



Observation of Magnetotail Structure in Comparison to the Substorm Current Wedge

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Spherical Elementary Current System(SECS)

OPENGGCM Simulations

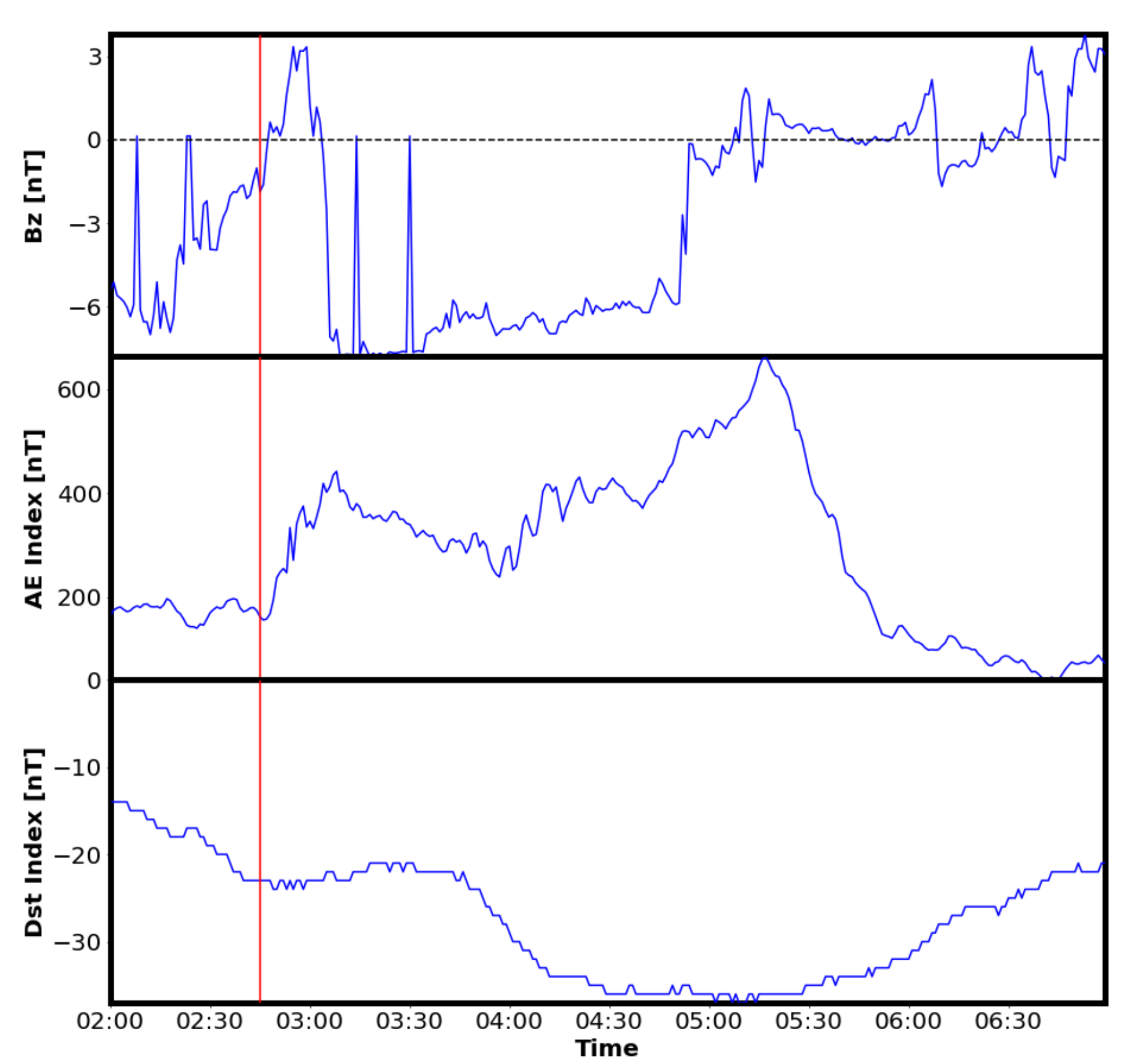


Fig 1: Geomagnetic background of the substorm of 10/10/14, with IMF Bz in the first panel, followed by AE index and then DST. The substorm event was taken from Ohtani's list of substorms. The time of onset is ~ 2:47 UT.

