THE ROLE OF REGION 2 FAC IN THE SUBSTORM CURRENT SYSTEM AT THE ONSET

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In this paper, a new substorm model which overcomes the difficulty of present current wedge model is developed from the analysis of numerical substorm obtained from the global MHD simulation. In the current wedge model, the region 1 field-aligned current (FAC) that causes the first brightening is the diverted cross-tail current due to the flow from the near earth neutral line (NENL). However, a well known difficulty for this model is the fact that a sudden brightening starts in the most equatorward preexisting arc without any perturbation in poleward arcs. In the present model, the onset is triggered by the abrupt formation of high-pressure region in the inner magnetosphere. This high-pressure region results from the magnetic tension released from the NENL, and intensifies the partial ring current. The tail disturbance is primary transmitted to the ionosphere by the region 2 FAC which is generated together with the partial ring current through the conversion of thermal energy to electromagnetic energy by convection crossing the high-pressure region. Since the ionospheric closure of region 2 FAC by midnight eastward current is equivalent to the dusk to dawn electric field that interrupt the convection, the closure of substorm region 2 FAC occurs by connecting with the newly developed nightside region 1 FAC, forming a grand loop. This connection with the region 1 FAC takes place through the nearest (most equatorward) arc. Associated nightside region 1 FAC does not connected to the traditional current wedge but to the cusp region.

region 2 FAC, substorm, arc

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