



Robust estimators of palaeosecular variation

Neil Suttie, Andy Biggin, and Richard Holme

Geomagnetism Lab., School of Environmental Sciences, University of Liverpool. L69 7ZE, UK

Studies of palaeosecular variation (PSV) were originally interpreted as supporting the hypothesis that long-term changes in the behaviour of the geodynamo could be seen on timescales consistent with mantle convection. Later, it became clear that estimates of the magnitude of PSV could be highly variable within a geological period, but it remained uncertain as to how much of this apparent variation is due to data treatment. We present a new statistical treatment of palaeomagnetic data which describes the observed distribution of directions as a spherical exponential distribution. This distribution allows the evaluation of robust estimates of both central direction and dispersion of groups of unit vectors. The distribution is parameterised by the mean angle between the central direction and the individual vectors, so this quantity is adopted as a robust estimate of PSV. When applied to direction from Cenozoic lavas, we find the directions to be well-fit by a spherical exponential distribution in the majority of cases. This provides a statistical feature to seek in the investigation of field models and numerical dynamos and allows us to re-evaluate the evidence for mantle control of the geodynamo as recorded by palaeosecular variation.