

# **A Chronology of Events Leading to the Accurate Prediction of the Storms of December 24, 2005 - January 3, 2006**

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This photo was taken on the morning of 12/31/05 in the Champion Oaks neighborhood of Roseville.

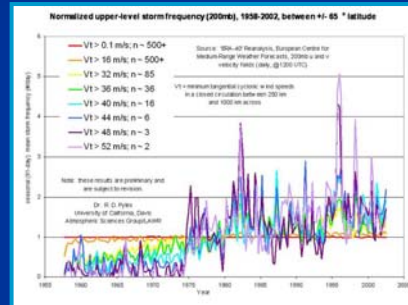
# Agenda

- Look back to last fall
- Pattern recognition
- Pattern change
- Coordinated message
- Coordinated response
- Outcome



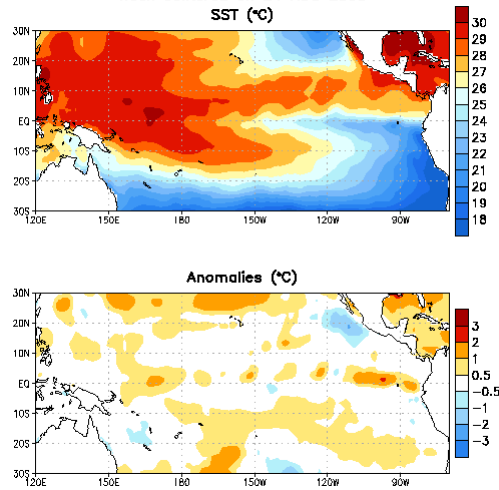
# Climate Outlook

- Greater emphasis being placed on improving long-lead outlooks
- Improved near real time monitoring capabilities



# SST Animation

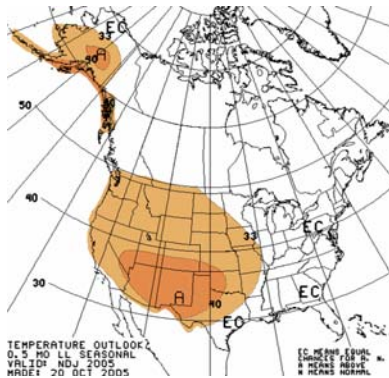
Week centered on 24 AUG 2005



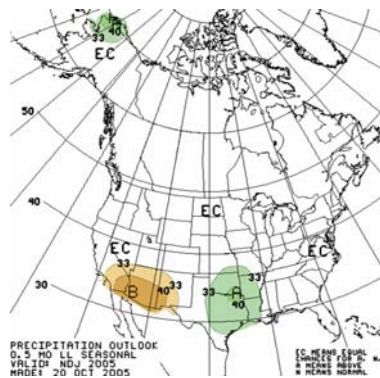
This SST animation shows the cool anomaly stretching across the equatorial east Pacific associated with a transition from ENSO neutral to weak La Niña.

