

***EUREKA FIRE WEATHER  
ANNUAL REPORT 2008  
For  
NORTHWEST CALIFORNIA***



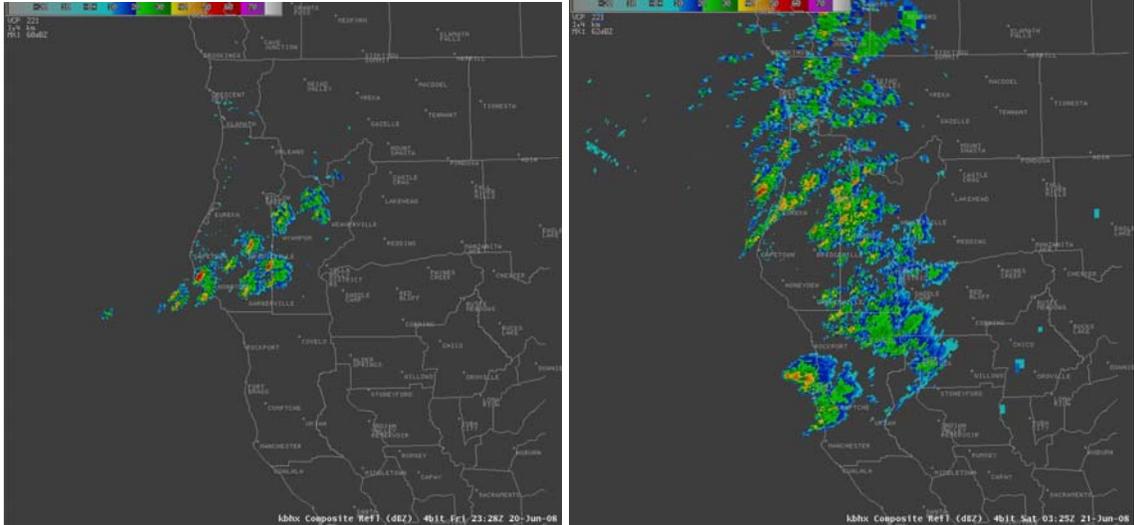
**Hundreds of active fires burn across Northwest California**

**June 26, 2008**

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# I. INCIDENT REVIEW

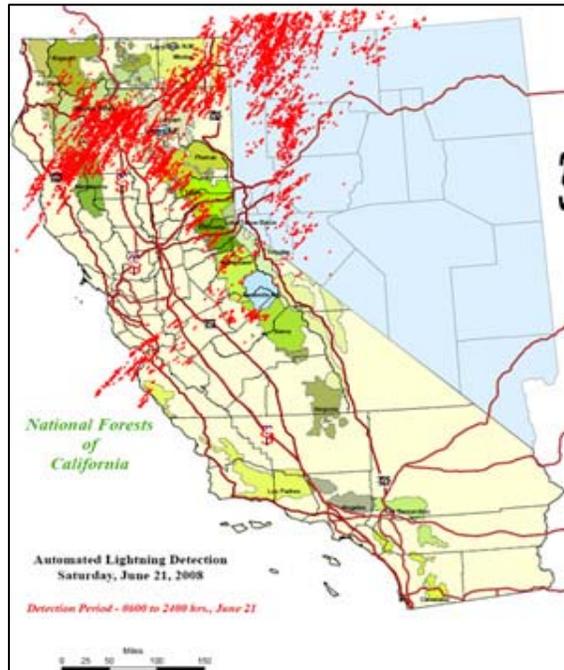
Late in the morning of June 20<sup>th</sup> a small cluster of lightning approximately 200 miles west of Cape Mendocino and light bands of altocumulus castellanus clouds were the only true visible indicators of what would quickly transpire into one of the most extraordinary lightning events in northern California's recent history. Bands of dry thunderstorms developed across southern Humboldt County early in the day Friday... then morphed into numerous and intense storms overnight and into Saturday across the



