



Reproducible research in palaeomagnetism

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The reproducibility of research findings is attracting increasing attention across all scientific disciplines. In palaeomagnetism as elsewhere, computer-based analysis techniques are becoming more commonplace, complex, and diverse. Analyses can often be difficult to reproduce from scratch, both for the original researchers and for others seeking to build on the work. We present a palaeomagnetic plotting and analysis program designed to make reproducibility easier.

Part of the problem is the divide between interactive and scripted (batch) analysis programs. An interactive desktop program with a graphical interface is a powerful tool for exploring data and iteratively refining analyses, but usually cannot operate without human interaction. This makes it impossible to re-run an analysis automatically, or to integrate it into a larger automated scientific workflow – for example, a script to generate figures and tables for a paper. In some cases the parameters of the analysis process itself are not saved explicitly, making it hard to repeat or improve the analysis even with human interaction. Conversely, non-interactive batch tools can be controlled by pre-written scripts and configuration files, allowing an analysis to be ‘replayed’ automatically from the raw data. However, this advantage comes at the expense of exploratory capability: iteratively improving an analysis entails a time-consuming cycle of editing scripts, running them, and viewing the output. Batch tools also tend to require more computer expertise from their users.

PuffinPlot is a palaeomagnetic plotting and analysis program which aims to bridge this gap. First released in 2012, it offers both an interactive, user-friendly desktop interface and a batch scripting interface, both making use of the same core library of palaeomagnetic functions. We present new improvements to the program that help to integrate the interactive and batch approaches, allowing an analysis to be interactively explored and refined, then saved as a self-contained configuration which can be re-run without human interaction. PuffinPlot can thus be used as a component of a larger scientific workflow, integrated with workflow management tools such as Kepler, without compromising its capabilities as an exploratory tool. Since both PuffinPlot and the platform it runs on (Java) are Free/Open Source software, even the most fundamental components of an analysis can be verified and reproduced.