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Evaluation of alternative model-data fusion approaches in water balance estimation across Australia

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Australia's national agencies are developing a continental modelling system to provide a range of water information services. It will include rolling water balance estimation to underpin national water accounts, water resources assessments that interpret current water resources availability and trends in a historical context, and water resources predictions coupled to climate and weather forecasting. The nation-wide coverage, currency, accuracy, and consistency required means that remote sensing will need to play an important role along with in-situ observations. Different approaches to blending models and observations can be considered. Integration of on-ground and remote sensing data into land surface models in atmospheric applications often involves state updating through model-data assimilation techniques. By comparison, retrospective water balance estimation and hydrological scenario modelling to date has mostly relied on static parameter fitting against observations and has made little use of earth observation. The model-data fusion approach most appropriate for a continental water balance estimation system will need to consider the trade-off between computational overhead and the accuracy gains achieved when using more sophisticated synthesis techniques and additional observations. This trade-off was investigated using a landscape hydrological model and satellite-based estimates of soil moisture and vegetation properties for aseveral gauged test catchments in southeast Australia.