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Constraints and inversed geomagnetic models

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The solving method of an inverse problem using a priori information of the model is necessary to reproduce of the past geomagnetic field derived from paleomagnetic/archeomagnetic data or observation data. There are some kinds of constraints, a priori informations, on the models used in such a procedure. Many of those are from that a physical condition at the core-mantle boundary or below requires field morphology as smooth as possible (e.g. Gubbins and Bloxham, 1985). The stronger condition we use, the smaller non-dipole components in the solution we obtain.

On the basis of the original philosophy of the stochastic inversion, the constraint of the model as a priori information has some meanings. One is that the constraint what we want the field to be restricts the solution such as the smoother field. Otherwise, there is a concept that the constraint shows the likelihood distribution functions of the model parameters.

In the case of the latter concept, the model likelihood is assumed to be distributed around a most likely mean and with a dispersion shown by a variance and higher order moments. This concept seems to be well matched with the use in solving the models of temporally fluctuated fields in which the time-averaged field (TAF) is the mean and the paleosecular variation (PSV) of the field shows the variance. Actually almost all recent PSV models have much moderate dependency of the degrees (L) than the constraints used in the stochastic inverse problems (e.g. Constable and Parker, 1988). Therefore it is natural that the higher-degree components in the solution are larger. That's it because the tempral field (snapshot) is much far from the smooth feature than the averaged field (Hatakeyama and Kono, 2002). In this presentation we show the comparison of some constraints and their resulting solutions.