VarPy: A python library for volcanology and rock physics data analysis

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The increasing prevalence of digital instrumentation in volcanology and rock physics is leading to a wealth of data, which in turn is increasing the need for computational analyses and models. Today, these are largely developed by each individual or researcher. The introduction of a shared library that can be used for this purpose has several benefits:

1. when an existing function in the library meets a need recognised by a researcher it is usually much less effort than developing ones own code;

2. once functions are established and multiply used they become better tested, more reliable and eventually trusted by the community;

3. use of the same functions by different researchers makes it easier to compare results and to compare the skill of rival analysis and modelling methods; and
4. in the longer term the cost of maintaining these functions is shared over a wide community and they therefore have greater duration.
Python is a high-level interpreted programming language, with capabilities for object-oriented programming. Often scientists choose this language to program their programs because of the increased productivity it provides.

Although, there are many software tools available for interactive data analysis and development, there are not libraries designed specifically for volcanology and rock physics data. Therefore, we propose a new Python open-source toolbox called "VarPy" to facilitate rapid application development for rock physicists and volcanologists, which allow users to define their own workflows to develop models, analyses and visualisations.

This proposal is triggered by our work on data assimilation in the NERC EFFORT (Earthquake and Failure Forecasting in Real Time) project, using data provided by the NERC CREEP 2 experimental project and volcanic experiments from INVG observatory Etna and IGN observatory Hierro as a test cases.

In EFFORT project we are developing a scientist gateway which offers services for collecting and sharing volcanology and rock physics data with the intent of stimulating sharing, collaboration and comparison of methods among the practitioners in the two fields. As such, it offers facilities for running analyses and models either under a researcher's control or periodically as part of an experiment and to compare the skills of predictive methods. The gateway therefore runs code on behalf of volcanology and rock physics researchers. Varpy library is intended to make it much easier for those researchers to set up the code they need to run. The library also makes it easier to arrange that code is in a form suitable for running in the EFFORT computational services. Care has been taken to ensure that the library can also be used outside of EFFORT systems, e.g., on a researcher's own laptop, providing two variants of the library: the gateway version and developer's version, with many of the functions completely identical.

The library must fulfill two purposes simultaneously:
• by providing a full repertoire of commonly required actions it must make it easy for volcanologist and rock physicists to write the python scripts they need to accomplish their work, and
• by wrapping operations it must enable the EFFORT gateway to maintain the integrity of its data.

Notice that proposal of VarPy library does not attempt to replace the functions provided by other libraries, such as NumpY and ScipY. VarPy is complementary to them.