A Comparative Study of Substorms and Steady Magnetospheric Convection and their Associated Solar Wind Conditions

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An outstanding question in magnetospheric physics is what causes the onset of a magnetospheric substorm. This question has motivated researches for nearly four decades and is still an unsolved problem. While our knowledge has increased greatly we are still unable to decide where or how its explosive phase is initiated. It was found recently that another form of geomagnetic activity, SMC, (steady magnetospheric convection) plays an important role in the response of the magnetosphere to the solar wind. It is not clear how the magnetosphere evolves from one form of activity to another. Is the solar wind driver the controlling factor? Or, does the magnetosphere respond to the solar wind as the result of specific internal changes caused by prior activity? It is important to study how the magnetosphere responds to the solar wind during different types of geomagnetic activity. The answers to this question may provide us significant insights of substorm studies.

In the years 1978 -1988, we have established a fairly complete list of SMC events and a partial list of substorm onsets. We will expand the substorm onset list to cover the entire interval in order to make a complete comparative study. The solar wind condition such as VBz and integration of VBz and delta(B)/B, a measure of solar wind MHD turbulence, will be compared for different types of geomagnetic activities. Similarly, a comparison of the tail observations during SMC and substorms will be analyzed. These tail observations include the geosynchronous magnetic field, tail lobe magnetic field and tail flaring angle. Furthermore we will examine the relative timing between SMC and substorms. This relative timing can help us to determine whether substorms are necessary to initiate or terminate the SMC, or whether SMC can occur spontaneously without regard to substorm occurrence