International workshop on seasonal to decadal prediction
Toulouse, France, 13-16 May, 2013

An Assessment of the Skill of GEOS-5 Seasonal forecasts

Yoo-GEUN HAM

Global Modeling and Assimilation Office, NASA/GSFC, U.S.A, yoo-geun.ham@nasa.gov
Siegfried Schubert, and Michele M. Rienecker
Presenter : Yoo-Geun Ham

The seasonal forecast skill of NASA's Global Modeling and Assimilation Office (GMAO) GEOS-5 coupled atmosphere-ocean general circulation model (AOGCM) is evaluated based on an ensemble of 9-month lead forecasts for the period 1993 to 2010. Comparisons are made with an earlier version (V1) of the system in which the AGCM (the NSIPP model) was coupled to the Poseidon Ocean Model. The current version (V2) is a major upgrade of that system consisting of the GEOS-5 AGCM coupled to the MOM4 ocean model.

The correlation skill of the sea surface temperature (SST) forecasts is generally better in V2, especially over the sub-tropical and tropical central and eastern Pacific. V2 also shows improved correlation skill and Mean Square Skill Score (MSSS) over the Atlantic and Indian Ocean for all forecast lead months. The correlation skill of NINO3.4 SST is greater than 0.7 for up to 7-month forecast lead times – a substantial improvement compared with V1. The improvements in V2 come mainly from the better forecasts of the developing phase of ENSO from boreal spring to fall. An analysis of the SST tendencies during the ENSO developing phase shows that the magnitude of ENSO in V1 is excessive during its developing phase due to a model bias characterized by a too strong climatological zonal temperature gradient. This is due to a cold bias located over the eastern Pacific. In contrast, V2 has a more zonally uniform cold bias extending from the central to eastern Pacific that to a large extent preserves the observed climatological zonal temperature gradient in that region. It is further shown that an excessive climatological meridional current in V1 is responsible for the development of ENSOs that are stronger than observed.

On the other hand, the skill of forecasts initiated during the peak phase of ENSO (i.e. the boreal winter season) is slightly worse in V2. In both observations and V1, the discharge of equatorial Warm Water Volume (WWV) leads the equatorial geostrophic easterly current so as to damp the ENSO signal from January onwards. On the other hand, in V2, this damping is delayed by about 2 months due to slow phase transition of the ENSO-related zonal current led by the weak discharge of equatorial WWV. It is found that this is due to the systematic difference in ENSO-related zonal wind stress anomaly in V2, which leads the local equatorward Sverdrup transport over the eastern Pacific. The result is that ENSO in V2 grows excessively during the ENSO mature phase.