Failure forecasting in real-time: a forecasting model testing centre for capturing and sharing data and models

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Laboratory rock deformation experiments are a key tool for developing and testing eruption forecasting models. Worldwide there are a large number of rock deformation laboratories, each of which runs many experiments. Similarly there are a large number of theoreticians who develop constitutive and computational models for rock deformation. Here we consider how to open opportunities for sharing experimental data in a way that is integrated with multiple hypothesis testing. We present a prototype for a new forecasting model testing centre based on e-infrastructures for capturing and sharing data and models to expedite research. Here we outline our work on data assimilation in the EFFORT (Exploring Failure Forecasting in Real Time) project. EFFORT is a multidisciplinary collaboration which aims to determine the predictability of brittle failure of rock samples in laboratory experiments. The proposed forecasting model testing centre acts a hub for archiving, analysing and monitoring experimental data and models. It also provides facilities to share data and models. The testing centre uses a repository to store all of the data and models and a catalogue to store all of the corresponding metadata. Data transfer is achieved using the FAST (Flexible Automated Streaming Transfer) tool to upload periodically data from laboratories to the repository. Metadata are automatically created and stored in the catalogue, and data sharing is encouraged. Data is accessed through the Web. Users can create synthetic data, or select archive or real-time data and models via their metadata. User-defined models can be uploaded and stored with associated metadata, providing an opportunity to share models. Metadata describing each model are automatically created. Selected data and models are submitted to a High Performance Computational resource while hiding technical details. Results are displayed and stored allowing retrieval, inspection and aggregation. Benefits of the expected forecasting model testing are improved understanding of brittle failure prediction and its scalability to natural phenomena, accelerated and extensive testing and rapid sharing of insights, increased impact and visibility of research, and resources for education and training. We plan to extend the forecasting model centre to include volcanic data from different observatories. In the current prototype, we have made the first steps in that direction by integrating data from an Icelandic Observatory.