Geophysical Research Abstracts
Vol. 18, EGU2016-6054, 2016
EGU General Assembly 2016

Automated curve matching techniques for reproducible, high-resolution palaeomagnetic dating

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High-resolution relative palaeointensity (RPI) and palaeosecular variation (PSV) data are increasingly important for accurate dating of sedimentary sequences, often in combination with oxygen isotope (δ^{18}O) measurements. A chronology is established by matching a measured downcore signal to a dated reference curve, but there is no standard methodology for performing this correlation. Traditionally, matching is done by eye, but this becomes difficult when two parameters (e.g. RPI and δ^{18}O) are being matched simultaneously, and cannot be done entirely objectively or repeatably. More recently, various automated techniques have appeared for matching one or more signals. We present Scoter, a user-friendly program for dating by signal matching and for comparing different matching techniques.

Scoter is a cross-platform application implemented in Python, and consists of a general-purpose signal processing and correlation library linked to a graphical desktop front-end. RPI, PSV, and other records can be opened, pre-processed, and automatically matched with reference curves. A Scoter project can be exported as a self-contained bundle, encapsulating the input data, pre-processing steps, and correlation parameters, as well as the program itself. The analysis can be automatically replicated by anyone using only the resources in the bundle, ensuring full reproducibility. The current version of Scoter incorporates an experimental signal-matching algorithm based on simulated annealing, as well as an interface to the well-established Match program of Lisiecki and Lisiecki (2002), enabling results of the two approaches to be compared directly.