A dynamic-statistical multimodel ensemble forecasting approach for summer precipitation in China

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Meteorological disasters, such as droughts and floods, occur frequently and cause considerable damage to the economy and social development. Therefore, precipitation predictions during summer are critical and necessary on most continents, especially in monsoon impacted areas. In this study, we propose a dynamic-statistical multimodel ensemble (DSME) approach to predict the summer precipitation in China by using ECMWF_System4, NCEP_CFSv2 and BCC_CSM1.1. Due to the complex climatic conditions, China is divided into eight regions. The skills of precipitation hindcasts and probability distributions of prediction errors from three climate forecast systems were investigated for each region. It is found that all the probability distributions of prediction errors satisfy approximately Gaussian distribution. Thus, the probability distribution function (PDF) and the characteristic values of different models in different regions are presented. The predictive abilities of different models can be analyzed and compared through their Gaussian distribution characteristics of prediction errors. Then we employ statistical method to evaluate the prediction errors of different models for the prediction year through digging out the historical similar prediction error (HSPE). All the prediction of different models can be calibrated by using HSPE. The probability that HSPE coincide with the actual error of the prediction year is calculated based on the PDF of model, and it can be treated as the reliability of modified prediction. Therefore, we utilize the reliability of prediction as weight coefficient to assess the usefulness of multimodel ensemble members. On this basis, experiments of multimodel ensemble forecasts are performed. The results of independent sample hindcasts have shown that applying the DSME scheme successfully improves prediction skills of summer precipitation in China. DSME performs reasonably well in the determination of weight coefficient, which makes prediction result achieve the optimization. The validity and suitability of DSME has been verified through two years real time predictions.