Magnetohydrodynamic simulation of solar emerging flux and its reconnection with preexisting coronal field

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Magnetic reconnection and solar emerging flux play essential role in energy accumulation and trigger of solar flares and coronal mass ejections. Therefore understanding the basic physics of reconnection and emerging flux is the basis of space weather studies. We present the results of three-dimensional magnetohydrodynamic simulations of solar emerging flux and its interaction with pre-existing coronal field using the Earth Simulator.The emergence of horizontal magnetic sheet in the upper convection zone and its interaction with overlying coronal field are investigated. It is found that: (1) Dense filaments similar to H alpha arch filaments are formed in the emerging flux by the Rayleigh-Taylor type instability. (2) Filamentary current sheets are created in the emerging flux due to the nonlinear development of Rayleigh-Taylor instability, which may serve for the intermittent, nonuiform heating of the corona. (3) Magnetic reconnection between the emerging flux and preexisting coronal field occurs in a spatially intermittent way. Similar structure formation and patchy reconnection are likely to occur in various situations such as magnetopause and magnetotail.