太陽地球システムのデータ駆動連結階層モデリング：太陽活動領域の３次元磁場構造再現

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Data-driven Interlocked Modeling of the Sun-Earth System:Reconstruction of 3D Magnetic Structure in Solar Active Regions

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The coronal magnetic field plays a very important role of solar active phenomena, such as solar flares and coronal mass ejections (CMEs). Especially, before flares, the space satellites often observe the sheared magnetic field, which is called Sigmoid, on the neutral line. Because it is widely believed that the magnetic energy is stored into this sheared magnetic field, therefore we have to understand 3D energy stored magnetic configuration to understand the active phenomena in the solar corona. Unfortunately, magnetic field data, however, is from only solar surface. Therefore,to extrapolate using the only solar surface data is needed to obtain the 3D coronal magnetic field.

Recently we developed the magnetofrictional method as one of the extrapolation methods under the Non-Linear Force-Free(NLFF) approximation to reconstruct the 3D coronal magnetic field. In this paper, at first, we will introduce the way to extrapolate the 3D coronal magnetic field from only solar surface data and the results of accuracy and reliability of our solver.Second, we have applied the new solver to magnetogram data for the active region NOAA10930 observed by Hinode/SOT covering from pre-flare to post flare phases of X-class flare on Dec.13,2006. As a result, before flare, the strong sheared magnetic field on the neutral line can be reproduced by our NLFF extrapolation solver and we found the strong current region is also formed on the same region. We will report 3D magnetic configuration before and after flare and furthermore, the reliability of our NLFF model comparing X-ray observation.