The Effect of SST Forcing on Seasonal Prediction by Nonlinear Multimodel Ensemble

**Motivations**

- Nonlinear multimodel ensemble approach is adopted to improve the skill of seasonal prediction.
- It has been long known that an ensemble average of global forecasts from different operational centers is far more skillful than the best individual forecast (e.g., Kalnay and Ham, 1989; Fritsch et al., 200).
- Krishnamurti et al. (2000) have shown that if the multimodel ensemble includes correction of the systematic errors by regression, the quality of the ensemble system is further significantly improved.

**Nonlinear Multimodel Ensemble Prediction System**

- Brief descriptions
  - The multimodel ensemble with correction of the systematic errors by nonlinear neural network model is developed.
- Model forecasts are trained, using hindcast data of participating AGCMs and observation data.

**Results and Discussion**

**Relation between SST forcing and prediction of precipitation**

- Results of ANN and its relation with SST forcing
  - Cross-validation is adopted
  - The skill of precipitation prediction by nonlinear multimodel ensemble (ANN) technique is better than those of each participating models.
  - Figures showed that years of high skill are almost strong ENSO phase.
  - It shows that there are strong relation between SST forcing and skill of prediction.

- EOF Analysis of precipitation and SST
  - The EOF analysis of boreal winter precipitation shows two leading mode, which are ENSO (El Nino-Southern Oscillation) and PDO-like (Pacific decadal oscillation) modes.

- Correlation between prediction and observation
  - Pattern correlations coefficients of the spatial patterns and temporal correlation coefficients of time series for two leading modes obtained from EOF analysis of precipitation by participating models and multimodel ensemble with observation.
  - The improvement of predictability by NME technique is due to the correction of the spatial structure of the variability of precipitation in response to SST forcing.

**Summary**

- According to the forecast results of boreal winter precipitation, the prediction skill reproduced by nonlinear multimodel ensemble (ANN) is better than individual model skill.
- The improvement of predictability by ANN technique is likely due to the correction of the spatial structure of the variability of precipitation in response to SST forcing.
- The ANN with persisted SSTA degrades predictability about 25% with respect to potential predictability.
- In case there is the inconsistency of data between training and forecast periods, forecast skill of ANN is degraded additional 10%.
- It is found that the intraseasonal variation of SSTA affects the temporal variability of ENSO and PDO-like mode in predicted precipitation, and the inconsistency of data between two periods affects both temporal and spatial structure of variability.