Geophysical Research Abstracts
Vol. 20, EGU2018-15464-1, 2018
EGU General Assembly 2018

Thermal Soil Clustering - Mapping variations of thermal conductivity for high-voltage underground power lines

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Germany has set itself the ambitious objective that until 2050 at least 80% of the national power supply should be fed by renewable energies. Thus, a profound instauration of the country's power grid is obligatory and new power lines have to be constructed.

Due to decisive heat emission of the live wire exigent requirements concerning characteristics of the surrounding soil need to be modeled and documented. Heat transport mechanisms in soils are, among the influence of bulk density, mineral and organic constituents and their temperature, tightly coupled to their water content. This natural water content depends strongly i.a. on the characteristic water retention, which is a function of a location's soil type and climatic conditions.

This investigation has to be performed along potential corridors for the construction of new power lines. To serve this purpose, an extensive GIS database was elaborated, incorporating various climate and soil parameters from the affected federal states' agencies for an area of approximately 3100 km^2. In general, the systemically important parameters are extracted from soil maps and drilling protocols. For incorporating the federal system's mostly inhomogeneous data, manual synchronization of the data for the expanse of the proposed corridors is necessary. Within GIS all gathered basic digital data has to be incorporated in various processes for deriving formula inlet parameters like bulk density, water content, thermal conductivity or climate water budget.

Aim of the project is to generate relevant soil parameters such as thermal conductivity, susceptibility to compaction and diggability throughout the whole corridor area. Subsequently, the acquired data has to be modeled and mapped, which enables a proper soil assessment along the corridors.

As a result, well-founded derived information for assistance during the planning and construction phase concerning locally adequate constructional aspects ought to be provided. This includes soil conserving construction measures, required cable diameters, as well as trench shoring systems or need for imported backfill material. Based on the project's aim an extensive pedological transect, included and processed within a GIS architecture, is generated.