An Examination of a Dynamic Warm Season Convective Event Over Northern California

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INTRODUCTION

Strong to severe thunderstorms and heavy showers can occur any time of the year over northern California if the necessary ingredients are present: sufficient moisture, instability and lift. While not unheard of, strong, dynamically-driven convective events are unusual for early June. The following is an illustration of such a seasonally rare convective outbreak associated with the passage of an upper level low and an associated strong short wave.

EVENT SYNOPSIS

An unseasonably deep trough of low pressure was present along the west coast with a closed low at 500 millibars located over the Pacific Northwest at 12Z on June 7th. By 12Z on June 8th, the low had drifted south toward the Oregon/California border and had begun to slowly fill. During the morning of June 8th, a strong vorticity center located near Cape Mendocino began to move south along the coastal range. The low moved over interior northern California during the afternoon with a 5560 dm center analyzed over Sacramento at 00Z on June 9th (figure 1). Showers and a few thunderstorms began to develop during the late morning and early afternoon, to the east of the track of the vorticity center, over Plumas, eastern Tehama, and eastern Shasta counties. By mid-afternoon, strong to severe thunderstorms began to develop over southern Lake county (directly under the vorticity center), then moved and redeveloped southward into Napa county (figure 2). Areal coverage and intensity of the showers and storms decreased during the evening with the loss of insolation. However, isolated showers and thunderstorms continued through the night as the strong vorticity center tracked across the southern Sacramento Valley.

VERIFICATION

The strongest storms developed in the afternoon beneath the most unstable airmass directly beneath the upper vorticity center in southern Lake and Napa counties. Impressive storm structure was observed via the KDAX 88D radar with several cells indicating weak echo regions (WER), and one cell briefly appeared to have a bounded weak echo region (BWER). Radar also indicated several cells with large areas of elevated reflectivity cores of 60 dBZ or higher extending to heights of 25k to 35k feet. Unfortunately, the tracks of most of these storms were over relatively unpopulated and data sparse areas, so ground truth verification was difficult to achieve. However, a spotter for the Monterey WFO reported 3/4 inch hail near Yountville in Napa county with one of the storms late in the afternoon.

CONCLUSIONS

Tardy (2001) identified the importance of identifying areas of strong dynamic forcing when forecasting seasonally atypical convective events over northern California. Also, the location of the upper-level cool pool can also serve as an important forecast aid when attempting to identify areas most prone to maintained nocturnal convection. In this event, the nocturnal activity could be attributed not only to the strong vorticity advection that was occurring, but also to the relative strength of the cool pool dynamics associated with the upper low. While Tardy (2001) showed the utility of basic numerical model output for identifying regions supportive of elevated nocturnal thunderstorms, in this case the model output continued to identify surface-based instability well into the evening. The Workstation ETA analyzed moderately strong (~300 J/kg) surface-based CAPE values over the southern half of the WFO Sacramento forecast area through 06Z on June 9th. This could be attributed to the steepening of mid-level lapse rates as the upper level cold pool approached the valley.

REFERENCES

Cunningham, S.J. and A.O. Tardy, 2002: Nocturnal Thunderstorm Redevelopment Under Synoptic Scale Destabilization in the Northern Sacramento Valley. WFO Sacramento Staff Note.

Tardy, A. O., 2001: Forecasting Applications for Elevated Thunderstorms Part 2: Nocturnal Thunderstorms Over Central California in August 1999. Western Region Technical Attachment No. 01-12.

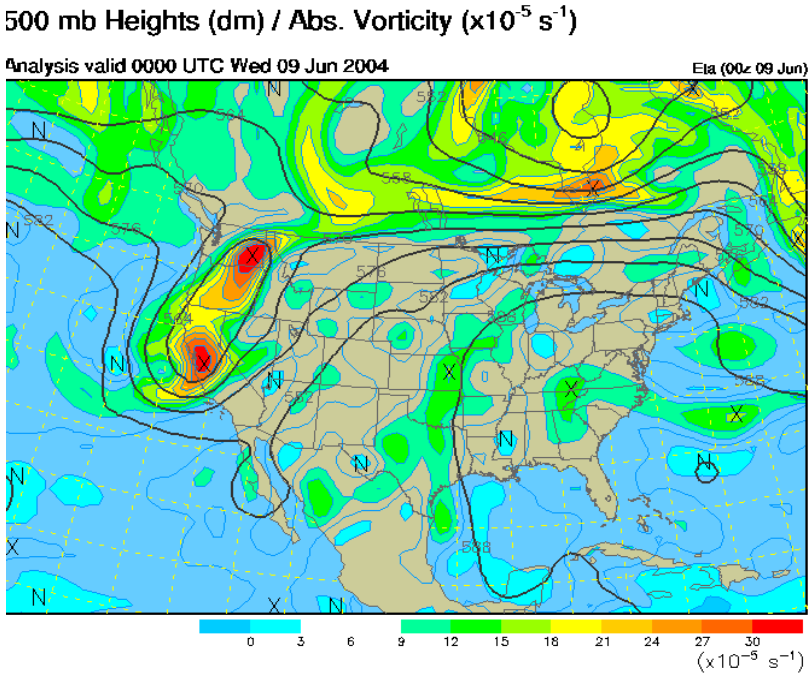

Figure 1. 00Z Wed June 2004. 500 mb Heights and Vorticity

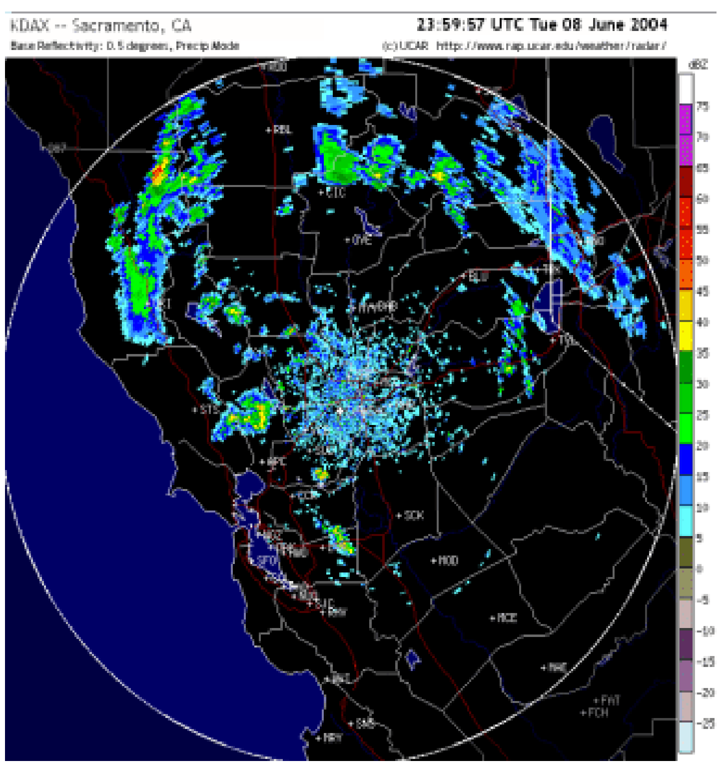

Figure 2. 00Z Wed June 2004. KDAX 0.5 degree Base Reflectivity Image.