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Operationalization of Prediction, Hindcast, and Evaluation Systems using the Freie Univ Evaluation System Framework (Freva) incl. a Showcase in Decadal Climate Prediction

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Operationalization processes are important for Weather and Climate Services. Complex data and work flows need to be combined fast to fulfill the needs of service centers. Standards in data and software formats help in automatic solutions. In this study we show a software solution in between hindcasts, forecasts, and validation to be operationalized. Freva (see below) structures data and evaluation procedures and can easily be monitored. Especially in the development process of operationalized services, Freva supports scientists and project partners. The showcase of the decadal climate prediction project MiKlip (fona-miklip.de) shows such a complex development process. Different predictions, scientists input, tasks, and time evolving adjustments need to be combined to host precise climate informations in a web environment without losing track of its evolution.

The Freie Univ Evaluation System Framework (Freva - freva.met.fu-berlin.de) is a software infrastructure for standardized data and tool solutions in Earth system science. Freva runs on high performance computers to handle customizable evaluation systems of research projects, institutes or universities. It combines different software technologies into one common hybrid infrastructure, including all features present in the shell and web environment. The database interface satisfies the international standards provided by the Earth System Grid Federation (ESGF). Freva indexes different data projects into one common search environment by storing the meta data information of the self-describing model, reanalysis and observational data sets in a database. This implemented meta data
system with its advanced but easy-to-handle search tool supports users, developers and their plugins to retrieve the required information. A generic application programming interface (API) allows scientific developers to connect their analysis tools with the evaluation system independently of the programming language used. Users of the evaluation techniques benefit from the common interface of the evaluation system without any need to understand the different scripting languages. Facilitation of the provision and usage of tools and climate data automatically increases the number of scientists working with the data sets and identifying discrepancies. The integrated webshell (shellinabox) adds a degree of freedom in the choice of the working environment and can be used as a gateto the research projects HPC. Plugins are able to integrate their e.g. post-processed results into the database ofthe user. This allows e.g. post-processing plugins to feed statistical analysis plugins, which fosters an active exchange between plugin developers of a research project. Additionally, the history and configuration sub-system stores every analysis performed with the evaluation system in a database. Configurations and results of the tools can be shared among scientists via shell or web system. Therefore, plugged-in tools benefit from transparency and reproducibility. Furthermore, if configurations match while starting an evaluation plugin, the system suggests to use results already produced by other users – saving CPU/h, I/O, disk space and time. The efficient interaction between different technologies improves the Earth system modeling science framed by Freva.