Geophysical Research Abstracts
Vol. 15, EGU2013-8734, 2013
EGU General Assembly 2013

A morphological description and statistical classification of dayside diffuse aurora observed at Yellow River Station in Ny-Ålesund, Svalbard

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Ground optical observations are best suited to identify morphological characteristics of the dayside diffuse aurora that usually brightens at the equatorward of the auroral oval. Using 7-winter optical auroral observations, we recognized that the dayside diffuse aurora has a variety of temporal and spatial size scales and forms. Mostly dayside diffuse auroral forms have drawn together in a general classification based on their morphological characteristics and occurrence time. Four primary categories of dayside diffuse aurora are classified: (1) Veiling Diffuse Aurora (VDA), which has no obvious morphological structure and clear boundaries, sometimes like a thick cloud covering the entire sky; (2) Patchy Diffuse Aurora (PDA), which usually occurred accompany by pulsating aurora, mostly in spatial scale of 10-100 km diameter width but occasionally to hundreds kilometer; (3) Diffuse Aurora Arc (DAA), which was obviously different from discrete auroral arcs in morphology; (4) Pulsating Aurora (PA), occurred with sparkling forms. The luminosity of PA commonly showed periodic variation with the oscillating appearance.
The occurrence rate of each type shows a parabolic distribution with magnetic local time (MLT), and the occurrence peak is found to be mostly near the cusp region. The duration time of pulsating aurora on cusp region was markedly longer than that on nightside. Dayside diffuse aurora more commonly occurred under quiet geomagnetic condition as measured by the Kp index, which indicates almost 92.2% occurrence at the Kp $\leq$ 3. To investigate whether the interplanetary magnetic field (IMF) controls dayside diffuse aurora occurrence, we present a general bias comparison of IMF three components. Under the IMF condition of negative By accompanied with positive Bz, it could be expected that the dayside diffuse aurora would be easier to observe. We suggest that a negative IMF By associated field-aligned current (FAC) at the lower latitude region in the Northern Hemisphere is preferable for the occurrence of dayside diffuse aurora. Furthermore, the footprints of the FACs associated with northward IMF are located at the higher latitudes. This statistical study suggests that the ionosphere-magnetosphere coupling environment plays an important role in producing different diffuse aurora form.