# U. S. Seasonal Outlooks November 2005- January 2006

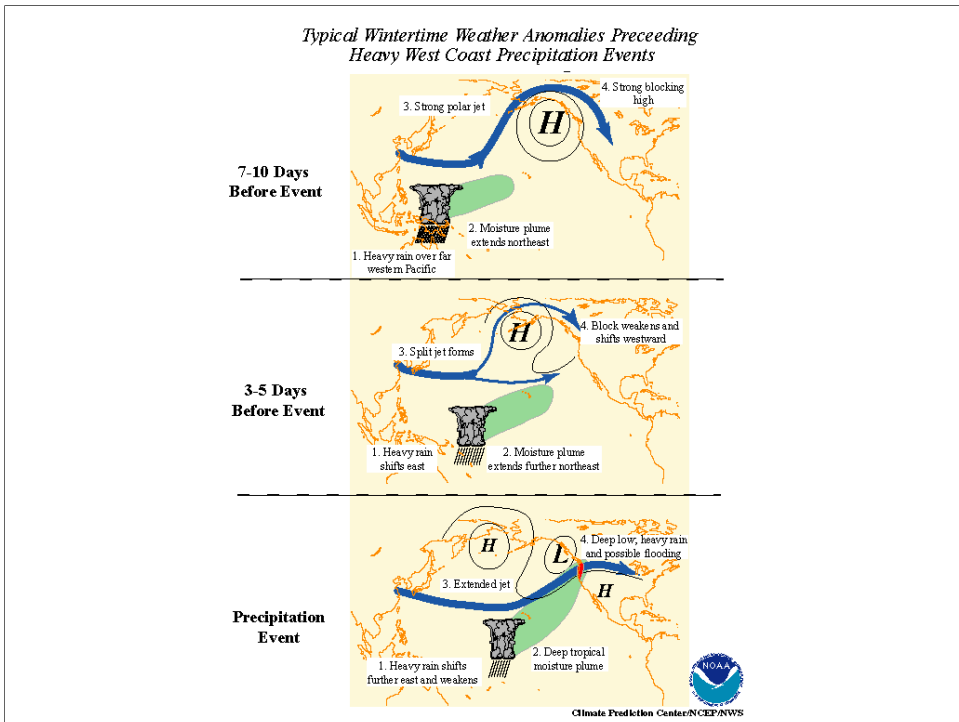
## Temperature



## Precipitation



With a weak La Nina, the correlated CPC forecast for November, December and January showed “Equal Chances” (EC) of above or below normal precipitation for much of the west coast.



With such weak SST anomalies it was recognized that the west coast would be more likely to see a “Pineapple Express” storm system. This is the classic graphic depicting the evolution of a “Pineapple Express” storm.

## So What Did We Know?

- Challenging seasonal forecast
- ENSO neutral (trending cooler)
- No strong indicators on whether we'd be wetter or drier than average
- At best, can hope for about a 2 week lead time before a “big” event
- Almost twice as likely we'll see a “Pineapple Express” storm

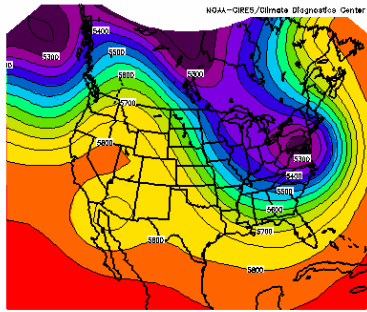


## So What Did We Do?

- Anomalously dry and warm November creating a false sense of security
- Decided to make a “preemptive strike”
- Staff note detailing comparisons with 1995-96 issued on 11/18
- Heightened awareness through information statements and interviews
- Weekly coordination calls between all Western Region offices

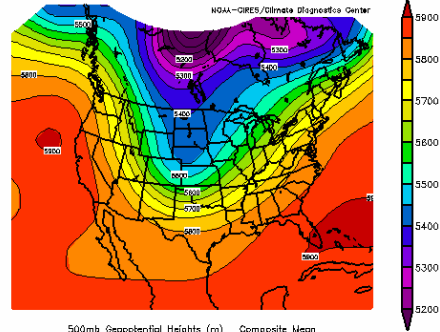


# 500 mb Height Comparisons



500mb Geopotential Heights (m) Composite Mean  
11/15/95 12z  
NCEP/NCAR Reanalysis

**1995**



500mb Geopotential Heights (m) Composite Mean  
11/15/05 12z  
NCEP/NCAR Reanalysis

