Comparison of direct and indirect geomagnetic records

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Abstract: Two data types are available to reconstruct the temporal variations of the Earth's past magnetic field. Historical direct measurements of geomagnetic field components provide information about the field evolution back to the late Middle Age. Before the 19th century the direct data mainly consist of declination determinations due to application in navigation and orientation. Indirect records derived from archeo- and paleomagnetic measurements are therefore indispensable in the retrieval of inclination and intensity values for the period of historical observations and allow the expansion of the data collection much further back into the past. These indirect records are believed to be less reliable than their direct counterparts. Field intensity is the most difficult information to extract and biasing mechanisms related to materials and experimental procedures can cause significantly deviating field readings and consequently misinterpretations of the geomagnetic field evolution.
We have integrated collections of direct (e.g. Jonkers et al., 2003) and indirect (e.g. Korhonen, 2008) data with corresponding metadata in a single database, which enables the evaluation of reliability and uncertainty ranges of the available data using statistical approaches. A comparison of field components of direct and indirect records from the same time periods and close-by locations is being performed. This approach allows us to decipher the quality of the underlying datasets and it is possible to identify deviating records based on their metadata. In this way, the accuracy of direct records showing large scatters (e.g. sundials) can also be scrutinized. The obtained information is invaluable in establishing validity and weighting criteria for modelling approaches of the geomagnetic field evolution.

Keywords: Historical records, paleo- and archeomagnetics, data analysis

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