



Towards reducing uncertainty in rainfall–streamflow model parameter regionalisation (TRUMPER)

a PUB international community project organised by the Top-Down modelling Working Group (TDWG)

Introduction

For gauged basins the uncertainty in statistical relationships between rainfall–streamflow model parameters and physical catchment properties is typically large, with knock-on consequences for flows estimated from rainfall at ungauged (flow) sites using such relationships. One likely reason for the large uncertainty is that the rainfall–streamflow model parameters are often derived using data at a given time-step (e.g. daily), irrespective of whether or not that data time-step is small enough to capture the dynamics of the flow regime at each of the gauged sites. To date, this has received little attention in parameter regionalisation studies or by commentators on rainfall–streamflow modelling. This lack of attention would be acceptable if the effect of data time-step was always small. However, recent work¹ has shown that for the 10.6 km² Wye at Cefn Brwyn (one of the Plynlimon research basins in Wales) each of the five parameters of an IHACRES model changes by between 50% and 80% as different time-step data (daily to hourly) are employed for model calibration. The analysis also outlined a simple method for normalising IHACRES parameters for the Wye at Cefn Brwyn (i.e. giving parameters essentially independent of data time-step). Further work² includes similar analysis for a much larger (298 km²) basin, also in Wales.

Anticipating that statistical relationships between physical basin properties and normalised model parameters (rather than data-time-step-dependent parameters) will be better predictors of model parameters at ungauged sites, the TDWG has initiated TRUMPER. Analyses of datasets (at 1-hour, 2-hour, 4-hour, ... 24-hour time-steps) for many basins will be undertaken using IHACRES and other rainfall–streamflow models. Although the initial focus will be on the data time-step issue many related measurement and modelling issues will arise during this work, so other PUB WGs (e.g. WG2-MOPEX and WG7-uncertainties), the ERB Network³ and FRIEND researchers are warmly invited to participate in TRUMPER.

Within the overall PUB objective of reducing predictive uncertainty the initial objectives of TRUMPER are to

- investigate model parameter data-time-step-dependency, for ranges of catchment type (size, percentage yield, land-use, etc.) and model/modelling approach
- formulate and test different (including new) methods of model parameter normalisation, i.e. to obtain model parameters essentially independent of data time-step
- publish results in refereed journals and conference/workshop Proceedings
- identify related model parameter regionalisation issues and, working with the wider research community (other PUB WGs, FRIEND, ERB), investigate ways of reducing uncertainty in (a) rainfall–streamflow model parameter regionalisation and (b) estimates of flows at ungauged sites obtained by that method.

¹ Littlewood, I.G. (in press). Rainfall–streamflow models for ungauged basins: uncertainty due to modelling time-step. Proceedings Eleventh Biennial Conference of the EuroMediterranean Network of Experimental and Representative Basins (ERB2006), 13-17 October 2006, Luxembourg. UNESCO Technical Documents in Hydrology Series.

² Littlewood, I.G. and Croke, B.F.W. (submitted). Towards an instantaneous rainfall–streamflow model for ungauged catchments: parameter dependency on data time-step.

³ EuroMediterranean Network of Experimental and Representative Basins (ERB)

Resources

Time

Participation is voluntary and on a self-funded basis. TRUMPER is open-ended; it will be discussed at IUGG/IAHS July 2007 and progress will be reported at IAHS 2009, when it will be decided how to proceed with TRUMPER in later stages of PUB.

Data

To initiate the project, datasets that were prepared for the work already mentioned^{1,2} are available for downloading (via the TDWG website⁴) for others to apply their models/modelling approaches. The project will benefit greatly by participants making other datasets available in a similar way. For given periods of record each type of data (rainfall, streamflow, etc.) should comprise unbroken time series at a (small) common data time-step such that the reconstituted hydrograph is a good representation of high-flow dynamics (and therefore low flows). The data might be at an hourly (or smaller) time-step, in which case it would be helpful if corresponding 2-hourly, 4-hourly, ..., 24 hourly, ... datasets could also be made available. Datasets for some basins in Luxembourg are currently being prepared and will also be available via the TDWG website in due course.

Participation

There are few conditions of engagement. Research as outlined above can, of course be undertaken independently, with collation and comparison of results using common datasets being the aim of TRUMPER. Researchers are requested to register their interest in taking part and sharing datasets and results, giving an outline of what they might do (e.g. brief details of their catchments, data and models). Please include these details in an email to ianlittlewood505@btinternet.com or Laurent Pfister pfister@lippmann.lu.

A first stage of the project might be for researchers to apply their models/modelling approaches to exactly the same datasets analysed in the earlier work^{1,2}, for direct comparison. Wherever possible, it is hoped that those using the data will make available suitable data for other catchments for TRUMPER. It is appreciated that researchers are not always able to freely release to others the data they have used, and that often they may wish to publish their results before letting others use the same datasets. It is anticipated that TRUMPER participants will adopt a generous spirit towards sharing data, models, etc.

Dissemination of results

Researchers can, of course, present their results in the usual way at workshops and in journal and conference papers, e.g. *Nordic Hydrology/Hydrology Research*, *Hydrological Sciences Journal*, *Environmental Modelling and Software*, and Proceedings of IAHS, MOPEX, ERB, iEMSs and MODSIM Conferences⁵.

June 2007

⁴ <http://www.stars.net.au/tdwg/>

⁵ For recent and upcoming IAHS/PUB, ERB, iEMSs and MODSIM conferences/workshops in which the TDWG has participated, or convened or otherwise helped to arrange see <http://pub.iwmi.org/UI/Content/Default.aspx?PGID=0> , <http://www.cemagref.fr/Informations/Actualites/colloque/Mopexweb/MOPEXParisWorkshop.htm> , <http://erb2006.lippmann.lu/> , <http://www.iemss.org/> and <http://modsim.lincoln.ac.nz/> .