EXPERIMENTAL REGIONAL CLIMATE PREDICTION FOR CALIFORNIA

November 1997 - April 1998

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Back in May 1997, as the El Nino was getting stronger, a group of scientists in the Campus Laboratory Collaboration (CLC) Program on California Water Resources met at UCD and decided on an ambitious project of making an experimental seasonal climate prediction for the winter season of 1997-98. UC Davis participated in this experiment as a partner with Lawrence Livermore National Laboratory (LLNL), National Center for Environmental Prediction (NCEP) and UCLA. The climate prediction starts from the Sea Surface Temperature (SST) prediction by NCEP, which drives the global general circulation model of UCLA, which in turn drives the Mesoscale Atmospheric Simulation (MAS) model of UC Davis/LLNL. All of the predictions are made using observed weather and SST data from October 1997. The prediction of the MAS model is made over the area of California using a 20 km grid resolution. The prediction period is from November 1997 to April 1998.

A climate prediction, unlike a daily weather forecast, is not expected to provide correct information on day to day weather. For example, using October 1997 data, the models will not be able to predict if it is going to be clear or rainy on Picnic Day, 1998. The prediction is considered successful if it can distinguish a wet season from a normal or dry season. The MAS model did predict 80 inches of precipitation over both the Northern and Southern Sierra Nevada and 30 inches of precipitation over the Los Angeles area for this six-month period (Figure 1). These values are close to the observed values. However, the model under predicted the amount of precipitation over the Coastal Ranges and the Central Valley. A possible explanation is that the model has a tendency of under predicting the precipitation due to convective clouds, which were quite prevalent this year. The UCLA global model, which drives the UC Davis/LLNL regional scale MAS model, also tends to under predict the amount of moisture available for cloud formation.

The most exciting information contained in the prediction is illustrated by looking at the observed daily precipitation at Bluecayon (Figure 2) and the MAS model predicted rainfall at the same location (Figure 3). The observation shows that the rainy season started with a wet period in November followed by a dry period in December. There were two periods of persistent and heavy precipitation in January and early February, which caused a wide spread flood over the Central Valley. The rainy season lingered on and off after that time and lasted through the end of May. The prediction shows a similar trend. It started with a wet period, followed by a dry period, then periods of heavy precipitation, and finally lingering on and off precipitation until the end of the prediction. The predicted dry period came later and lasted longer than the observed dry period. But overall, the trends of the observed and predicted precipitation are quite similar. Table 1 shows the observed and predicted precipitation over two ten-day heavy precipitation periods. The predicted total precipitation over the two heavy precipitation periods is 31.9 inches, which is very close to the 31.0 inches of the observed total precipitation. The two heavy precipitation periods were observed to be 10 days apart and predicted to be 9 days apart. This amount of precipitation over a 30-day period indicates a potential of flood in the 1997-1998 rainy season and the MAS model correctly anticipated this coming event.

In summary, the model has correctly predicted the following:

1. The 1997-1998 rainy season starts with a wet period followed by a dry period.
2. Two heavy precipitation periods follow the dry period. The total precipitation over these two periods is more than 30 inches at Bluecayon, and this amount of precipitation indicates a great potential for flood in the Central Valley.
3. The rainy season lingers on and off after that through at least the end of April.

This work has shown the skill of the regional climate prediction over the strong El Nino year. During non El Nino years, the signal given by SST is weak and the prediction may not be as accurate. Since the two big floods of 1986 and 1997 happened in non El Nino years, it is important and it is also a challenge to study if these flood events can be predicted several months ahead of time through a concerted effort of SST, global circulation and regional climate predictions.

TABLE 1: Observed and predicted precipitation at Bluecayon for two 10-day heavy precipitation periods.

