



Comparison of Information-based Measures of Forecast Uncertainty in Ensemble ENSO Prediction

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In this study, ensemble predictions of the El Niño Southern Oscillation (ENSO) were conducted for the period from 1981-1998 using two hybrid coupled models. Several recently proposed information-based measures of predictability, including relative entropy (R), predictive information (PI), predictive power (PP) and mutual information (MI), were explored in terms of their ability of estimating a priori the predictive skill of the ENSO ensemble predictions. The emphasis was put on examining the relationship between the measures of predictability that do not use observations, and the model prediction skills of correlation and root mean square error (RMSE) that make use of observations. The relationship identified here offers a practical means of estimating the potential predictability and the confidence level of an individual prediction.

It was found that the MI is a good indicator of overall skill. When it is large, the prediction system has high prediction skill whereas small MI often corresponds to a low prediction skill. This suggests the MI to be a good indicator of the actual skill of the models. The R and PI have a nearly identical average (over all predictions) as should be the case in theory.

Comparing the different information-based measures reveals that R is a better predictor of prediction skill than PI and PP, especially when correlation-based metrics are used to evaluate model skill. A “triangular relationship” emerges between R and the model skill, namely that when R is large, the prediction is likely to be reliable, whereas when R is small the prediction skill is quite variable. A small R is often accompanied by relatively weak ENSO variability. The possible reasons why R is superior to PI and PP as a measure of ENSO predictability will also be discussed.