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Solar wind pressure sudden change and the geospace response

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In this presentation we will introduce our recent study and show some new results on the Magnetosphere and Ionosphere Response to Dynamic Pressure Change/disturbances in the Solar Wind and foreshock regions. We study the solar wind dynamic pressure change (increase/decrease) interaction with the magnetosphere using THEMIS satellites at both dayside and nightside in different geocentric distances. Vortices generated by the dynamic pressure change passing along the magnetopause are found and compared with model predictions. ULF waves and vortices are excited in the dayside and nightside plasma sheet when dynamic pressure change hit the magnetotail. The related ionospheric responses, such as aurora and TCVs, are also investigated. We compare Global MHD simulations with the observations. The global processes are summarized as follows.

1. A sudden change of the solar wind dynamic pressure can induce a pair of vortex in the dawn and dusk, and they are propagating tailward. 2. The sense of rotation is different in the dawn and dusk, and different for solar wind dynamic pressure increase and decrease. 3. These vortices can connect to the ionospheric vortices through FAC. 4. And this FAC is like region I sense for pressure increase case, and Region II sense for the for the pressure decrease case.5. Sometimes, the vortex can be related to ULF waves and aurora.

We will also show some new results that dayside magnetospheric FLRs might be caused by foreshock structures.

References

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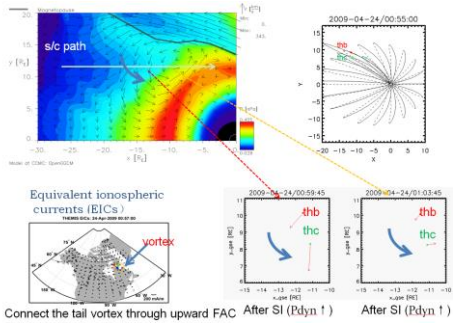

Figure 1 A nightside event we studied in [Shi et al. 2014], in which from our globlal MHD simulation and two-point Themis observations, we find that the ion flow rotates, and this is a tailward moving vortex caused by the solar wind pressure enhancement. From the ground magnetometer data, we also can find a vortex around the footpoints of THEMIS B, C and D in the ionosphere, and it can connect with the magnetotail vortex through upward FAC.

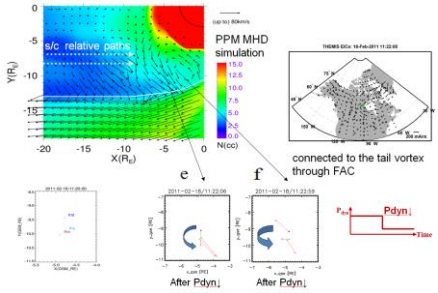

Figure 2 Using three themis satellite we find a vortex After Pdyn decrease, and it is consistent with our global simulation, but the rotation sense of this vortex is just opposite to what we have seen in the pressure increase case. And it also shows a consistent vortex in the ionosphere, which is connected to this magnetotail vortex through FAC [Zhao et al., JGR, 2016].