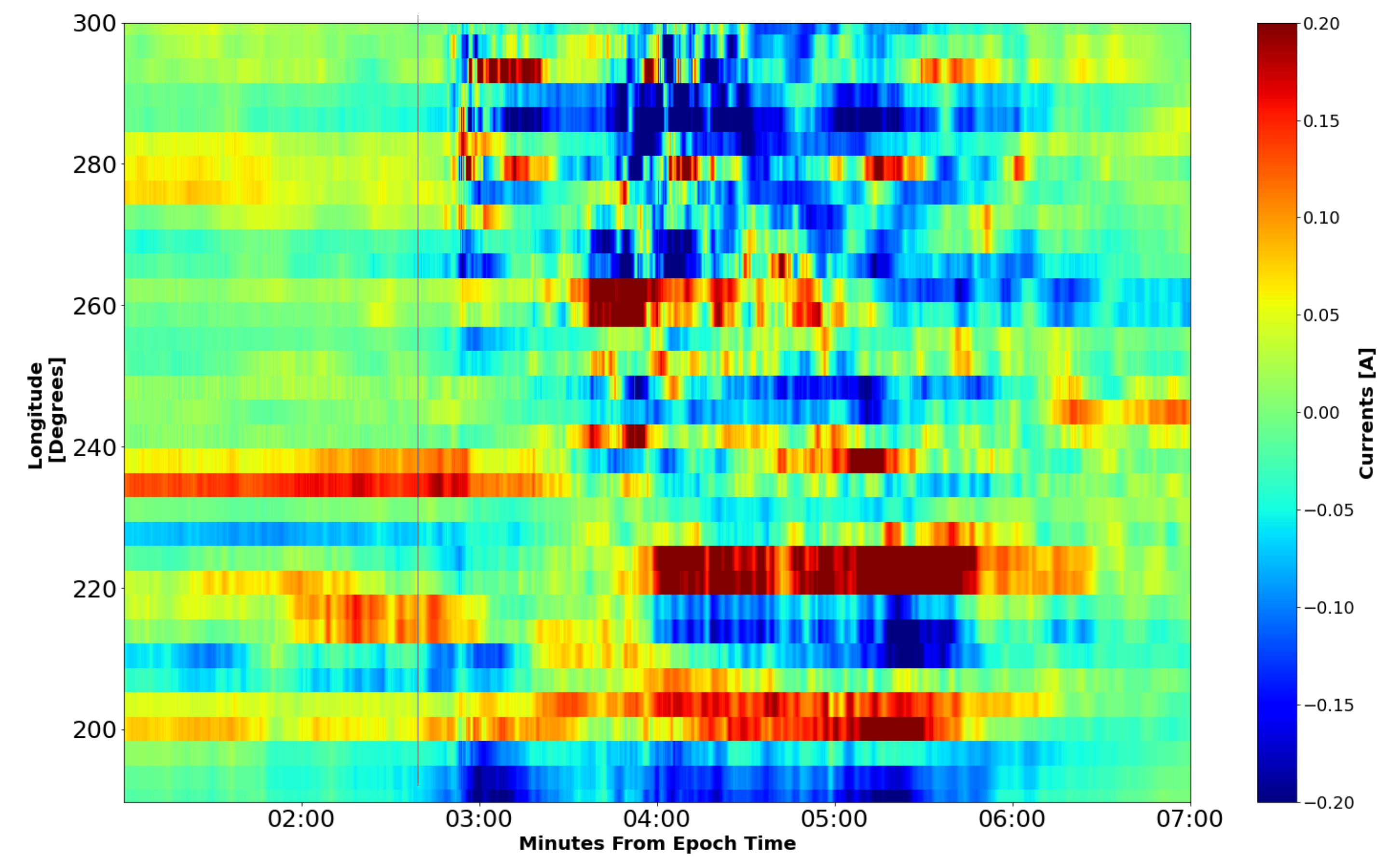


Fig. 2: Keogram of Currents averaged over latitudes. Instances of current enhancements can be seen in the keogram, starting shortly before 03:00 UT at around 280 degrees latitude (~21 MLT) and moves down in longitude over time to ~ 18 MLT.

