A statistical study of the polar cap patches observed by the EISCAT Svalbard Radar

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The polar cap patches are common irregularities in the polar ionosphere, where formation and evolution can directly effect satellite navigation and communication as well as over-the-horizon radar observations, etc. However, affected by the various dynamic processes during the solar wind-magnetosphere-ionosphere coupling, there is no fully accepted formation mechanism of polar cap patches. In this paper, a statistical analysis of 345 patches at the dayside sectors (0900MLT-1500MLT), observed by EISCAT Svalbard Radar (ESR) from 2010 to 2013, has been preformed, which discussed the dependence of their occurrence on solar wind and IMF conditions as well as their MLT distributions. The results show that the polar cap patches are preferentially formed during the IMF conditions of Bz <0, By >0 and Bx <0. In particular, the MLT dependence of the patches presents a clear IMF By-related prenoon-postnoon asymmetry, suggesting the patch formation is clearly influenced by the IMF By polarity. In addition, our statistical results indicate that the patches are not caused by the variations of the solar wind dynamic pressure or the solar wind velocity. All the results demonstrated that the pulsed dayside magnetic reconnection is possibly the main mechanism of the patch formation.