**2005**

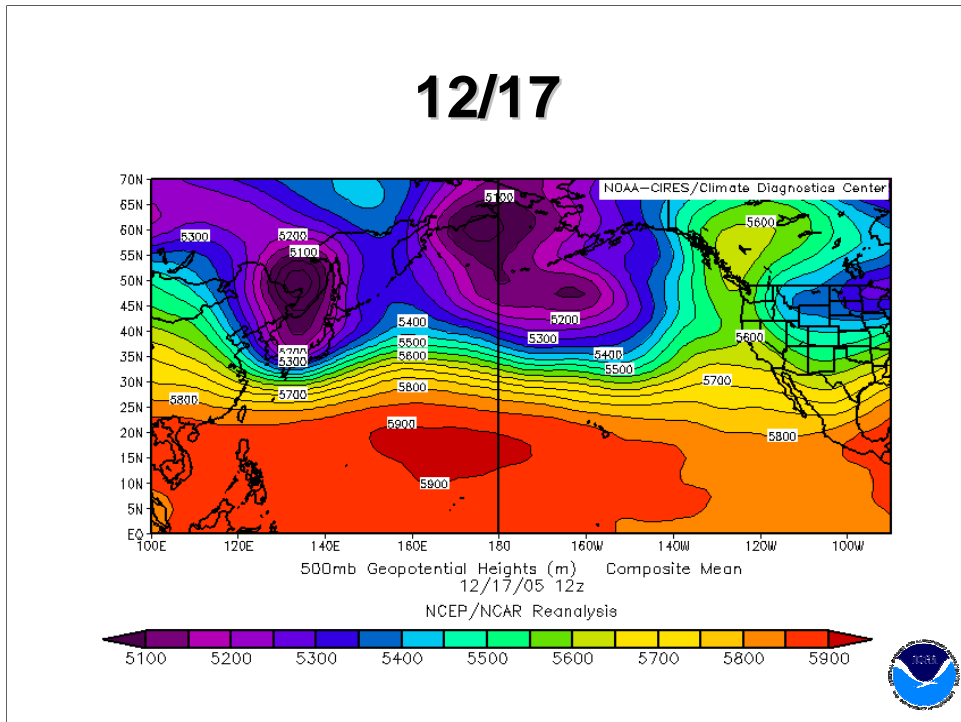


# Significant Pattern Change

Early development recognized  
on December 17<sup>th</sup>

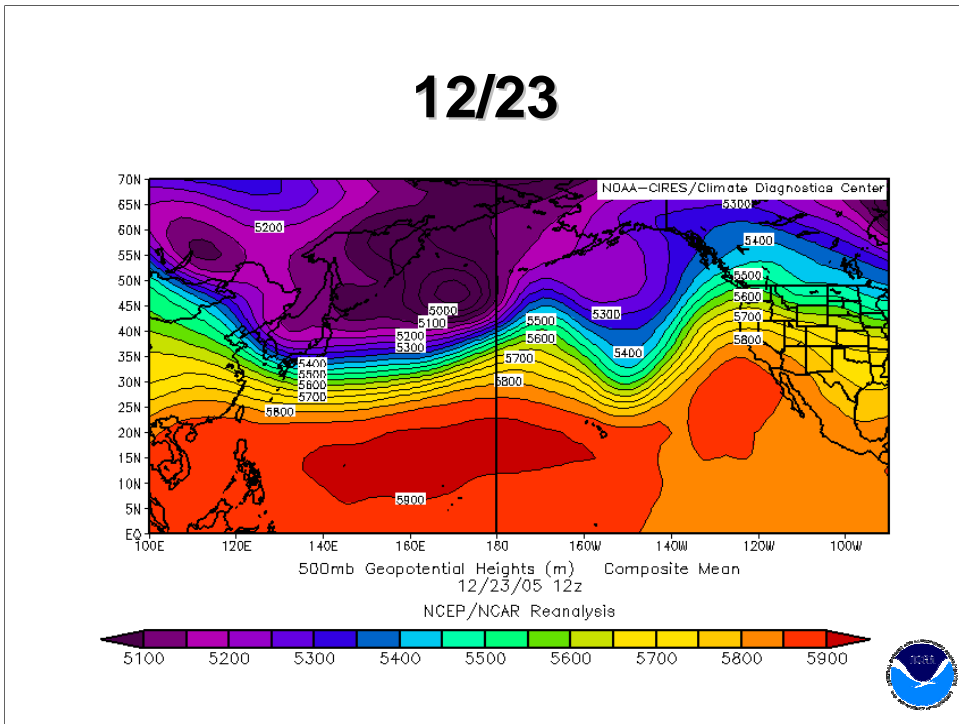


# 12/17

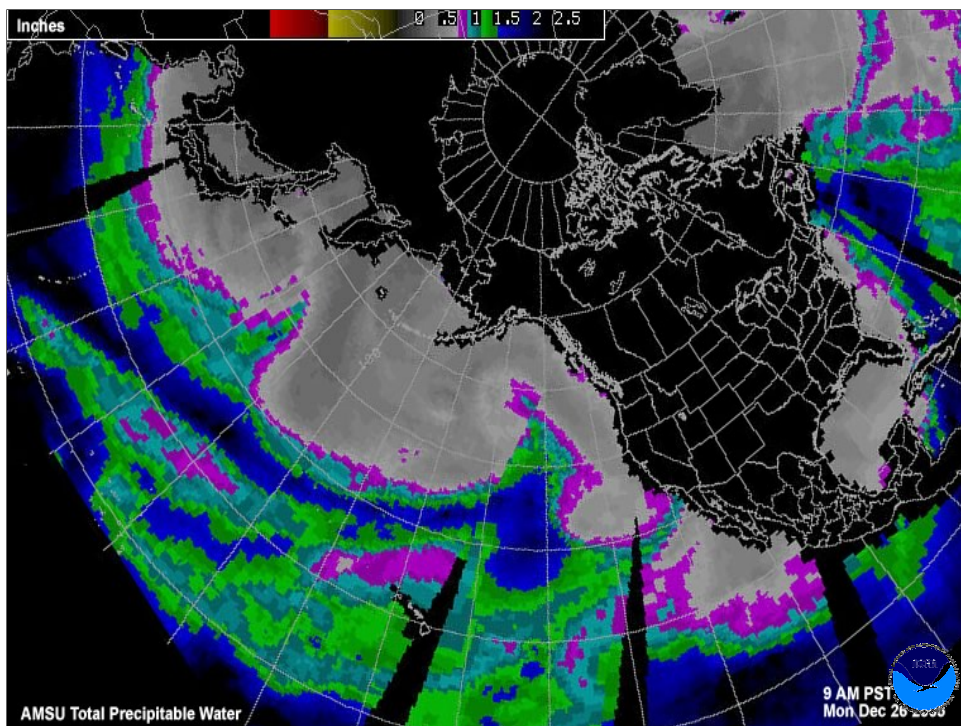


Here we begin to see a weakening of the west coast ridge along with a better consolidation of the EAJ. Notice the significantly colder troughs over the north Pacific.

# 12/23



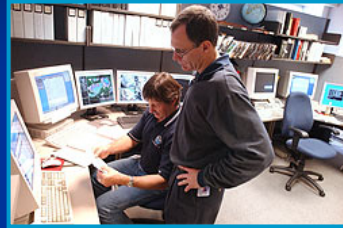
Weak ridging continues, but first in a series of strong troughs can be seen taking shape around 150w. Again, pay particular attention to the consolidated westerly flow west of the dateline.



This TPW product illustrates the extensive feed of tropical moisture into the series of storms described in the previous slide. There is also a significant contribution of subtropical moisture from the eastern Pacific at this time.

# Coordinated Hydrologic Outlook December 23<sup>rd</sup>

...A SERIES OF WET STORM  
SYSTEMS TO AFFECT  
NORTHERN CALIFORNIA IN  
THE UPCOMING WEEK...

