

Tropical Pacific SST Forecasts Utilizing Multiple Coupled GCMs

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We describe forecasts for tropical Pacific sea surface temperature (SST) made by combining the forecasts produced by multiple independent coupled atmosphere-ocean general circulation models (CGCMs). This initial forecast framework uses two CGCMs. The two CGCMs utilize the same ocean component model and are initialized using the same ocean data assimilation product. This work is an extension of the combined CGCM forecasts described in Schneider et al. (2003). Differences between that work and the current forecasts include use of an extended period for developing prior statistics, use of fewer models, and employment of a different technique for combining the SST forecasts from the different models. This manuscript gives the real time forecast starting from April 1, 2008. In a previous version of the ELLFB, retrospective forecast skill for April 1 IC forecasts has been documented.

The model descriptions have been given in previous versions of the Extended Long-Lead Forecast Bulletin (ELLFB) and are skipped here for brevity. The atmospheric GCM (AGCM) component models used are the ECHAM4.5 AGCM of the Max Planck Institute for Meteorologie (Roeckner et al., 1996) and the Center for Ocean-Land-Atmosphere (COLA) studies AGCM version 2 (Schneider, 2002). The ocean GCM (OGCM) component model is version 3 of the Geophysical Fluid Dynamics Laboratory (GFDL) modular ocean model (MOM) (Pacanowski and Griffes, 1998). The ocean initial conditions are taken from an ocean data assimilation system produced at GFDL using a variational optimal interpolation (Derber and Rosati, 1989).

Procedure for Producing the Forecast

Retrospective forecasts using 7 ensemble members for the period January 1982 to present have been made using the coupled system with ECHAM AGCM component. Similar retrospective forecasts using 5 ensemble members have been made using the coupled system with COLA AGCM component. The variance of SST anomalies differs between the two models and is also not the same as found in nature. The retrospective forecasts from both of the coupled systems have been normalized by the observed variance. At each point a bootstrap cross validation procedure is applied to bring the forecast variance closer to observed. In this calculation, the forecast for a particular year is not used to compute the mean or the standard deviation for either the model or the observations. The forecast anomaly for that year is taken as the difference from the model climatology made without using that year multiplied by the ratio of observed to model standard deviation also calculated without the data from the year of the forecast. The final SST forecast is the simple arithmetic mean of the normalized forecasts from the two coupled models.

Current Forecast

The current forecast for the Nino indices averaged SST anomalies made from April 1, 2008 is shown in Figure 1. The combined coupled forecast calls for Nino3 to warm gradually over the period to warm-neutral conditions. Nino3.4 is forecast to warm in the beginning of the period but to stay cool over the period of the forecast.

Acknowledgements

These forecasts were made possible due to help from several institutions. Matt Harrison and Tony Rosati of GFDL developed the ODA system and ran the 1980 to 1999 period. Ben Kirtman and Duhong Min of COLA have ported the ODA to their system and run the 2000 to present period. Bohua Huang of COLA implemented the lower resolution of the OGCM used here. Max Planck has kindly provided the ECHAM4.5 AGCM to the IRI. David DeWitt was supported by a grant from the National Oceanic and Atmospheric Administration: (NA07-GP0213). Support for Schneider and Hu was provided by the

National Science Foundation (ATM 98-14295,ATM01-22859), the National Oceanic and Atmospheric Administration (NA 96-GP0056), and the National Aeronautics and Space Administration (NAG 5-8202).

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Figure Captions

Figure 1. Combined coupled model forecast for the Nino3 and Nino3.4 regions from April 1, 2005 initial conditions

Combined Coupled SST Forecast

