**P10.1 Bias Correction of Rainfall Simulation in East Asia Using a Statistical-Dynamic Method**

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## 1. INTRODUCTION

In recent years, some statistical methods, such as Singular Value Decomposition Analysis （SVDA; Bretherton et al. 1992）and Canonical Correlation Analysis（CCA; Barnett and Preisendorfer 1987）, have become the popular multivariate statistical techniques applied to resolve the problem that the precipitation anomaly pattern of a model simulation is a kind of deviation from that of observation（Feddersen et al. 1999; Moron et al. 2001; Kang et al. 2004）.

In the present study, we attempt to explore the evolution of skills based on SVDA between different seasons in EAM region by evaluating the seasonal precipitation simulated by Max Planck Institute GCM version 4.6 (ECHAM4.6), which is forced by prescribed boundary condition..

## 2. EXPERIMENT DESIGN

Three strategies are used to adjust the simulated anomaly field. One is that the adjusted field is purely constructed (hereafter adj(-lin)) by the transfer function, another (hereafter adj(+lin)) is that the adjusted field is not only constructed by the transfer function, but also modified by adding weighting factors to the adjusted field when the linear regression method, the least square method, is applied to the adjusted field during the training period, and the other (hereafter lin) is that the adjusted field can be obtained directly when the weighting functions based on the least square method are applied to the raw data. The double cross validation (Kass et al. 1996) is utilized for the purpose of controlling the problem that the relative short period of record, 25yr, used in this study, may involve overestimated skill scores by overfitting random variability as indicated by Davis (1976). Details of the verification procedures and the principle for selecting the dominant modes used to reconstruct the adjusted field can be found in Feddersen (1999).

## 3. RESULTS

In Figure 1, these three strategies are examined during different periods in the respect of the spatial pattern correlation between the observed and the simulated fields in each year, which are all the results based on the double cross-validation. The open and the shaded bars represent the pattern correlations for the raw data of simulation and for the strategy of adj(+lin), respectively. Adj(-lin) and lin for the distribution in a year can be expressed by the marks of the line and the closed circle, respectively.

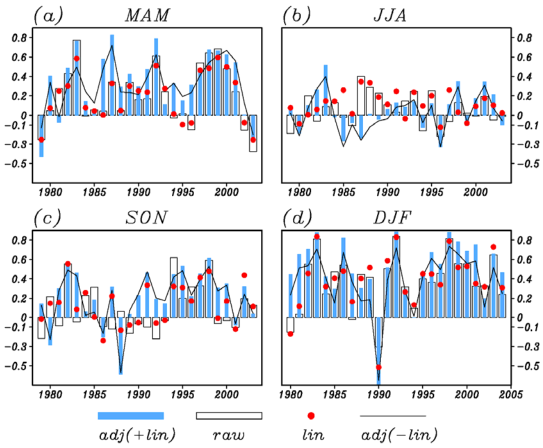


*Fig. 1 The skills of the three strategies during different periods in the respect of the spatial pattern correlation between the observed and the simulated fields in each year, which are all the results based on the double cross-validation. The open and the shaded bars represent the pattern correlations for the raw data of simulation and for the strategy of adj(+lin), respectively. Adj(-lin) and lin for the distribution in a year can be expressed by the marks of the line and the closed circle, respectively.*

Generally speaking, there exists a seasonal variation of skills for the raw data in simulating the precipitation anomalies in the region of EAM. A good result can be found during the period of DJF, and the result is relatively better during the period of MAM. On the other hand, during the boreal summer, the model, it seems, operates poorly, which may be due to the complexity of the climate system that happens in this period.

The Root Mean Square (RMS) is shown in figure 2. In figure 2, the post-processed data are lower than the raw data during all these periods, and the evolution of RMS for these three strategies are similar to each other, even though the patterns of correlation for them are significantly different. And the RMSs are usually lower during the periods of DJF and MAM, and relatively higher in the periods of JJA and SON.

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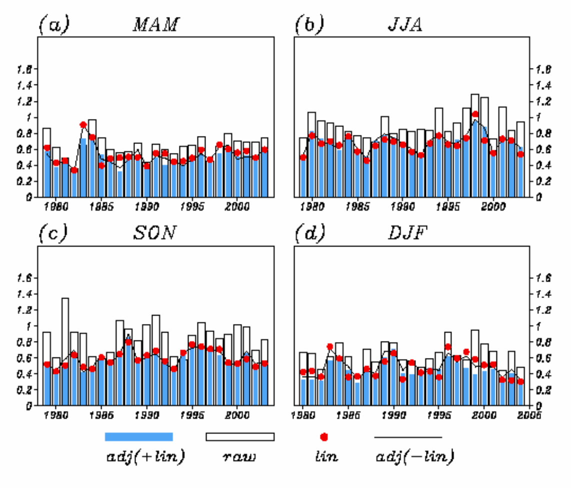


*Fig. 2 As in Fig1, except for the root mean square error (RMS).*

This study presents comprehensive documentation, which is concerned in the evolution of the raw data and of some bias correction skills based on the SVDA during different periods in the region of EAM. Higher skill occurs in DJF-near periods, and relatively lower skill is found in JJA-near ones. It would be of some help in raising the ability of systematic bias correction based on SVDA if the simulated inter-annual variability of precipitation were satisfactorily similar to the observed one. Therefore, how to simulate effectively, through the help of satisfactory AGCMs, the inter-annual variability of these observed complex climate systems, particularly that of the East Asia Summer Monsoon, will be worthy of further investigation in the future.

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