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PAF: A Cloud Based Framework for Site Monitoring

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Water resource management, agriculture and contaminated site remediation all require a timely understanding of subsurface processes to support operational efforts. This understanding requires the autonomous application of multi scale, multi domain models which are parameterized by heterogeneous multi scale data (geophysical, geochemical, hydrological and remote sensing) and the distillation of data and model outcomes into actionable information.

Under DOE SBIR award DE-SC0009732 Subsurface Insights in collaboration with LBNL scientists has developed the modular cloud based software framework PAF (Predictive Assimilation Framework) for providing this actionable information. PAF was designed from the ground up to provide a vertically integrated platform for all tasks ranging from heterogeneous data ingestion, qa/qc, data processing, parameter estimation, modeling, result sharing and information generation.

To achieve this PAF extensively leverages open source codes and capabilities for data ingestion, processing and modeling, including Landlab and PFLOTRAN (modeling), E4D (electrical geophysical data processing), ODM2 (Data storage), R (statistics), QGIS (data visualization and processing) and TikiWiki (knowledgebase).

Data is stored in a variety of ways including standard relational database (Mysql/PostGIS) and NoSQL solutions such as HDF5 data for storage of model results and Distributed Temperature Data. PAF uses configurable python workflows for back end tasks (such as data ingestion/harvesting and processing) which allows for rapid extension of capabilities as well as the use of the built in capabilities provided by Python for data processing and image manipulation. Within PAF, data and capabilities are exposed through APIs (either native to the open source component or developed in house) allowing for easy integration between components. PAF uses Zend Framework 2, a PHP 7 web application framework in the backend. Users interact with PAF through standard browsers and IOS and Android Apps. PAF is being developed and validated with data from different sites including the LBNL East River site. Specifically, we are currently extending PAF to include coupled surface/subsurface processes occurring between the bedrock and the soil/atmosphere interface. PAF: a cloud based framework for site monitoring