A new approach to estimating Mean Flow in the UK

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Abstract. Traditionally, the estimation of Mean Flow (MF) in ungauged catchments has been approached using conceptual water balance models or empirical formulae relating climatic inputs to stream flow. In the UK, these types of models have difficulty in predicting MF in low rainfall areas because the conceptualisation of soil moisture behaviour and its relationship with evaporation rates used is rather simplistic. However, it is in these dry regions where the accurate estimation of flows is most critical to effective management of a scarce resource. A novel approach to estimating MF, specifically designed to improve estimation of runoff in dry catchments, has been developed using a regionalisation of the Penman drying curve theory. The dynamic water balance style Daily Soil Moisture Accounting (DSMA) model operates at a daily time step, using inputs of precipitation and potential evaporation and simulates the development of soil moisture deficits explicitly. The model has been calibrated using measured MFs from a large data set of catchments in the United Kingdom. The performance of the DSMA model is superior to existing established steady state and dynamic water-balance models over the entire data set considered and the largest improvement is observed in very low rainfall catchments. It is concluded that the performance of all models in high rainfall areas is likely to be limited by the spatial representation of rainfall.

Keywords: hydrological models, regionalisation, water resources, mean flow, runoff, water balance, Penman drying curve, soil moisture model

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