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Attribution of Extreme Heat Event Using a Seasonal Forecast Framework

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Here we present a method for the attribution of extreme climate events using an initialised climate prediction system to attribute the degree of influence from increasing levels of atmospheric carbon dioxide (CO_2) on an extreme event. The initial-value nature of our method allows little time for the growth of model-driven biases, while allowing the full coupled response of the ocean–atmosphere–land system. To illustrate the use of this method, we attribute the causes of two recent month long record heat events that occurred in October 2014 and 2015 over Australia. The events were forecast twice, one initialised with real world analysed ocean-land-atmosphere states and current CO_2 concentration and another with altered ocean-land-atmosphere states corresponding to a counterfactual world with low CO_2. We find that relative to the climatology with CO_2 level of 1960, at least half of the heat anomaly forecasted across Australia in the two events can be attributed to global warming associated with increased CO_2. Additional sensitivity experiments were conducted to assess the impact of the internal climate drivers on the events. The sensitivity experiment results suggest that the atmospheric circulation anomalies played a more important role than the direct impact from the ocean in promoting extreme heat across Australia.