M09a Comparison of Coronal Field Models Using a Flux Emergence Simulation as a Ground-truth Data Set

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Realistic reproduction of coronal magnetic field is critically important for the understanding of various coronal dynamics including flares and CMEs. To this end, an intensive workshop on the "data-driven" models, in which the evolving coronal field is computed by sequentially updating the photospheric boundary condition, was held as one of the Nagoya University ISEE/CICR workshops. Here we introduce our attepmt to compare different coronal field models using a flux emergence simulation as a ground-truth data set. The series of photospheric magnetic and velocity slices from Toriumi & Takasao (2017)'s simulation was provided to the team, and the magneto-friction data-driven model (Cheung & DeRosa 2012), the MHD data-driven model (Jiang et al., 2016), and the non-linear force-free field model (Inoue et al., 2014) were performed to reconstruct the magnetic field. As a result, we found that all three models did not successfully reproduce the dynamically-evolving (i.e. non-force-free) ground-truth field, although the topology was similar to each other. The three models consistently showed an expanded flux-rope structure in the atmosphere. This is mainly because these models do not assume the physics of the thin, dense layer from the photosphere and chromosphere to the transition region. Therefore, the Lorentz force exerted by the emerging flux was not counteracted by the pressure gradient and gravity, which allows the field to expand rapidly and the helicity to propagate into the corona.