

MONTHLY-SCALE VARIATION OF THE DST INDEX AND ITS RELATIONSHIP WITH SOLAR-WIND CONDITIONS

Shinya Nakano, TOMOYUKI HIGUCHI

The Institute of Statistical Mathematics, Tokyo, Japan

Characteristics of hourly- or daily-scale short-term variations of the Dst index are well known. Burton et al. (1975) have proposed an empirical model of the temporal evolution of the Dst index which uses some solar-wind parameters as inputs. Their model successfully represents short-term variations of the Dst index. This fact means that most of short-term Dst variations can be sufficiently explained by some mechanisms taken into account in their model. However, this empirical model does not well reproduce the long-term variations such as monthly-scale variation. This suggests that the long-term variation would be controlled by mechanisms which were not taken into account.

In order to resolve what mechanism causes the monthly-scale long-term variation, we separate the long-term variation from the short-term variation using state space modeling and the so-called particle filter algorithm. We then compared the estimated monthly-scale variation with various solar parameters, such as solar-wind density, solar radiation, and sunspot number. It was found that the long-term variation of the Dst index is negatively correlated with the solar-wind dynamic pressure. (Note that the short-term Dst variation is positively correlated with the solar-wind dynamic pressure.) One possible reason of this negative correlation is as follows. If high solar-wind density and high solar-wind velocity are maintained for a long time, the density of the plasmasheet would be enhanced, which could cause the intense ring current and tail current. This effect might depress the Dst index during the high solar-wind dynamic pressure conditions.

Dst index, long-term variation, solar-wind dynamic pressure

Shin'ya Nakano, The Institute of Statistical Mathematics,
4-6-9 Minami-Azabu, Minato, Tokyo 106-8569, Japan, tel: +81-3-3446-1501,
e-mail: shiny@ism.ac.jp