3 New Data Collection, Approaches and Model Development

With the advent of the digital age, and with the progress in the use of digital information and remote sensing observation techniques, the field of catchment hydrology has undergone a rapid metamorphosis in the past 30 years.

The first use of a computer in simulation of weather occurred in the late 1950s. This was followed very shortly by deployment of certain satellite sensors, mainly to sense surface temperatures, in the early to mid 1970s. Following that, there have been various developments that have integrated the use of the digital technology, viz. computer and automated systems, as well as using a variety of remote sensing data sets, to better understand the complex processes in catchment hydrology.

In the past two decades, with the advent of Geographic Information Systems (GIS), it has been possible to integrate the two, viz. spatially-distributed satellite data and spatially-distributed hydrological process modelling. This has helped in understanding a variety of distributed processes. We can now use observations at a plot scale and integrate to the catchment. The contribution of a hillslope to runoff can be measured and its affect translated through distributed modelling to the catchment streamflow.

The last step in this metamorphosis has been the introduction of data assimilation, using a technique called Kalman filtering, into hydrological sciences. This technique was developed as an electrical engineering/information theory tool in the 1950s. It has been used by atmospheric and ocean scientists to integrate observations of the atmosphere and ocean into atmosphere and ocean models. This method introduces observations into the modelling/simulation framework thereby "correcting" the model predictions at every step. This offers an exciting era of possibilities for integrating modelling and observations.

In our session at the International Association of Hydrological Sciences Scientific Assembly in Foz do Iguaçu (S7.3), *New Data Collection, Approaches and Model Development*, we had a wide spectrum of presentations both as talks and as posters. Only a fraction of them are published here but these attest to the diversity of the various techniques we have in use today in the field of hydrological sciences.

These presentations included the role of spatial aggregation in hydrological modelling. As data are not available at every location, there is some amount of averaging that needs to be performed. A test case of studies in French catchments by Eid *et al*. helps understanding of the various issues and challenges in such a study. Spatial variability of precipitation has a profound impact on the hydrology of runoff, and this is a topic of the study by Das *et al*. Temporal variability of precipitation is also

an important issue as the timing of overland and streamflow is affected by the frequency of rainfall and the time in between rainstorms. This is studied by Wu *et al*. for a few catchments in China. Zhou *et al.* have investigated the impact of land surface characteristics on estimation of potential evapotranspiration, which is a very important component of the water balance in hydrological models. Assimilation of remotely sensed soil moisture into a hydrological model has been studied by Matgen *et al*. and a coupled land–atmosphere assimilation system is the topic of the contribution by Boussetta *et al*. Hydrological modelling of Amazonia is a well-studied subject due to its wide impact on water resources and climate and this is dealt with in the paper by Neto *et al*. Modelling of groundwater (Maryska *et al.*), the use of the principles of PUB in water resources management in Nigeria (Adeaga), and the use of ground penetrating radar to characterize near surface observations of the subsurface (Serbin *et al.*) are important topics that illustrate some of the diversity of our new data approaches in hydrology. An important connection between water level in wells and earthquakes is explored by Guttman; this can serve as a predictor for earthquakes.

In short, this section provides a window into the future of hydrology, building on the traditional past experiences of hydrological modelling, studies of heterogeneity and temporal variability and expanding into remote sensing and data assimilation.

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