Bluecayon Precipitation (inches)							
Observed Daily Precipitation				Predicted Daily Precipitation			
Jan 09	1.8	Jan 29	1.8	Feb 09	1.0	Feb 28	1.8
Jan 10	3.3	Jan 30	0.0	Feb 10	3.2	Mar 1	1.0
Jan 11	3.4	Jan 31	0.1	Feb 11	1.7	Mar 2	1.8
Jan 12	0.2	Feb 01	1.4	Feb 12	1.1	Mar 3	0.7
Jan 13	1.7	Feb 02	2.3	Feb 13	0.7	Mar 4	2.3
Jan 14	2.5	Feb 03	2.1	Feb 14	2.5	Mar 5	2.9
Jan 15	1.6	Feb 04	0.5	Feb 15	0.7	Mar 6	3.0
Jan 16	1.0	Feb 05	1.2	Feb 16	1.0	Mar 7	0.6
Jan 17	0.3	Feb 06	2.4	Feb 17	1.1	Mar 8	2.4
Jan 18	1.6	Feb 07	1.8	Feb 18	1.8	Mar 9	0.6
Total	17.4	Total	13.6	Total	14.8	Total	17.1

NOV97–APR98 Total Precipitation

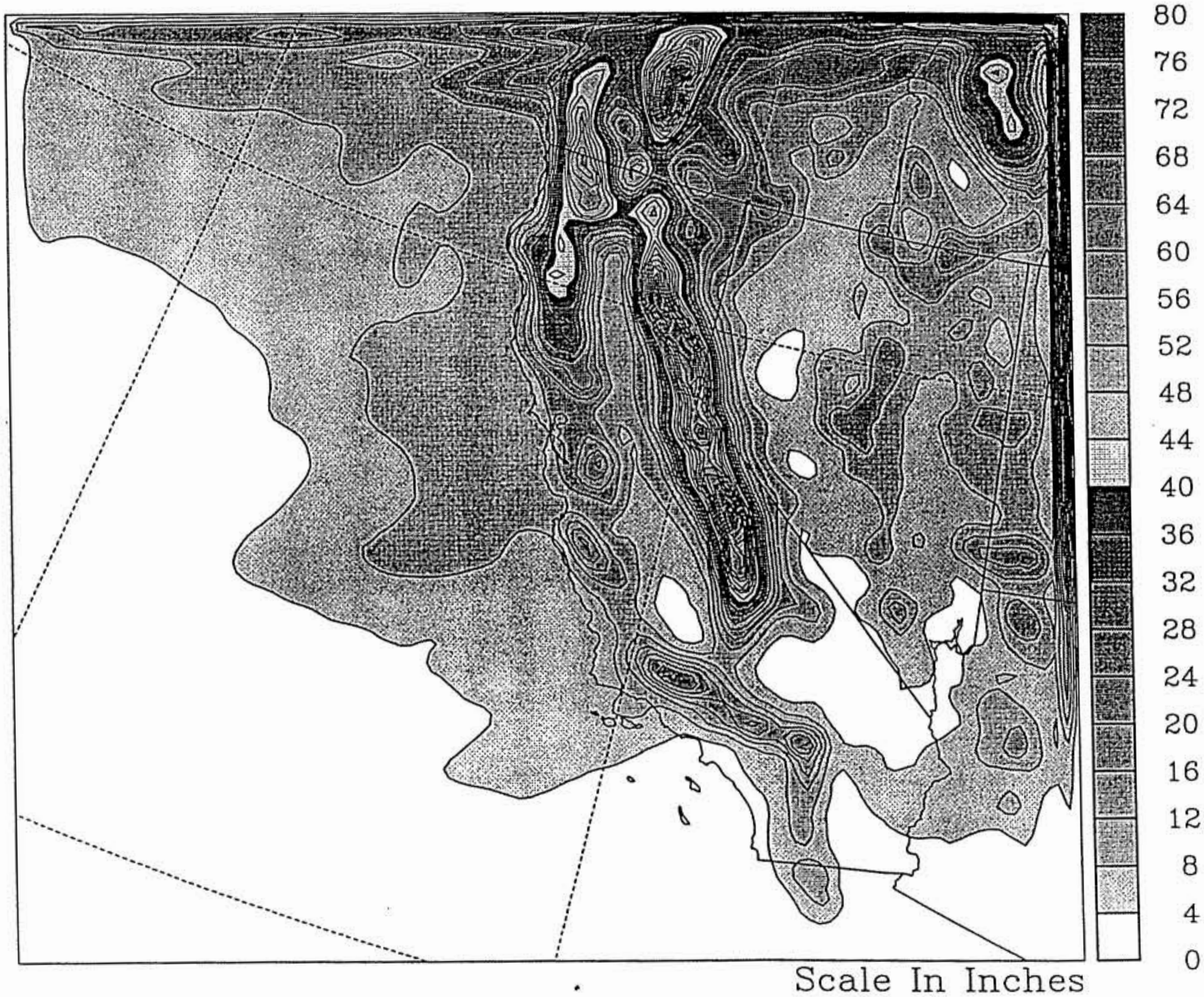

Figure 1. The predicted total precipitation for November 1997 to April 1998.

