Petrophysical uncertainty in electrical geophysics

Michael Tso and Andrew Binley

**Description:**

Here we deposit the data used to generate the article “On the field estimation of moisture content using electrical geophysics--the impact of petrophysical model uncertainty” that is published in the American Geophysical Union journal Water Resources Research in 2019 (DOI: [10.1029/2019WR024964](https://dx.doi.org/10.1029/2019WR024964)). The dataset includes two main parts: (1) laboratory measurements for Sherwood Sandstone cores collected in North Yorkshire, and (2) input files and accompanying scripts for flow modelling and geoelectrical modelling and inversion. All figure files for the article are also included.

**Content:**

* Figure files for the article (*img*):
	+ They can be readily edited using vector drawing software
* Saturation vs. conductivity fits in the lab for Eggborough cores (*Sherwood sandstone*)
	+ You can plot it using software of your choice or use the script MATLAB/particle\_size.m
* Grain size and mercury intrusion data for Eggborough and Hatfield cores (*Eggborough\_dc\_fits\_CI.xlsx*)
	+ You can plot it using software of your choice or use the script MATLAB/hatfield2.m
* PFLOTORAN-E4D\* input files for water injection simulation (*water injection simulation*):
	+ Please install PFLOTRAN and E4D on a Linux machine first
	+ Run E4D in mode 1 first to generate mesh
	+ Then run PFLOTRAN-E4D
	+ Interpolate hydrological variables to E4D mesh when necessary
	+ Visualize results (e.g. extract zones) using software such as Paraview or VisIt
* R3t input files for inversion (*ERT inversion*)
	+ R3t version 3.0 (Andrew Binley) is used. A copy of the .exe file is in the folder *codes*
	+ Example input files (*baseline*)
	+ Example MATLAB script to run R3t Monte Carlo simulations (*MC*) on Linux Terminal
		- Need to set up appropriate subfolders and reference paths to E4D output
* MATLAB scripts for uncertainty propagation (*MATLAB*)
	+ Extracted cell-centered fluid conductivity values from the E4D mesh (*fcond\_map.txt*)
	+ Values of the core fit results (*fit\_result.mat*)
	+ Matrix containing results from the 100 Monte Carlo ERT inversion runs (*Hatfield\_water\_MC100.mat*)
	+ MATLAB script for processing and plotting petrophysical uncertainty propagation results (*Swc\_extract.m*)
	+ MATLAB function for petrophysical uncertainty propagation (*Swc\_prop.m*)

Note: .mat files can be opened by MATLAB® or free software such as Octave or appropriate Python packages.