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An atmospheric forcing extending ENSO forecast horizon using statistical models

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Interseasonal forecasting of El Niño Southern Oscillation (ENSO), which is traditionally based on data of tropical sea surface temperatures (SST), is in high demand due to the impacts of ENSO on regional climatic conditions around the world as well as the global climate. Improvements in the quality of data in recent decades have led to the active use of statistical ENSO models, which compete with physical models in predictive power. The main disadvantage of statistical forecasts is the pronounced seasonal growth of uncertainty when predicting the upcoming summer-fall ENSO conditions from winter-spring months (so called the spring predictability barrier (SPB)). Recent studies show that Pacific atmospheric circulation anomalies in winter-spring may have a long-term impact on the summer tropical climate via the SST footprint. Here, we infer an index based on sea level pressure (SLP) data from February-March in a single area surrounding Hawaii, and show that this area is the most informative part of the large SLP pattern initiating the SST footprinting mechanism. We define the Hawaiian index (HI) as the mean SLP anomalies in the region (13^0N-19^0N, 150^0W-160^0W) averaged over February-March and demonstrate that the statistical AR model of the Niño 3.4 index taking the HI as a forcing is better in the Bayesian sense and delivers significantly better multimonth predictions. In fact, the HI forcing in the model substantially lowers the SPB and hence increases the predictability of the whole June-May ENSO cycle for forecasts starting in spring. Thus, we can recommend that modelers test the HI as an additional predictor in statistical ENSO models.

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