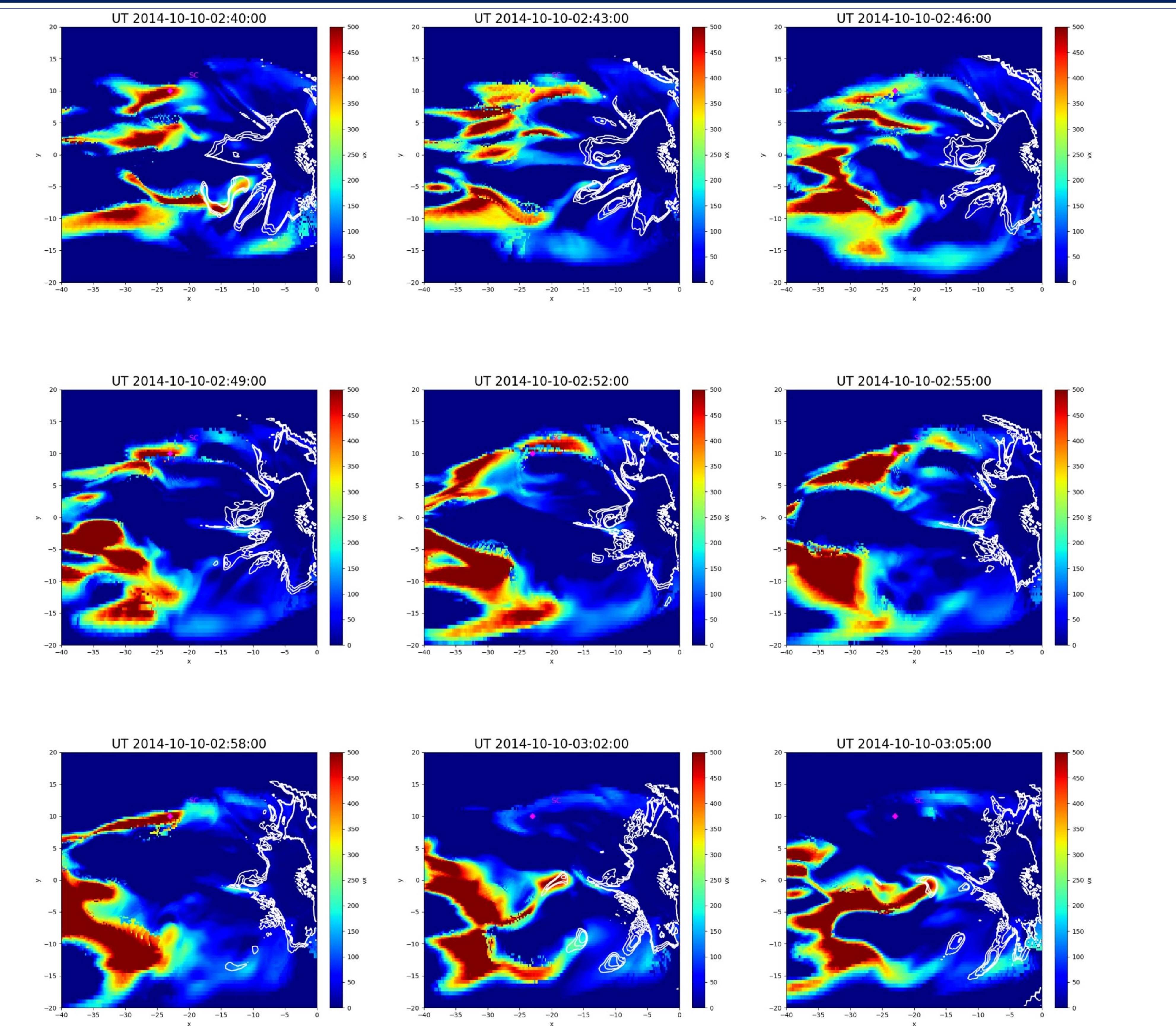


Fig. 3: Simulations of ions for the October 10th 2014 event. This is a plot of the velocity in the x direction (earthward) with the contours being Bz. Earth is to the right of the plots and the red colors are positive velocity (earthward), while colors towards the blue are negative velocity (tailward). Flows earthward can be observed prior to the substorm onset, but an intensification of these flow channels can be seen promptly after 2:46 UT (third panel).

