

Prediction of seasonal variations in atmospheric moisture fluxes by the CSIRO Climate Analysis Forecast Ensemble system

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CSIRO’s Decadal Forecasting Project has developed a Climate Analysis and Forecast Ensemble (CAFÉ) decadal prediction system to investigate climate predictability and deliver multi-year climate forecasts for Australia. Century-long simulations of the CAFÉ atmosphere-ocean model demonstrate considerable realism in the model ENSO and its teleconnection to rainfall in much of the Asia-Pacific region, and beyond. Atmospheric horizontal moisture transport is modulated, and the convergence of the moisture fluxes is a key component of the moisture budget. Over Australia, particularly in summer, interannual variability of convergence is highly correlated with that in rainfall.

Increasingly, moisture transport is being analysed in the assessment of seasonal forecasts. New multi-year hindcast ensembles from CAFÉ provide an opportunity to extend this to the Australian region. These ensembles are initialised at starting times within 2002 to 2015. Perturbations generated using a bred vector approach provide slightly differing initial ocean states for the ensemble members. These target growth in the ocean thermocline, with the aim of improving skill in the ensemble mean over the following six months or longer. Preliminary analyses show that the skill for the NINO indices of equatorial SST is comparable to that for other systems and extends to a second year for some starting months. Consistent with the influence of ENSO, there is some skill in the prediction of rainfall anomalies over Australia and various other regions. There is also skill for the convergence of moisture fluxes, when compared to that from ERA-Interim reanalyses. Potentially, there can be more skill in predicting the fluxes themselves in some regions.