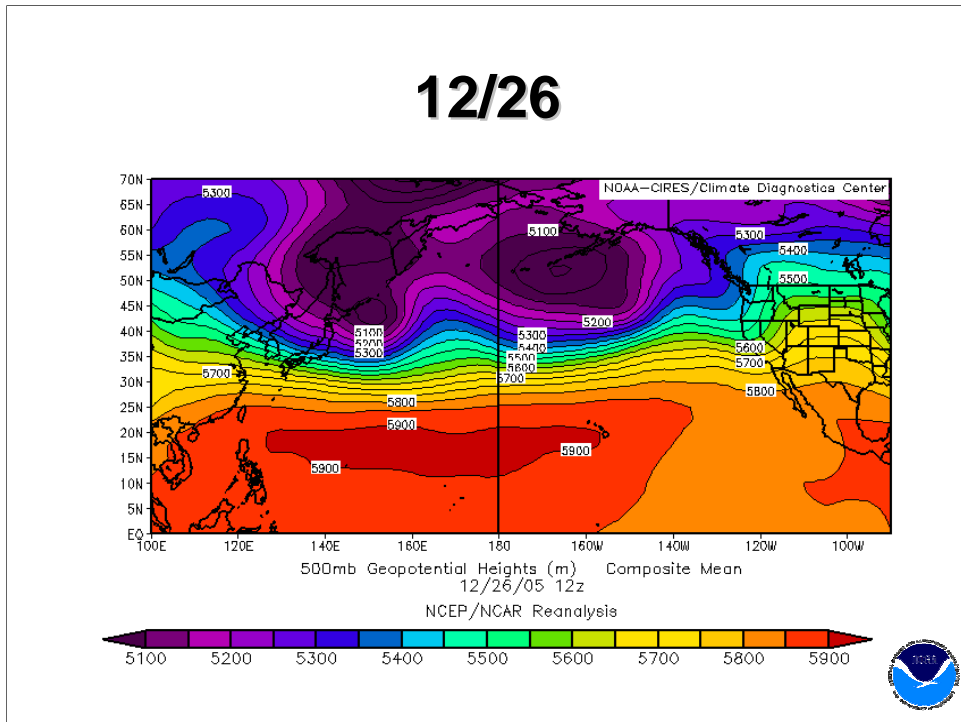


...WET AND WARM STORMS ARE  
FORECAST TO HIT THE AREA  
TUESDAY AND WEDNESDAY  
AND POSSIBLY ON THE NEW  
YEARS DAY WEEKEND AS  
WELL...



A coordinated effort was organized on 12/23 identifying the potential for significant precipitation for the upcoming week. One hydrologic outlook highlighted the potential for 6+ inches of precipitation.

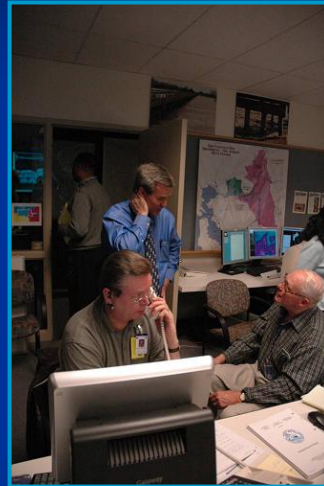
# 12/26



The 500 mb pattern on 12/26 shows the first significant trough impacting the west coast. A series of strong troughs are shown to stretch completely across the Pacific.

December 26<sup>th</sup>

Multi-agency  
effort gets kicked  
into “high gear”



# Flood Operations Center Spins Up



24 hour operations ensue for the Flood Center and for the CNRFC.

