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Classifying the hydrology of European soils

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Flood forecasting and the prediction of diffuse pollution are environmental questions requiring information on the hydrologic response of soils, e.g. how much precipitation results in fast discharge. On a pan-European scale, information on the hydrology of soils is completely lacking. We aim to overcome this limitation by classifying European soils into conceptual classes of water flow regime.

In the UK, soils have been classified into 29 HOST (Hydrology of Soil Types) classes according to conceptual models of water flow in soil. The soil attributes used were depth to gleying and slowly permeable layers, peaty topsoil, depth to groundwater or an aquifer, parent material and integrated air capacity (soil drainable porosity within 1m depth). Development of the classification was calibrated using a database of river runoff measurements from approximately 600 catchments across the UK. The main runoff characteristics used were Base Flow Index (BFI) and Standard Percentage Runoff (SPR) and the final classification is well capable of predicting runoff parameters in ungauged catchments, explaining 79% of the measured variation of BFI and 59% of the measured variation in SPR.

In this project, we extend the HOST classification to the rest of Europe with the aid of the Soil Geographical Database of Europe (SGDBE) at 1:1 Mio scale. This database has been compiled and harmonised from national soil maps and is the most complete source of pan-European soil information. It consists of a polygon map of soil mapping units (SMU). Each SMU consists of one or more soil type units (STU) carrying information on soil types, texture classes, and parent material. Additional attributes for the STUs have been derived using pedotransfer rules.

Based on attributes present in the SGDBE, the flow models of the HOST classes were reconstructed. A major challenge lays in the less detailed information available in

the SGDBE than that used to develop HOST, in particular the lack of information on soil drainable porosity. The resulting map was compared with the original UK-HOST map. There was a good agreement between the two maps for the principal groups of permeability and peaty topsoil, with an average difference in percentage coverage of only 2.2%. Important discrepancies (average difference of 4.4%) were found for classes with different groundwater or aquifer level, principally because this information is largely missing in the SGDBE and needs to be interpreted using data on soil parent material. The reclassification of peat soils was also difficult because the UK-HOST classification uses more detailed attributes than the SGDBE provides.

In both maps, the BFI as the relevant soil response for runoff is calculated from the full information of all STUs in the SGDBE and of all HOST classes within a pixel in the UK-HOST map. Comparing the two maps for the UK will inform us about the uncertainty of the BFI prediction using the SGDBE information. In further steps, the predicted BFI should be validated and calibrated using river runoff data from outside the UK. The resulting hydrological map of Europe will provide environmental scientists and modellers with a powerful tool for runoff prediction.