, 2003 were absent at the Weimer driven WAM-IPE drifts.

Summary and Conclusions

- The horizontal drifts from Weimer driven WAM-IPE have shown good agreement with negative transition of IMF Bz. But they underestimated the DMSP plasma drifts near the high latitudes.
- Intense vertical ExB plasma drifts from Millstone Hill ISR near 18 UT, November 20, 2003 were absent from the same from Weimer driven WAM-IPE.
- Weimer driven WAM-IPE derived O/N₂ has shown good correlations with TIMED GUVI O/N₂ mainly at the southern hemisphere.
- Weimer WAM-IPE has overestimated the TEC near the EIA crest region during the disturbed periods on November 20, 2003.
- Weimer WAM-IPE has also overestimated the tongue of ionization structure extending from equator to pole during 20UT and 22UT on November 20, 2003.

Acknowledgements

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