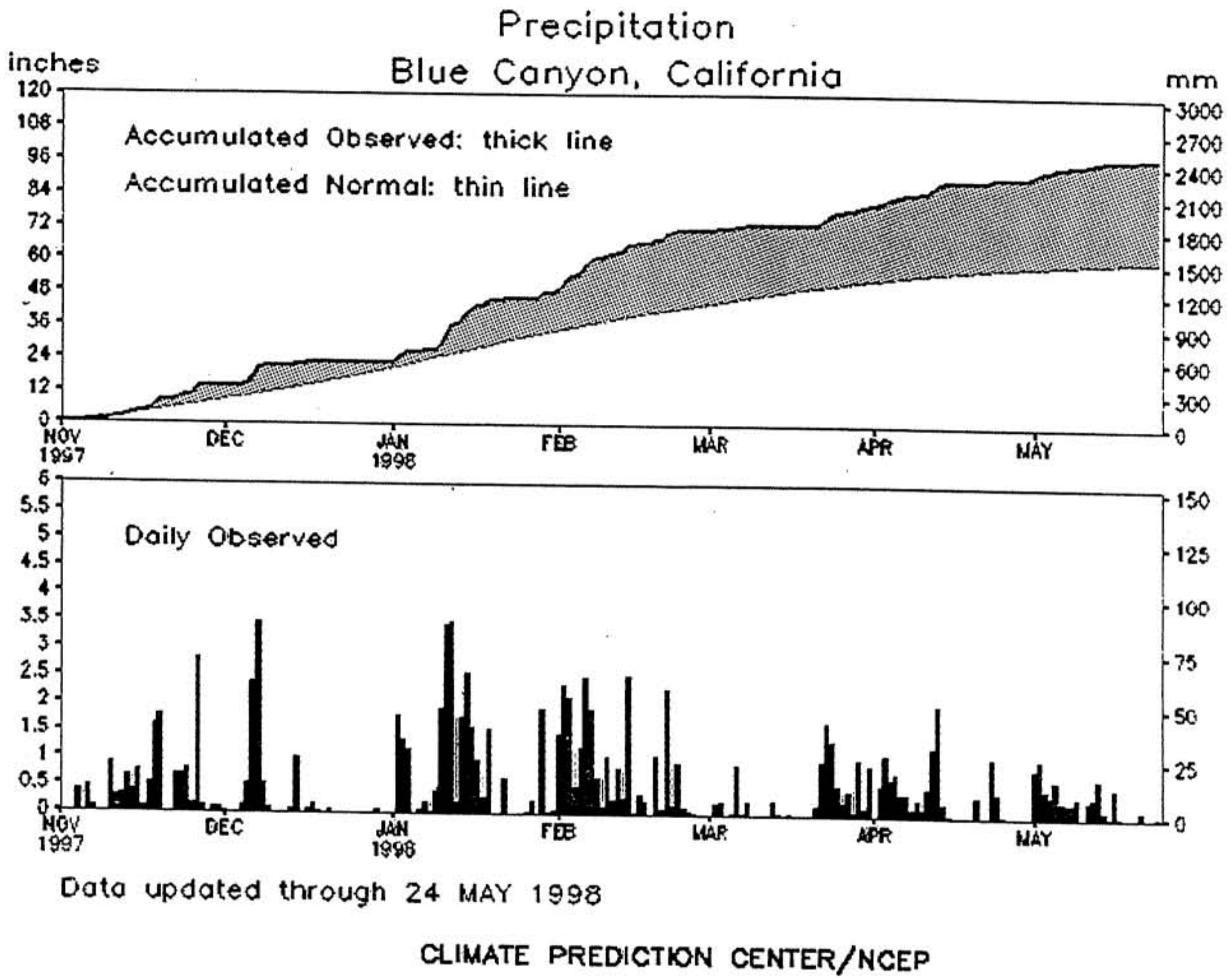

Figure 2. The observed precipitation at Blue Canyon.

