# Investigating Model Error Using Data Assimilation

Robert Pipunic[1], Jeffrey P. Walker[2], Gabriëlle de Lannoy[3,4]

[1] Department of Civil and Environmental Engineering, The University of Melbourne, Parkville, Australia
[2] Department of Civil Engineering, Monash University, Clayton, Australia
[3] Laboratory of Hydrology and Water Management, Ghent University, Ghent, Belgium
[4] Center for Research on Environment and Water, George Mason University, Calverton, USA

Data assimilation has demonstrated a capability to improve predictions from hydrological models by continuous model confrontation with observations. Examples include improved representation of soil moisture states through time by assimilating soil moisture observations, or assimilating heat flux observations to improve the prediction of time series heat fluxes. However, due to limitations with model structure and inaccurate parameter information, it is difficult to simultaneously improve all major components of the water balance through assimilation alone. Such an approach is only able to improve the most closely related quantities in the model. While the increasing range of remote sensing data types that are becoming available has led to developments in assimilating multiple data types, with the aim of simultaneously optimising the different hydrologic components of hydrological models, there are limitations due to errors in model structure. Additionally, not all models contain prognostic states that are related to the available observations. Consequently, in some instances the model physics need to be revised in order to provide this link with observations, so that model structural errors can then be diagnosed through continuous model confrontation with observations. Such information on model limitations will aid model developers to improve their models for use in catchment planning. In this work different remotely sensed datasets – soil moisture and skin surface temperature – have been assimilated into a spatially distributed model for a 100km by 100km region in south eastern Australia. Model outputs are compared with available in-situ and airborne measurements as a first step to highlight how different state variables are impacted. This is a precursor to analysing the model structural errors that exist and development of analytical tools that enable water management practitioners to make routine use of data assimilation for model improvement.