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Assessment of the APCC coupled MME suite in predicting the distinctive climate impacts of two flavors of ENSO during boreal winter

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The purpose of this work is to evaluate the ability of the APCC coupled MME suite in predicting the two types of ENSO, namely cold tongue ENSO and ENSO Modoki during the boreal winter, and also to document the skills of the respective climate impacts of these Pacific climate drivers at lead time of 1-4 months, or in other words, ahead of 1 to 2 seasons. The current work, demonstrates that that the APCC coupled MME prediction can simulate the ENSO and ENSO Modoki events, represented by the EOF1 and EOF2 from an EOF analysis of tropical Pacific SST anomalies, reasonably well. The spatial pattern correlations between observation and MME prediction at 1-month lead time are 0.96 for the ENSO and 0.91 for the ENSO Modoki, even though the total variance of EOF 1 is much larger than that for observation, while that associated with the EOF2 is slightly under-predicted. At 4-month lead, the variance explained by the predicted EOF2 is almost less than that from observations by about 30%. When evaluating the local climate predictability over 4 specific regions, the MME prediction captures the distinguishing features such as the strong winter monsoon over East Asia, the severe drought condition and above than normal temperature over Australia, the wet and cold climate over the whole area of USA, and the anomalous dry condition over South America associated with an El Niño reasonably well. However, there are limitations in predicting the Modoki-associated rainfall signatures over Australasia and tropical South America. Interestingly, the skills of the MME in predicting the Modoki-associated impacts over East Asia and North America are slightly higher or similar as compared to those related to the ENSO impacts. To find out the reason, we did regression analysis of the 200-hPa velocity potential and related divergent wind to see the upper level atmospheric circulation. In ENSO years, the MME prediction captures the observed upper level divergence convergence area over the equatorial Pacific (East Asia and Australia) well. On the other hand, while the coupled MME prediction can simulate the El Niño Modoki-associated upper level convergence over East Asia and the divergence along the west coast of North America as well as the convergence over the eastern North America, it cannot reproduce the teleconnection paths from equatorial Pacific to Australasia and South America appropriately. It is interesting to note that the limitations are in regions which experience the summer season.