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Paleomagnetic field strength over the last million years

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Absolute paleomagnetic intensity data derived from thermally magnetized lavas and archeological objects provide information about past geomagnetic field behavior, but the average field strength, its variability, and the expected statistical distribution of these observations remain uncertain despite growing data sets. We present statistical characterizations of the 0–1 Ma field strength, in terms of virtual axial dipole moment (VADM), using data from the PINT, MagIC, and Geomagia50 databases. Uneven temporal sampling and large age uncertainties in the available data produce biased estimates for the mean field and its statistical distribution. We describe and apply bootstrap resampling techniques to correct for these effects. The influence of material type is assessed using independent data compilations to compare Holocene data from lava flows, Submarine Basaltic Glass (SBG), and archeological objects. The comparison to SBG is inconclusive because of dating issues, but paleointensity estimates from lavas are on average about 10% higher than for archeological materials and show greater dispersion. A further interesting basis for comparison is provided by PADM2M, a continuous model of temporal variations in axial dipole moment principally derived from relative paleointensity time series, but calibrated by incorporating absolute measurements. On average, absolute VADMs are higher than the axial dipole moment estimated in PADM2M, with greater spread in the VADM distribution. Both VADM and PADM2M distribution estimates from lavas show more structure than might be expected: neither has a smooth, unimodal distribution despite the large numbers of data used in the estimation. Simulations from a stochastic model based on the geomagnetic field spectrum demonstrate that long period intensity variations can have a strong impact on the observed distributions and could plausibly explain apparent bimodality.