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On the possibility of assessing processes in planetary dynamos based on the recunstruction of current density distribution using a combined machine learning - genetic algorithm inversion approach

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The ongoing investigation of the spatially and temporally varying planetary magnetic fields is addressed with numerous different methods. In case of the Earth there has been a significant increase in available information since the advent of satellites, especially that of the SWARM constellation. Methods for the estimation of internal parameters concerning the magneto-hydrodynamic (MHD) system inside the liquid core of the Earth include that of data assimilation; horizontal core-flow inversions; analytical models; and simple inverted source models using stationary sources of the field. The main goal of this presentation is to demonstrate the possibilities of using an inversion algorithm of the latter type in resolving local structures inside the Earth's deep interior, which could possibly act as the real sources of the Main Magnetic Field (MMF). The method assumes geometrically organized stationary electric current curves to be responsible for the MMF. The results suggest that reasoned application of stationary source inversions on MMF models could provide a useful completion to the existing and rapidly evolving inverse geodynamo models as resolving the small scale dynamics inside the core directly by using computationally expensive simulations presently seems a distant option.