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Magnetic energy fluctuations on the core-mantle boundary

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Considering the magnetic field energy and its temporal changes on the core-mantle boundary (CMB) has multivalent relevance: They can reflect and evaluate dynamical processes which are modelled on the basis of surface field data. On the other hand, these quantities form a significant link to features of the deeper field generation by a dynamo process.

Our investigation is focused on the temporal changes of geomagnetic field energy on the CMB and their connection with sudden trend changes of the geomagnetic secular variation on the CMB (jerks). We show examples of the different components (radial and tangential) at different epoches. Further, we investigate the differently influenced degree parts. A measure for the total activity is introduced and compared for the whole CMB.

As data we use the geomagnetic field model $\mathrm{C^3FM2}$ (Wardinski and Lesur, GFZ Potsdam, 2009) covering the years 1957-2006, which enables secular variation investigations with monthly values. Assuming a low, radially dependent mantle conductivity with a conductance of about $10^7\mathrm{S}$, we determine the geomagnetic field and the secular variation components on the CMB by the method of non-harmonic downward continuation. With these field quantities the geomagnetic energy and its time derivative on the CMB can be calculated. For the jerk detection, we use a simple straight-line approximation algorithm applied to each (ϑ, φ) position of a global 1 degree by 1 degree grid.