SESSION: (A1) Mechanisms of S2S predictability

(A1-03)

Sources of tropical subseasonal predictability beyond the MJO

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The relative importance of ENSO and the MJO to tropical subseasonal predictability is assessed with a coupled linear inverse model (LIM) derived from the simultaneous and 5-day lag covariances of observed 5-day running mean atmospheric and oceanic anomalies for the years 1982-2009. The oceanic portion of the LIM state vector is made up of sea surface temperature (SST) and sea surface height (SSH) anomalies, whereas the atmospheric portion is made up of outgoing longwave radiation (OLR) and 200 and 850 hPa zonal and meridional wind anomalies. A comparison of the LIM (cross-validated) hindcast skill with that of the operational versions of the NCEP CVSv2 and ECMWF models for the years 1999-2010 is also made. LIM S2S skill (Weeks 3-6) is comparable with both forecast models. The ECMWF hindcasts generally have highest skill for Weeks 3-4, with both the LIM and ECMWF hindcasts having about the same skill in Weeks 5-6.

Given that its forecast skill is comparable with operational coupled GCMs and it reproduces observed spatio-temporal statistics, the much simpler LIM is useful for diagnosis of predictability, which may be determined from its forecast signal-to-noise ratios. The state-dependence of potential LIM skill is assessed and shown to compare well both with the LIM and operational model realized skill. Further analysis is performed based on the fact that the eigenvectors of the LIM dynamical evolution operator separate into two distinct, but nonorthogonal, subspaces: an "internal" space governing the nearly uncoupled subseasonal dynamics, and a "coupled" space governing the strongly coupled longer-term dynamics. These subspaces arise naturally from the LIM analysis; no bandpass frequency filtering need be applied. The internal space eigenmodes typically have much shorter periods and e-folding time scales than the coupled space eigenmodes. Additionally, the MJO mostly lies in this internal space, whereas ENSO mostly lies in the coupled space. Anomalies that project onto the coupled space are shown to more predictable than those projecting onto the internal space, even for relatively "short" Weeks 3-4 leads. That is, ENSO is the primary contributor to overall tropical skill even on the Weeks 3-4 time scale, and provides almost all of it on longer S2S forecast leads.