Towards unified and reproducible processing of geoelectrical data

Maximilian Weigand[1], Florian Wagner[1]

(1) *Department of Geophysics, Steinmann Institute, University of Bonn, Bonn, Germany*

keywords: Geoelectrical data processing, Reproducible research, Python

The multitude of geoelectric measurement devices and inversion codes in use is mirrored in a multitude of individually tailored data importing and processing routines. The majority of scientific advancements in data processing (e.g., filtering schemes, error estimation) is therefore not directly transferable between use cases, especially when measurement devices and inversion codes change. Reproducibility may be further impeded by the use of commercial software such as MATLAB and Microsoft Excel.

To accelerate and concentrate scientific advancement and ensure reproducibility of processing workflows, a unified framework for geoelectrical data processing is required. Based on the free and platform-compatible programming language Python, we present a working prototype of such a unified interface and demonstrate its functionality and ease of use by means of classical processing workflow of geoelectrical time-lapse data (i.e., import, filtering, error estimation, visualization, data export). Encompassing all functionality in a journaling system, which keeps track of all actions applied to the data sets, thereby making the processing testable and reproducible. The framework is designed to be as non-intrusive as possible, only to provide functionality without forcing the user to follow a specific processing workflow. A variety of importers and exporters is provided, so that the processing steps applied to the data set do not depend on the measurement device and the inversion code used thereafter.

We believe that the approach presented could foster exchange of best practices and new techniques among academic groups and practitioners, and that a common data import, processing, and export framework can ease the transition to fully reproducible research. We welcome any feedback that could help in establishing such a tool in the geoelectrical community.