Geophysical Research Abstracts
Vol. 16, EGU2014-7515, 2014
EGU General Assembly 2014

Maximization of seasonal forecasts performance combining Grand Multi-Model Ensembles

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Multi-Model Ensembles (MMEs) are powerful tools in dynamical climate prediction as they account for the overconfidence and the uncertainties related to single-model errors. Previous works suggested that the potential benefit that can be expected by using a MME amplify with the increase of the independence of the contributing Seasonal Prediction Systems. In this work we combine the two Multi Model Ensemble (MME) Seasonal Prediction Systems (SPSs) independently developed by the European (ENSEMBLES) and by the Asian-Pacific (CliPAS/APCC) communities. To this aim, all the possible multi-model combinations obtained by putting together the 5 models from ENSEMBLES and the 11 models from CliPAS/APCC have been evaluated.
The grand ENSEMBLES-CliPAS/APCC Multi-Model enhances significantly the skill compared to previous estimates from the contributing MMEs. The combinations of SPSs maximizing the skill that is currently attainable for specific predictands/phenomena is evaluated. Our results show that, in general, the better combinations of SPSs are obtained by mixing ENSEMBLES and CliPAS/APCC models and that only a limited number of SPSs is required to obtain the maximum performance. The number and selection of models that perform better is usually different depending on the region/phenomenon under consideration. As an example for the tropical Pacific, the maximum performance is obtained with only the combination of 5-to-6 SPSs from the grand ENSEMBLES-CliPAS/APCC MME.
With particular focus over Tropical Pacific, the relationship between performance and bias of the grand-MME combinations is evaluated. The skill of the grand-MME combinations over Euro-Mediterranean and East-Asia regions is further evaluated as a function of the capability of the selected contributing SPSs to forecast anomalies of the Polar/Siberian highs during winter and of the Asian summer monsoon precipitation during summer.
Our results indicate that, combining SPSs from independent MME sources is a good strategy to go beyond current limitation in seasonal predictions. At the same time our results suggest that overconfidence may be still limiting performance of MME forecasts currently available from the European and the Asian-Pacific communities.