Institute of Environmental Engineering

Prof. Paolo Burlando

Chair of Hydrology and Water Resources Management

SEMINAR

Tuesday, December 13th, 2016, 16:00 h, ETH Hönggerberg HIT K51

Prof. Ashish Sharma

School of Civil and Environmental Engineering, University of New South Wales

ARE EQUIVALENT CROSS SECTIONS THE ANSWER TO THE COMPUTATIONAL WOES OF DISTRIBUTED HYDROLOGIC MODELLING?

Abstract

Distributed modelling or conceptual hydrologic modelling – this is a dilemma hydrologists have been grappling with since a long time. With climate change, and the presumption that the catchment response to the rainfall event will change in the future, traditional conceptual hydrologic model applications are becoming difficult to justify. While distributed hydro-ecological models are conceptually elegant and physically defensible to apply in future (warmer) climates, are they practical to apply given the significant computational expense they come at? We need ways of reducing the computational effort expended in simulating the hydrology in moderate to large sized catchments, to ensure accurate characterization of processes and uncertainties. One possible way of doing this is presented here.

A new approach of modelling over an equivalent cross-section is investigated where topographical and physiographic properties of first-order sub-basins are aggregated to constitute modelling elements. This approach is encapsulated in a recently developed software SMART (Soil Moisture and Runoff modelling Tool) which is now available on GitHub. The formulated equivalent cross-sections are simulated using a 2-dimensional, Richards' equation based distributed hydrological model. The simulated fluxes are multiplied by the weighted area of each equivalent cross-section to calculate the total fluxes from the sub-basins. The simulated fluxes include horizontal flow, transpiration, soil evaporation, deep drainage and soil moisture.

The equivalent cross-section approach is investigated for eight first order sub-basins in Australia and then over a larger catchment having 822 first order basins. Our results show that the simulated fluxes using an equivalent cross-section approach are very close to the reference fluxes whereas computational time is reduced of the order of ~4 to ~22 times in comparison to the fully distributed settings. The transpiration and soil evaporation are the dominant fluxes and constitute ~85% of actual rainfall. Overall, the accuracy achieved in dominant fluxes is higher than the other fluxes. As a result, this approach provides a great potential for implementation of distributed hydrological models at regional scales.