Recent progresses and applications of geomagnetic data assimilation

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Over the past ten years, numerical simulations of Earth's core magnetohydrodynamics have advanced to a point where their output can be compared in detail to the geomagnetic field behaviour over time scales ranging from a few years to centuries. Motivated by this progress, geomagnetic data assimilation is an emerging discipline that aims at optimally combining the statistical output of such simulations with geomagnetic data. Among the many possible outcomes of this approach, the main goals are to infer the hidden dynamical properties of Earth's core from the surface observations, forecast the future evolution of the geomagnetic field in a dynamically consistent way and at horizons of a few years to a century, and improve the quality of source separation in analyses of the geomagnetic field. We will present a few examples to emphasize the value added by statistics extracted from Earth-like geodynamo simulations when attempting to tackle these underdetermined geophysical inverse problems. We will also put these works in context of forthcoming contributions to the 13th iteration of the International Reference Geomagnetic Field (IGRF 2020).

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