Investigation of Surface Magnetic Flux Transport by use of Hinode/SOT and SDO/HMI

Iida, Yusuke (1), iida@solar.isas.jaxa.jp; Hideyuki Hotta (2,3).
(1) Institute of Space and Astronautical Science (ISAS) / Japan Aerospace Exploration Agency (JAXA)
(2) Japan Society for the Promotion of Science (JSPS)
(3) High Altitude Observatory, National Center for Atmospheric Research, Boulder, CO, USA

Magento-convection on the solar surface is thought to play an important role in structuring large-scale magnetic field. One important issue is how magnetic flux is transported there. The transport is treated as a classical diffusion process for long time but the recent observational papers report the different characters from the diffusion. One of the critical properties to understand such large-scale description is square displacement of each patches. In the diffusion case, it is necessarily proportional to the elapsed time. But from the recent studies, the dependence obtained from the observation shows more steep dependence, i.e. super-diffusion scaling.

One problem to extend it to a larger-scale, i.e., global Sun, is the limitation of the observational period. So in this study we extend this kind of the investigations to a larger scale by use of satellite data, Hinode/SOT and SDO/HMI, and auto-tracking technique. It is critical to use longer observational data to see large-scale treatment. We want to note that this kind of study becomes possible because of the accumulation of the satellite data and development of auto-tracking technique which enables us to treat huge amount of the events. As a result of the analysis, we obtain super-diffusion scaling in the range smaller than network field and sub-diffusion scaling in the range larger than it. It can be interpreted as a result from network flow structures. In the presentation, we discuss the effect of these characters to the global-scale flux transport and also show some results from 3D MHD simulation.