Geophysical Research Abstracts
Vol. 17, EGU2015-14409, 2015
EGU General Assembly 2015

Coupling Radar Rainfall to Hydrological Models for Water Abstraction Management

Alemayehu Asfaw (1,2), James Shucksmith (1), Andrea Smith (2), and Ken MacDonald (2)

(1) Department of Civil and Structural Engineering, Pennine Water Group, University of Sheffield, Sheffield, S1 3JD, UK (j.shucksmith@sheffield.ac.uk), (2) Severn Trent Water LTD., Severn Trent Centre, PO Box 5309, Coventry CV3 9FH, West Midlands, UK

The impacts of climate change and growing water use are likely to put considerable pressure on water resources and the environment. In the UK, a reform to surface water abstraction policy has recently been proposed which aims to increase the efficiency of using available water resources whilst minimising impacts on the aquatic environment. Key aspects to this reform include the consideration of dynamic rather than static abstraction licensing as well as introducing water trading concepts. Dynamic licensing will permit varying levels of abstraction dependent on environmental conditions (i.e. river flow and quality).

The practical implementation of an effective dynamic abstraction strategy requires suitable flow forecasting techniques to inform abstraction asset management. Potentially the predicted availability of water resources within a catchment can be coupled to predicted demand and current storage to inform a cost effective water resource management strategy which minimises environmental impacts.

The aim of this work is to use a historical analysis of UK case study catchment to compare potential water resource availability using modelled dynamic abstraction scenario informed by a flow forecasting model, against observed abstraction under a conventional abstraction regime. The work also demonstrates the impacts of modelling uncertainties on the accuracy of predicted water availability over range of forecast lead times.

The study utilised a conceptual rainfall-runoff model PDM - Probability-Distributed Model developed by Centre for Ecology & Hydrology - set up in the Dove River catchment (UK) using 1km2 resolution radar rainfall as inputs and 15 min resolution gauged flow data for calibration and validation. Data assimilation procedures are implemented to improve flow predictions using observed flow data. Uncertainties in the radar rainfall data used in the model are quantified using artificial statistical error model described by Gaussian distribution and propagated through the model to assess its influence on the forecasted flow uncertainty. Furthermore, the effects of uncertainties at different forecast lead times on potential abstraction strategies are assessed. The results show that over a 10 year period, an average of approximately 70 ML/d of potential water is missed in the study catchment under a convention abstraction regime. This indicates a considerable potential for the use of flow forecasting models to effectively implement advanced abstraction management and more efficiently utilize available water resources in the study catchment.