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Development of new ensemble methods based on the performace skills of regional climate models over South Korea

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It is well known that multi-model ensembles can reduce the uncertainties of the model results and increase the reliability of the model results. In this paper, the prediction skills for temperature and precipitation of five ensemble methods were discussed by using the 20 years simulation results (from 1989 to 2008) by four regional climate models (RCMs : SNURCM, WRF, RegCM4, and RSM) driven by NCEP-DOE and ERA-interim boundary conditions. The simulation domain is CORDEX (COordinated Regional climate Downscaling Experiment) East Asia and the number of grids is 197 x 233 grids with a 50-km horizontal resolution. The new three ensemble methods, PEA_BRC, PEA_RAC and PEA_ROC, developed in this study, are performance based ensemble averaging methods by using bias, RMSE (root mean square errors) and correlation, RMSE and absolute correlation, and RMSE and original correlation, respectively. The other two ensemble methods are equal weighted averaging (EWA) and multivariate linear regression (Mul_Reg). Fifteen years and five years data from 20-year simulation data were used to derive the weighting coefficients and cross-validate the prediction skills of five ensemble methods. The total number of training and evaluation is 20 times through a cyclic method from 20 years data. The Mul_Reg (EWA) method among the five ensemble methods shows the best (worst) skill without regard to seasons and variables during the training period. And the PEA_RAC and PEA_ROC show very similar skills with Mul_Reg for all variables and seasons during training period. However, the skills and stabilities of Mul_Reg are drastically reduced when it applied to prediction regardless of variables and seasons. However, the skills and stabilities of PEA_RAC are slightly reduced. As a result, the PEA_RAC shows the best skill without regard to the seasons and variables during the prediction period. This result confirms that the new ensemble methods developed in this study, the PEA_RAC, can be used for the prediction of regional climate without regard to the variables and averaging time scale. In addition, the simplicity of deriving process of weighting coefficients and applications are also the strong points of the ensemble method, PEA_RAC.