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The differences and similarities between summer and winter substorms

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The summer and winter substorms have been examined and found out to differ from each other. The summer-winter asymmetry in substorm activity has been examined by identifying over 8000 substorms from IMAGE magnetometer measurements between 1993 and 2009. The substorms were identified by a search engine and the algorithmically observed substorms were compared into the manually observed substorms for 1997 and 1999. The substorm activity was analyzed by computing the substorm number (occurrence rate), the peak amplitude and duration for each event. Winter substorms were more intense than summer substorms, and summer substorms lasted longer than winter substorms. Either this indicates that summer substorms have more time to recover before the next activation begins than winter substorms, or that the auroral region activity is more "spiky" during the winter than during the summer (or both). The spikiness of the substorms will be examined in detail. Furthermore, we found a large summer-winter asymmetry in substorm number, such that dramatically more substorms were observed during the winter than during the summer months. In addition, we will examine the inter-annual and solar cycle variation of summer-winter asymmetry in substorm peak amplitude and substorm number, and will speculate what could be the reason for the asymmetry by examining the effect of internal and external drivers.