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Time-variation of Jupiter's internal magnetic field consistent with zonal wind advection

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Jupiter's magnetic field is the strongest planetary magnetic field in the Solar System, but fundamental characteristics of the field remain unknown. While the present-day spatial structure of Jupiter's field was recently revealed with much higher resolution than previously available (Connerney et al., 2018), its time-dependency (secular variation) is still poorly resolved (Ridley & Holme, 2016; Yu et al., 2010). For the Earth's magnetic field, many important dynamo processes are primarily evident through the secular variation, such as decay of the main dipole field, westward drift, and even polarity reversals. Detection of secular variation at Jupiter is likewise critical for understanding its dynamo.

Here we use the new Juno reference field model (JRM09; Connerney et al., 2018) together with magnetic field from the Pioneer 10 (1973), Pioneer 11 (1974), Voyager 1 (1979), and Ulysses (1992) flybys of Jupiter to investigate the secular variation of Jupiter's magnetic field. We account for confounding signals such as fields arising from magnetodisk currents, and possible ambiguity in Jupiter's System III rotation period. We interpret the resulting secular variation signal in terms of advection of Jupiter's magnetic field by deep zonal winds.