

Dear colleagues,

We are seeking your support in compiling a dataset of globally distributed **soil thermal properties**, ideally combined with hydraulic properties, if available.

This dataset would serve to **support development and verification of models simulating thermal properties**, by both existing and novel approaches.

We are hopeful that there are data available in the community, including unpublished data, that you are willing to share with us. We welcome data obtained from **laboratory and in-situ methods**.

Those who provide data, and assist with the description/interpretation of these data, will be invited to **co-author a journal article describing the new database**.

What we would need from you is described in detail in the **thermal data Excel template sheet**, and consists broadly of:

*Required data*

- Meta data:  
Data describing the experimental location and its land use, nature of the data and procedures, as well as basic soil physical properties
- Thermal property data:  
Thermal conductivity (& thermal diffusivity, volumetric heat capacity, if available) vs. soil moisture (or relative saturation)

*Optional data*, but very much desirable if available for the same sample/site

- Hydraulic properties  
Water retention curve and hydraulic conductivity curves, or parts thereof (e.g. soil moisture point at field capacity or wilting point, or saturated hydraulic conductivity)
- Soil mineralogical information  
Mineralogical composition (types of minerals) of the sand, silt and clay fractions, or any non-size-resolved information on the mineralogy, if available

A list of already available data is in the spreadsheet (please check this first before starting your contribution sheet, as your published data may already be contained in the current version of the database).

The global database to be constructed will be subjected to a preliminary analysis in first instance, and the paper submitted to a data journal (e.g. Earth System Data Science).

With this database in place, we aim to test existing, and design/test improved equations of thermal soil properties (that can be used in land surface models, for

example, at field to global scales). Furthermore, we plan to link thermal theories with hydraulic theories to develop a unified underlying theory, which will yield both thermal and hydraulic parameters, in a more consistent fashion.

There are currently about 8500 thermal/hydraulic property data points with corresponding soil properties, soil moisture contents (and mineral information in some cases) in the database, a distribution map of the available data is attached.

However, there are distinct gaps with regards to geographical coverage, certain textural classes, organic soils, periodically frozen soils, biomes, land uses etc.

With this effort we hope to build a more complete picture of the global distribution of thermal properties, and how they are best predicted based on auxiliary soil and other data (e.g. land use and vegetation).

As already mentioned above, your support and contribution to this effort will be acknowledged via co-authorship for the planned data manuscript. We hope that you are able to contribute to this initiative, and welcome any questions you may have.

Anne Verhoef  
Yijian Zeng  
Hailong He  
Nan Wei  
Yongjiu Dai