## Media Briefings Begin



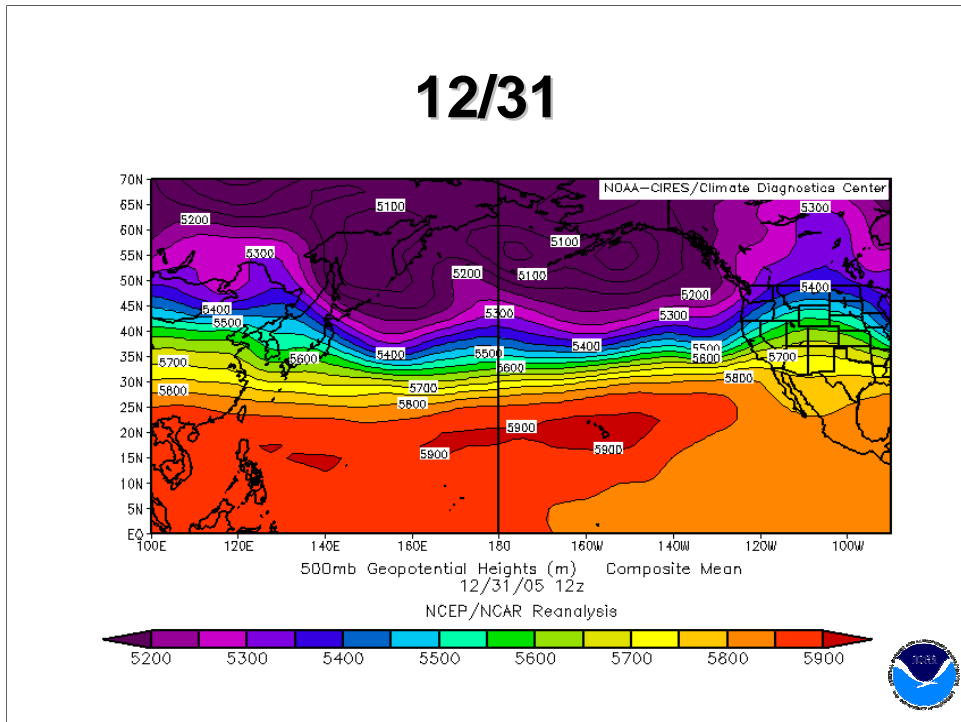
Coordinated media briefing with representatives from NWS, CNRFC, DWR and other state agencies take place twice per day. From the onset it was stressed that the mainstem rivers of interior northern California would be able to handle the sort of rainfall that was being predicted. The focus was then shifted to the smaller rivers and streams as well as those portions of the mainstem rivers without levee protection.

## OES Briefings Begin



One significant concern that was addressed throughout the event was the potential impact on Delta area levees. The main concern stemmed from the possibility of strong winds combining with high tides.

# 12/31



Of particular interest in this image is the implied strength of the jet stream. Winds at the 250 mb level were modeled at speeds nearing 300 mph at this time just east of the dateline. The models performed exceptionally well through this period showing a strong potential for a stalling boundary over northern California. This provided more confidence that our forecasts for extreme rainfall amounts were warranted.

## So What Actually Happened?



Photo taken on the morning of 12/31 in the Champion Oak neighborhood in Roseville.

