

Ensemble Canonical Correlation Prediction of Surface Temperature over the United States

Kingtse C. Mo
Climate Prediction Center
NCEP/NWS/NOAA
5200 Auth Rd., Camp Springs, MD, 20746
Email : Kingtse.Mo@noaa.gov
Tel: 301-763-8000 Ext 7540
Fax: 301-763-8395

Abstract

The ensemble canonical correlation (ECC) prediction method is applied to predict summer (July-September) and winter (January- March) seasonal mean surface temperature (T_{surf}) over the United States. The predictors are the global sea surface temperature (SST), sea level pressure over the Northern Hemisphere, T_{surf} and soil moisture over the United States from one to two seasons lead as well as the model outputs from the NCEP seasonal forecast model. The CCA prediction is performed for each variable separately. The predicted T_{surf} fields form an ensemble. The ensemble mean is the weighted average of its members. Both the ensemble with equal weighting EE and the super ensemble SE are tested. For the super ensemble, the weighting function is determined by linear regression based on the past history.

Overall, the ensemble mean forecasts for both EE and SE have higher forecast skill than its members. On average, the super ensemble gives the best forecasts as measured by the anomaly correlations. For summer, the ensemble mean forecasts improve forecasts over the central United States substantially in comparison with the CCA forecasts based on SST alone. Different variables recognize different forcing. They have forecast skills over different regions of the United States. Therefore, the ensemble forecasts have high skill. If the ensemble mean is the average of its members, the members should be chosen in such a way that each member has useful forecast skill in different regions of the domain. If the super ensemble is constructed, the linear regression will select the best weighting function at each climate division.

The leading CCA modes indicate the sources of forecast skill. For summer, the leading modes for SSTs are associated with the long term decadal trends, ENSO and SSTs in the North Atlantic. In addition to SSTs, soil moisture also plays an important role. For winter, SSTs in the tropical Pacific associated with the decadal and ENSO variability dominate the contribution.