NOTES AND CORRESPONDENCE

Comments on "Comparison of 1997–98 U.S. Temperature and Precipitation Anomalies to Historical ENSO Warm Phases"

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The connection between U.S. weather patterns and ENSO warm events is of great interest. During the 1997–98 ENSO warm event, one of the largest this century, major seasonal weather anomalies occurred over the continental United States. Two recent papers (Harrison and Larkin 1998a, hereafter HL98a; Smith et al. 1999) have attempted to place the 1997–98 U.S. seasonal weather anomalies in the historical context of the post-World War II ENSO warm events.

HL98a examined seasonal temperature and precipitation anomalies and compared the 1997–98 event to both the historical average anomalies and the historical frequency of occurrence of extreme seasonal anomalies during warm events. For this HL98a used data from the 344-region National Climatic Data Center, U.S. Climate Region dataset (NCDC 1994) and a warm event definition based on an index derived from the most robust tropical Pacific elements of warm events (Harrison and Larkin 1998b). Using a different U.S. weather dataset and warm event definition, Smith et al. (1999) examined nine-World War II post warm events and ranked the 1997–98 winter and spring anomalies against them.

Both studies found that the winter 1997/98 and spring 1998 seasonal temperature anomalies followed the historical patterns in a number of respects. However, some exceptions include that Texas was warmer than normal (not cooler) in the winter and spring of 1997/98, and that California was cooler (not warmer) during spring 1998. The precipitation anomalies departed much more from the historical averages. In particular, California had an extremely wet 1997/98 winter yet history indicates only a weak increase in precipitation is typical. It was also very wet in the coastal states from Louisiana up to Delaware in winter 1997/98, but only coastal Louisiana and Florida were expected to be significantly wetter than normal. In spring 1998, the Gulf Coast was generally drier (not wetter), and the Pacific Northwest region of eastern Washington and Idaho was considerably wetter (not drier).

While Smith et al. (1999) confined their focus to winter and spring anomalies, HL98a also examined the autumn (September–October–November) and the following summer (June–July–August) anomalies. The summer season did not exhibit any widespread, large-amplitude anomalies. However, they found significant associations for the autumn period; more of the continental United States has significant anomalies in autumn than in winter (for winter anomalies see Fig. 1 of HL98a). Figure 1 in this note shows some of the HL98a autumn season results. The upper panels show the historical average anomalies of the ten 1946–95 warm events. In the historical average, cooler than normal temperatures exist over much of the Midwest, south, and central-eastern seaboard, while warmer than normal temperatures exist in the Pacific Northwest. In precipitation, the Pacific Northwest tends to be considerably drier than normal while regions of the Southwest tend to be wetter.

Examining the frequency of occurrence of extreme seasonal weather during the 1946–95 warm events also shows significant results for autumn. Comparison with the other seasonal extreme results (see Fig. 2 of HL98a) indicates that these autumn extremes are the most robust extreme seasonal anomalies found by HL98a. The lower panels of Fig. 1 show the number of times extreme autumn seasonal weather has occurred during the ten 1946–95 warm events. Areas where 4 or more of the 10 warm events have had extreme seasonal anomalies

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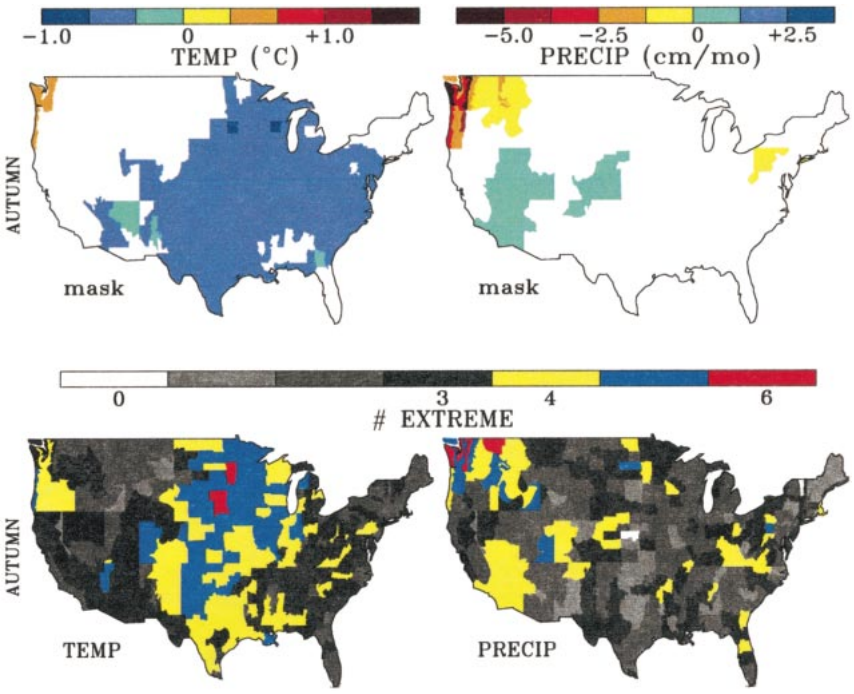

Fig. 1. The autumn temperature and precipitation anomalies associated with the 10 ENSO warm events 1946–95. (Upper panels) Average anomalies in °C and cm month^{-1}. (Lower panels) Number of extreme (upper quintile) seasonal anomalies occurring during the 10 warm events. The average anomalies are masked for 80% statistical significance (bootstrap technique). Four or more extreme seasons (colored) is statistically significant at 90%. (Adapted from HL98a.)

are statistically significant; these areas have an increased likelihood of extreme seasonal anomalies occurring during warm events. Over a generally north–south band extending from NW Texas up through Wisconsin, 5 or 6 out of 10 ENSO warm event autumns were among the coolest in this 50-yr period. The Pacific Northwest also had a number of climate regions with 6 out of the 10 warm event autumns among the driest in this period.

The autumn 1997 seasonal anomalies, however, only loosely followed the historical average autumn patterns. The relatively robust regions of extreme autumn anomalies did not well anticipate the autumn 1997 extremes. In fact the Pacific Northwest was wetter than normal (upper quintile), and there were no upper-quintile cool regions in the broad north–south band described above. See HL98a for a complete discussion of the autumn anomalies and extremes.

ENSO alone does not determine U.S. seasonal weather anomalies, even during a very strong warm event like 1997–98. Rather, the presence of a warm event shifts the seasonal weather probability, as indicated by the historical average anomaly patterns and the likelihood of seasonal extremes. This is true for the autumn as well as the winter and spring seasons. Learning how to make the best use of these statistical relationships season by season will benefit the most-affected regions of the United States.

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