

Two-year Predictions of ENSO Event Duration During 1954-2015

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The El Niño-Southern Oscillation (ENSO) is the leading mode of interannual climate variability and affects global weather patterns via atmospheric teleconnections. ENSO events that last two years or longer could prolong and exacerbate the climate impacts. Our previous idealized modeling studies suggest potential predictability of both multiyear El Niño and La Niña events with lead times up to two years. To explore the long-term predictability of ENSO event duration in the real world, we analyze a suite of ensemble seasonal forecasts conducted with the Community Earth System Model, version 1 (CESM1), one of a few climate models that reproduce the observed asymmetry and diversity of ENSO event evolution. Three sets of ensemble forecasts are initialized with observed oceanic conditions on every March, June, and November 1st during 1954-2015 and consist of 20-40 ensemble members with slightly different atmospheric initial conditions. All forecasts are integrated at least for two years. The CESM1 shows high skills of predicting the duration of El Niño and La Niña with lead times ranging from 6 to 24 months. The predictable component of event duration arises from the surface and subsurface oceanic initial conditions in the tropical Pacific as well as in the Indian and Atlantic Oceans. The error growth of event duration originates from the North Pacific atmospheric variability in the spring after the first peak. The high predictability of multi-year ENSO events may provide a major source of multi-year climate predictability. Our results indicate the potential of extending the operational ENSO forecasts by an additional year.