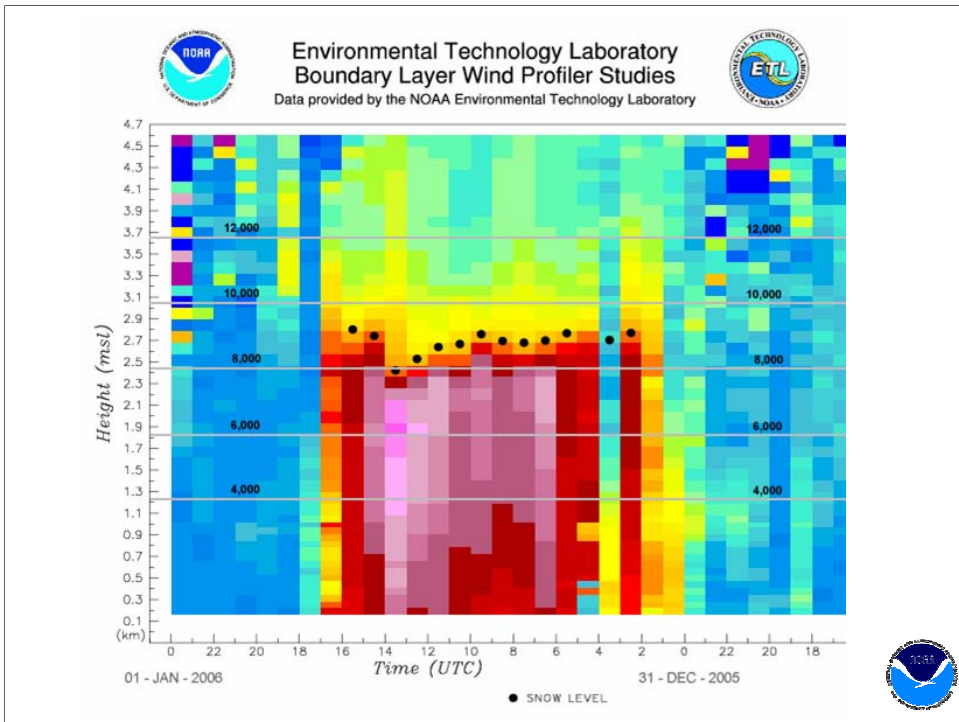
## Storm Totals 12/24 – 01/03

Bucks Lake	27.12 Inches	
Brush Creek	22.05	
Girard	20.08	
Blue Canyon	19.95	SHD – 22% (63.15)
Sugar Pine	16.12	BLU – 29% (68.21)
Pacific House	15.48	OVE – 29% (28.56)
Shasta Dam	13.68	DTS – 39% (18.15)
Oroville Dam	8.40	
Auburn Dam Ridge	7.72	
Sacramento (SAC)	6.40 (7.12E DTS)	

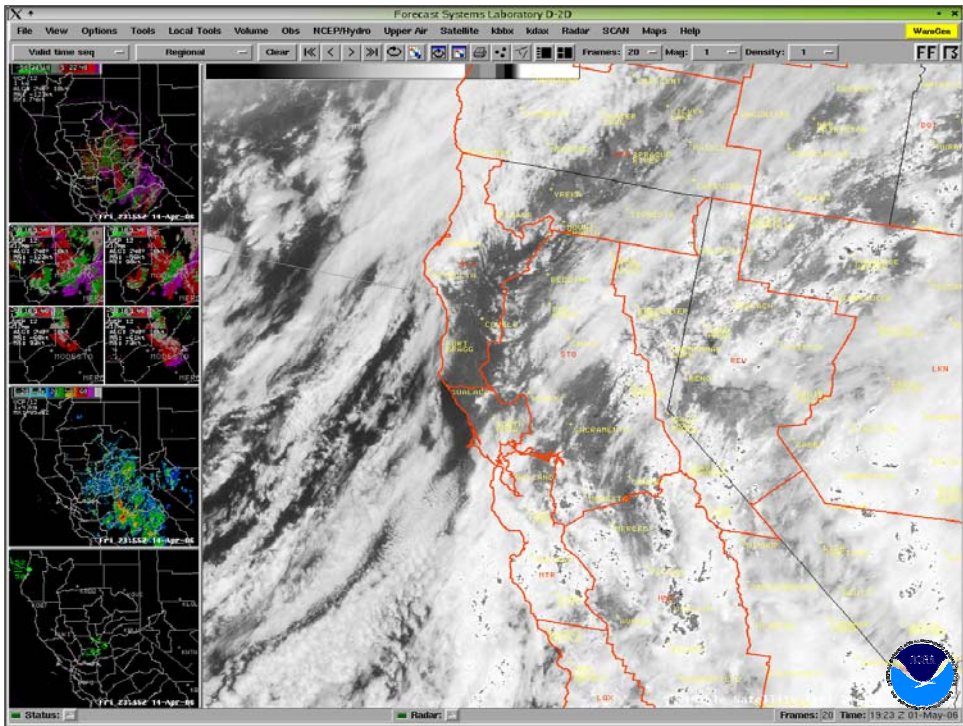


# Newer Technologies Employed





Here is a cross section from the ETL profiler at Sloughouse. The black dots represent the snow level which is based on the change in fall rate of the precipitation.



## Delta Issues...

- Astronomical high tides
- Very low atmospheric pressure
- Increased flows through the Sacramento River system
- Wave action from strong winds (gusts as high as 63 mph at Sacramento International Airport on New Year's Day)



## Lessons Learned

- Very beneficial in getting the word out early
- Proactive approach was imperative
- Excellent multi-agency effort
- Consistent messages
- Reinforced the need for the media to be heavily involved in the process



# Improvements to the Forecast Process Since 1986

- Climate monitoring
- Coordinated agencies
- Technology
- Better methods of dissemination

