Polar cap potential saturation during the Bastille day storm using global MHD simulation

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We are developing a real-time numerical simulator for the solar wind-magnetosphere-ionosphere coupling system using next generation magnetosphere-ionosphere coupling global MHD simulation called REPPU (REProduce Plasma Universe) code. The feature of simulation has an advanced robustness to strong solar wind case because a triangular grid is used, which is able to calculate in the uniform accuracy over the whole region. Therefore we can simulate extreme event such as the Bastille day storm. The resolution is 7682 grids in the horizontal direction and 240 grids in the radial direction. The inner boundary of the simulation box is set at 2.6 Re. We investigate the reproduction of the magnetosphere-ionosphere coupling simulation in strong solar wind case. Therefore we compared the simulation results with the observation of the Bastille day storm event (2000/7/15), in which the solar wind velocity is above 1000 km/s and the value of Bz reached -60 nT. Especially, we focus the CPCP saturation and time variation because the CPCP represents the value of magnetospheric - ionospheric convection strength via region 1 current. The CPCP depends on solar wind electric field, dynamic pressure and ionospheric conductivity [Siscoe et al., 2002; Kivelson et al., 2008]. The model of Kivelson et al. [2008] shows a good reproduction to the CPCP variation. However their study assumes that the ionospheric conductivity is constant. The conductivity in our simulation of the Bastille day event is varied by the auroral activity. In this lecture, we discuss the effect of both the auroral conductance and solar EUV-driven conductance to CPCP saturation.

Keywords: global MHD simulation, polar cap potential, extreme event

