EGU21-5169
https://doi.org/10.5194/egusphere-egu21-5169
EGU General Assembly 2021

EMI characterization in mountain catchments: multi-frequency versus multi-coil inversion using EMagPy

Guillaume Blanchy[1], Paul McLachlan[1], Matteo Censini[2], Jacopo Boaga[3], Andrew Binley[1], and **Giorgio Cassiani**[3]

[1]Lancaster Environment Centre, Lancaster University, Lancaster, UK
[2]Università di Padova, TESAF, Padova, Italy
[3]Università di Padova, Dipartimento di Geoscienze, Padova, Italy (giorgio.cassiani@unipd.it)

Advanced modeling of hydrological processes in mountain catchments requires accurate characterization of the shallow subsurface, and in particular the depth to the soil/bedrock interface. Frequency domain electromagnetic induction (EMI) methods are well suited to this challenge as they have short acquisition times and do not require direct coupling with the ground; consequently they can be highly productive. Moreover, although traditionally used for revealing lateral electrical conductivity changes, EMI inversion is increasingly used to quantitatively resolve both lateral and vertical changes. These quantitative models can then be used to inform several properties relevant for hydrological modelling (e.g. water content, permeability).

In this work the open-source software EMagPy is used to compare between EMI data collected with a multi-coil device (i.e. a single frequency device with multiple receiver coils) and a multi-frequency device (i.e. a single inter-coil distance and multiple frequencies). The latter instrument is easier to handle because of its shorter length and lower weight, and thus it is potentially more suitable for the rugged topography of mountain slopes. However it is important to compare the value of information (e.g. sensitivity patterns and data quality) obtained from both instruments.

To begin with, the performance of both devices is assessed using synthetic modeling. Following from this the analysis is focused on two mountainous catchments: one located in the Alpine region above 2000 m a.s.l., the other in a Mediterranean catchment in Southern Italy. Both sites have differing geological and hydrological conditions and provide a useful comparison to determine the suitability of multi-frequency and multi-coil devices, and highlight necessary considerations of EMI acquisition.