

A Source Model for the Geomagnetic Field

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A new model has been developed for the geomagnetic field observed over the past few million years. It consists of an axial dipole which is allowed to vary about a mean value, and a number of off centered vertical dipoles whose strength is chosen from a zero-mean Gaussian distribution with a certain standard deviation. The depth of the off centered dipoles is chosen so as to duplicate the slope of the Lowes-Mauersberger function which is a property of the Earth's magnetic field that does not vary significantly over the past 300 years, in contrast to other properties that vary considerably. The off centered dipoles are randomly located longitudinally, but are concentrated towards the poles, using a Fisher distribution, so as to give the correct distribution of Virtual Geomagnetic Pole scatter as a function of observation latitude. This requires the off centered dipoles to be statistically concentrated so that their polar concentration is ten times as large as their equatorial distribution. The number of dipoles and their variance is chosen so as to give the best fit to the latitudinal distribution of VGPs from Icelandic paleomagnetic data. No low latitude cutoff was employed. The variance of the central dipole was also allowed to vary but the best results were obtained when the variation was small. The model was checked using (a) latitudinal and longitudinal variation of magnetization of Icelandic lava flows, and (b) paleofield intensity measurements made on Icelandic lava flows using Thellier-Thellier or similar methods. The fits are very good. Since the central dipole does not vary in intensity very much, the off centered dipoles can partially cancel the central dipole's contribution to the first degree Gauss coefficients if they align statistically in the opposite direction to the central dipole.

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