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Paleomagnetic reconstruction of the global geomagnetic field evolution during the Matuyama/Brunhes transition

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A Bayesian inversion method is presented to reconstruct the spherical harmonic expansion of the transitional geomagnetic field during the Matuyama/Brunhes reversal from paleomagnetic data. This is achieved by minimizing the total variational power at the core-mantle boundary during the transition under paleomagnetic constraints. The suitability of the proposed inversion technique is successfully tested by inverting four simulated paleomagnetic time series calculated from a geodynamo model. Four geographically distributed high quality paleomagnetic records of the Matuyama/Brunhes reversal are combined into a single geometric reversal scenario without assuming an *a priori* common age model. The obtained spatio-temporal reversal scenario successfully predicts most independent Matuyama/Brunhes transitional records. Therefore, the obtained global reconstruction based on paleomagnetic data invites to compare the inferred transitional field structure with results from numerical geodynamo models regarding the morphology of the transitional field. It is found that radial magnetic flux patches form at the equator and move polewards during the transition. Our model indicates an increase of non-dipolar energy prior to the last reversal and a non-dipolar dominance during the transition. Thus, the character and information of surface geomagnetic field records is strongly site dependent. The reconstruction also offers new answers to the question of existence of preferred longitudinal bands during the transition and to the problem of reversal duration. Different types of directional variations of the surface geomagnetic field, continuous or abrupt, are found during the transition. Two preferred longitudinal bands along the Americas and East Asia are not predicted for uniformly distributed sampling locations on the globe. Similar to geodynamo models with CMB heatflux derived from present day lower mantle heterogeneities, a pref-

erence of transitional VGPs for the Pacific hemisphere is found. The paleomagnetic duration of reversals shows not only a latitudinal, but also a longitudinal variation. Even the paleomagnetically determined age of the reversal varies significantly between different sites on the globe.