Decadal modulation of ENSO-based long-lead outlooks of Southwest U.S. winter precipitation

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Seasonal predictability of winter precipitation anomalies across the American Southwest derived from knowledge of antecedent, late summer Pacific Ocean surface temperatures is examined empirically. Previous studies have shown that equatorial Pacific SST anomalies associated with the El Niño-Southern Oscillation (ENSO) cycle, which are quite persistent from late summer through the winter, exhibit a strong relationship with winter precipitation in Arizona and New Mexico. Here the degree to which seasonal predictability in this region is modulated by longer-term oceanic fluctuations associated with the Pacific Decadal Oscillation (PDO) is assessed. When all years from 1950 through 1997 are considered as a single data set, inclusion of the PDO signal adds only slightly to the ENSO-based statistical predictability of Southwest winter precipitation anomalies. However, when the data set is split into two sub-periods delineated by a major shift in the PDO (before and after 1977), the ENSO-based predictability, and to a lesser extent PDO-based predictability, are substantially modified. Before 1977 negative winter precipitation anomalies are strongly tied to ENSO cold years, but warm years do not systematically lead to positive precipitation anomalies. After 1977 this asymmetry is reversed and positive precipitation anomalies predictably follow warm ENSO years but cold years yield no precipitation predictability. Within each sub-period interannual PDO fluctuations yield less predictability than ENSO fluctuations. Thus ENSO-based predictability seems to undergo a profound decadal modification that might be associated statistically with the PDO but the physical link to North Pacific ocean temperatures is problematic.