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Correcting relative paleointensity records for compositional variation by automated discrete-sample sediment measurements on multiple cores

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Based on automated box-sample measurements using an individually modified cryogenic magnetometer at the University of Bremen, we identify and quantify sedimentary influences upon the relative paleointensity (RPI) records of eight sediment series from the subtropical and subantarctic South Atlantic. The cores were recovered in a constraint area crossing the subtropical front. Due to this oceanographic boundary, they have widely different sediment lithologies, which can be divided into three lithologic groups. Yet, their mutual proximity ensures that they have experienced approximately the same magnetic field history, and differences in their RPI signals must be caused by their varying sediment composition and recording properties. A large set of high-resolution rock-magnetic data on these cores has been obtained by a modified 2G Enterprises cryogenic rock magnetometer (755 R) with a pneumatic handler for discrete samples and additional DC coils to compensate for remaining fields inside the magnetometer. The system is controlled by an individually designed monitoring and processing software, with real-time display of all data and system parameters. Using script files, it is possible to perform fully automated series of arbitrary measurements. Together with further compositional data from susceptibility and X-ray scanners it is possible to quantitatively test and compare the influences of different sediment properties upon the RPI records. This comparison is based on a linear extension of the common RPI determination method. It is found that magnetic grain size, as measured by the magnetic parameter ARM/IRM, is most influential among the parameters tested. Weak to moderate reductive diagenesis, as measured by the parameter Fe/κ, turns out to be the second most important factor. The results provide a quantitative argument induced remanent magnetization (IRM) is a more robust normalizer than anhysteretic remanent magnetization ARM. Using the extended linear RPI theory, we calculate a composition-corrected RPI stack for the investigated cores. This correction improves the correlation with respect to independent global paleointensity stacks in comparison to an uncorrected RPI stack. The ratio between corrected and uncorrected RPI stacks reveals a hidden global climate signal, which indicates that climatic variations in sediment composition may be hard to detect in marine sediment sequences.