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Assimilation for latent and sensible heat flux prediction – a synthetic study

R. Pipunic (1), **J. Walker (1)**, C. Trudinger (2) and A. Western (1)

(1) Department of Civil and Environmental Engineering, The University of Melbourne, Parkville, Victoria 3010, Australia (r.pipunic@civenv.unimelb.edu.au), (2) CSIRO Atmospheric Research, Aspendale, Victoria 3195, Australia

Land surface models such as the CSIRO Biosphere Model are often coupled with weather and climate forecast models to provide a continuous feedback of latent and sensible heat flux values as the lower boundary condition for weather and climate forecast models. However, these flux estimates are typically poor due to approximations of complex physical processes, errors in atmospheric forcing data, and errors in model parameters. Hence the technique of data assimilation is commonly applied to improve latent and sensible heat flux prediction, traditionally using soil moisture or skin temperature measurements. Yet these variables typically share a weak or indirect relationship with latent and sensible heat fluxes, meaning that adjustments to soil moisture and/or soil temperature to match these observed states may not result in the desired improvement in latent and sensible heat flux predictions. To overcome this limitation it has been proposed that latent and sensible heat flux data be directly assimilated to improve both land surface model predictions of latent and sensible heat fluxes and soil moisture and temperature states. Therefore this paper intercompares these three assimilation approaches (soil moisture, skin temperature and fluxes) to make a recommendation of the most promising approach. This is demonstrated in a synthetic ensemble data assimilation study for south-eastern Australia.