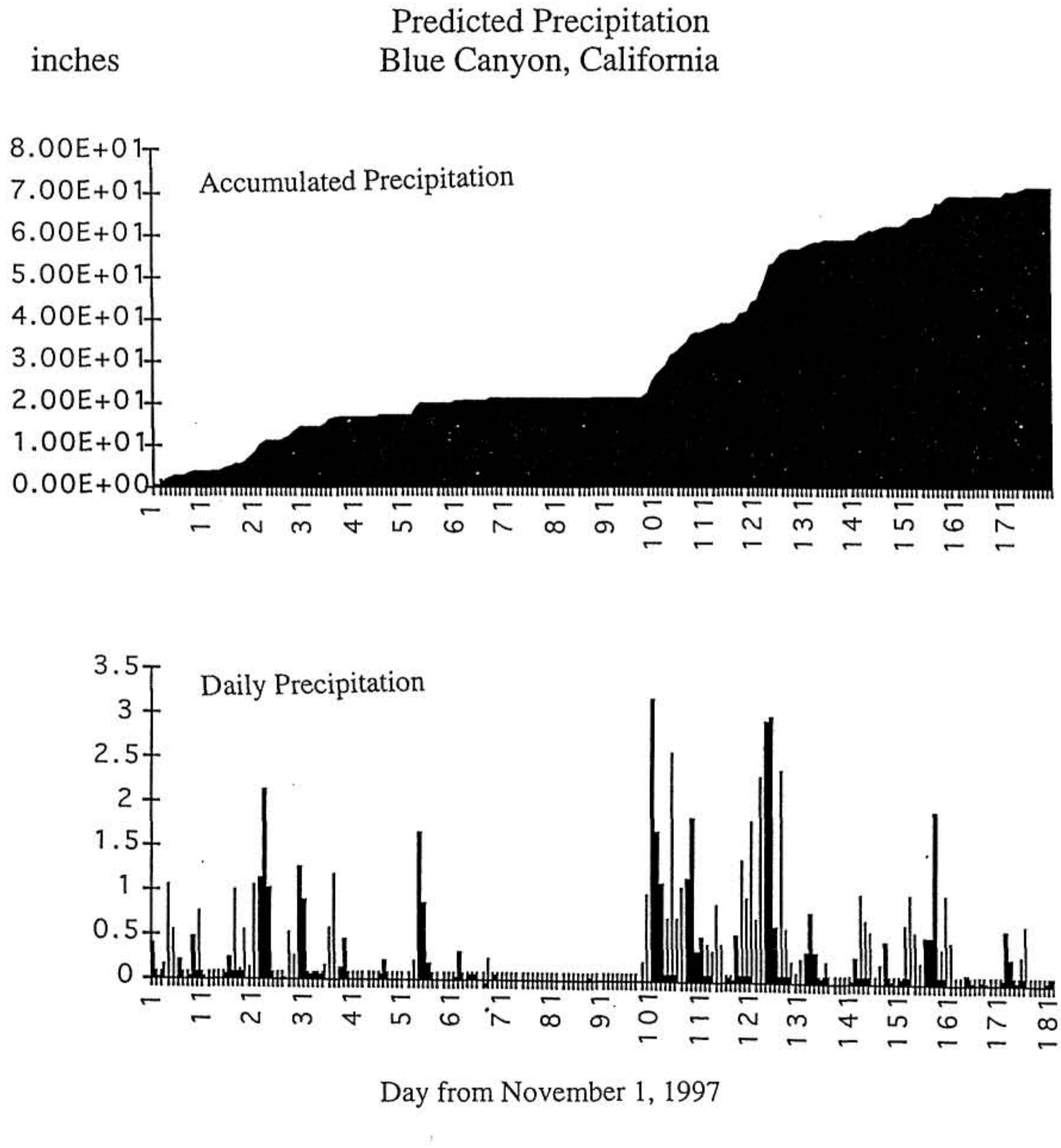

Figure 3. The predicted precipitation at Blue Canyon.