ENA Temperature Map

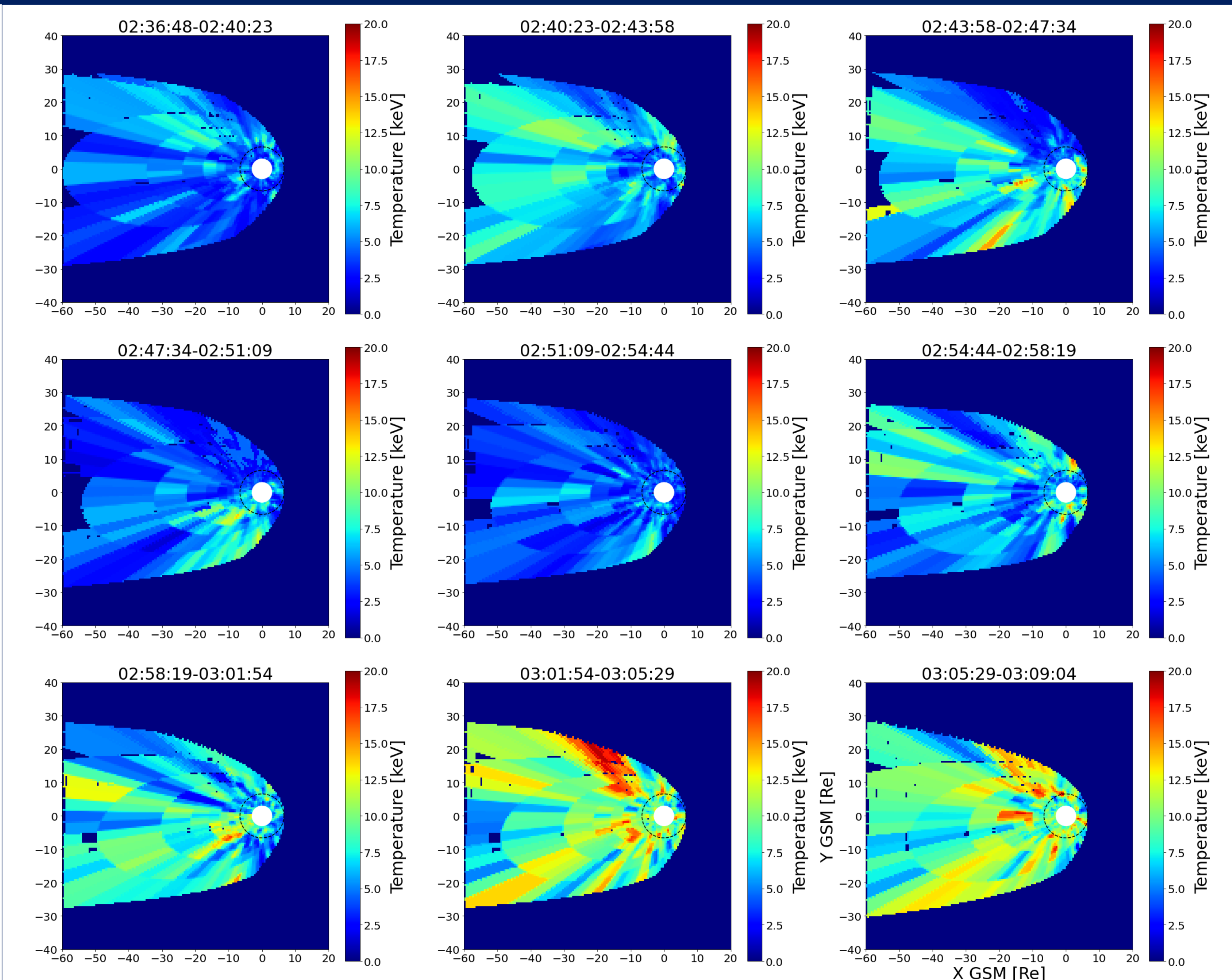


Fig. 4: Temperature maps of the magnetotail for the time intervals of interest. The black dashed circles is geosynchronous orbit. The white circle has a radius of about 3 Re and blocks out region where the temperature map calculations are not valid. Slight increase in the temperature map can be seen from the first to second panels just before substorm onset. A more pronounced enhancement can be seen towards the last few panels when the AE index increases.

Conclusions

- Temperature maps of the magnetotail were generated using ENA data from the TWINS mission.
- October 10th 2014 substorm event was analyzed.
- Fast flows can be observed in the temperature maps, but rarely penetrating into geosynchronous orbit.
- Simulation of the event was performed with flow channels being observed but also rarely penetrating geosynchronous orbit.
- Formation of SCW can be observed in the ionosphere, with a separation between the upward and downward FAC that reduced overtime.
- Strong temporal and spatial correlation between the SECS and the temperature maps.

References

- A. M. Keese, R. M. Katus, M.Floyd, and E. E. Scime (2020), Database of storm-time equatorial ion temperatures in Earth's magnetosphere calculated from energetic neutral atom data. *Journal of Geophysical Research: Space Physics*
- Scime, E., and S. Hokin (1992), Design and calibration of a fast-time resolution charge-exchange analyzer, *Rev. Sci. Instrum.*, **63**, 4527.

Acknowledgements

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