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Asymmetries of substorm onset location and the dynamic behavior of auroral substorms during expansion phase

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More than 6600 substorms identified by both IMAGE FUV and Polar UVI data have provided a new opportunity to examine the IMF control of substorm locations in both hemispheres. We find very strong support for the IMF clock angle being the main controlling parameter for substorm onset location. The average substorm onset locations in 30 degree bins of clock angles follow a sine function in both hemispheres, but in anti-phase to each other. The relative asymmetry of substorm locations also follows a sine function. Comparing with IMF By component only there is not a linear relation as previously though, but a saturation effect, that can be explained by the non-uniform penatrtion of IMF By into the closed magnetosphere.

Simultaneous global imaging in the ultraviolet wavelengths by the IMAGE and Polar satellites are used to examine the dynamics of the auroral substorm. When mapped onto apex coordinates, the auroral features in the conjugate hemispheres We follow similar features in the two hemispheres during expansion phase of several substorms. We find that the asymmetry induced by the IMF clock angle at substorm onset disappear during the expansion phase implying that magnetic field lines with asymmetric footpoints are rectified during expansion phase. Various mechanism that can re-establish the symmetric aurora are discussed.