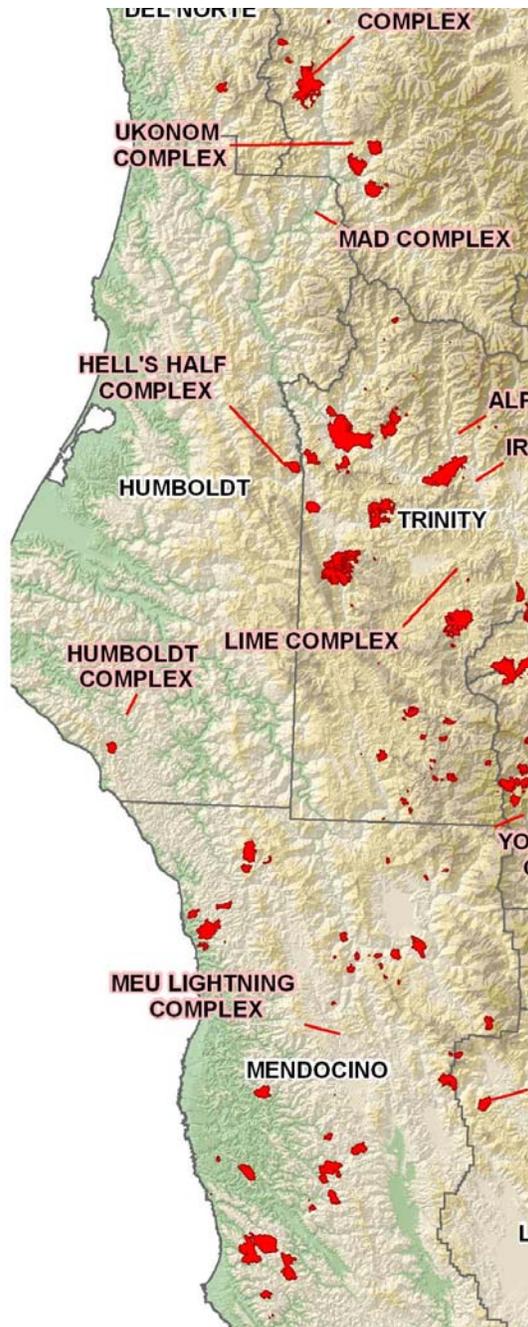
**NWS radar returns showing thunderstorm growth from June 20 (left) to the afternoon of June 21<sup>st</sup> (right).**

entire northern portion of the state. The event culminated late Saturday, resulting in over 6,000 lightning strikes recorded over the two-day period. The extreme lightning sparked nearly 602 separate fire starts within the northern California Geographic Area Coordination Center region. Specifically, across extreme northwest California, the counties of Del Norte, Humboldt, Trinity, and Mendocino, which comprise the Eureka forecast office County Warning Area (CWA), re-corded most of their lightning during the late afternoon of June 20 through the morning hours of June 21, with approximately 1,500 strikes observed.

The massive lightning outbreak resulted in hundreds of individual fires which were eventually combined into large complexes



**Recorded Lightning Strikes during the period of June 20<sup>th</sup> and June 21<sup>st</sup>.**



that are highlighted in the image at left. Within Eureka's area of responsibility 3 of the largest, The MEU Complex, The Iron/Alps Complex and the Lime Complex alone totaled 225,000 acres at a cost of \$172 million dollars. Impacts associated with the resulting wildfires were considerable. Tragically, 12 firefighters perished in connection with the suppression efforts of these fires. In addition to the financial and human costs, other less quantifiable impacts were also associated with the fire activity. Highway closures, evacuations, and three months of smoke, often dense and sufficient to cause health advisories, was experienced from the source of the fires to areas hundreds of miles away, including the coast...where a loss of tourism dollars was obvious. Timber losses, while difficult to ascertain, were undoubtedly high, and burn scars will leave a changed landscape more vulnerable to erosion and flash floods. The aggregate area burned within the Eureka CWA, as a result of these fires, reached some 432,000 acres, or 6% of the total land area. Numerous incident management teams were brought in from across the nation while over 15 incident meteorologists (IMET) were stationed at the various fire camps within Eureka's CWA alone.

This lightning event was among the most significant in California's history, yet it was not forecasted. However, a comprehensive study<sup>1</sup> was conducted by a WFO Eureka senior forecaster attempting quantify the antecedent meteorological and fuel conditions, evolving weather parameters and forecast model data to gain a thorough comprehension of the event. The ultimate

goal of the study was not only to dissect what occurred but to understand why, prior to the event, it was not overly apparent to forecasters across northern California what was about to un-fold. The study is also meant to provide other forecasters and land management officials with points of consideration for sub-sequent events while enhancing situational awareness and decision making processes.

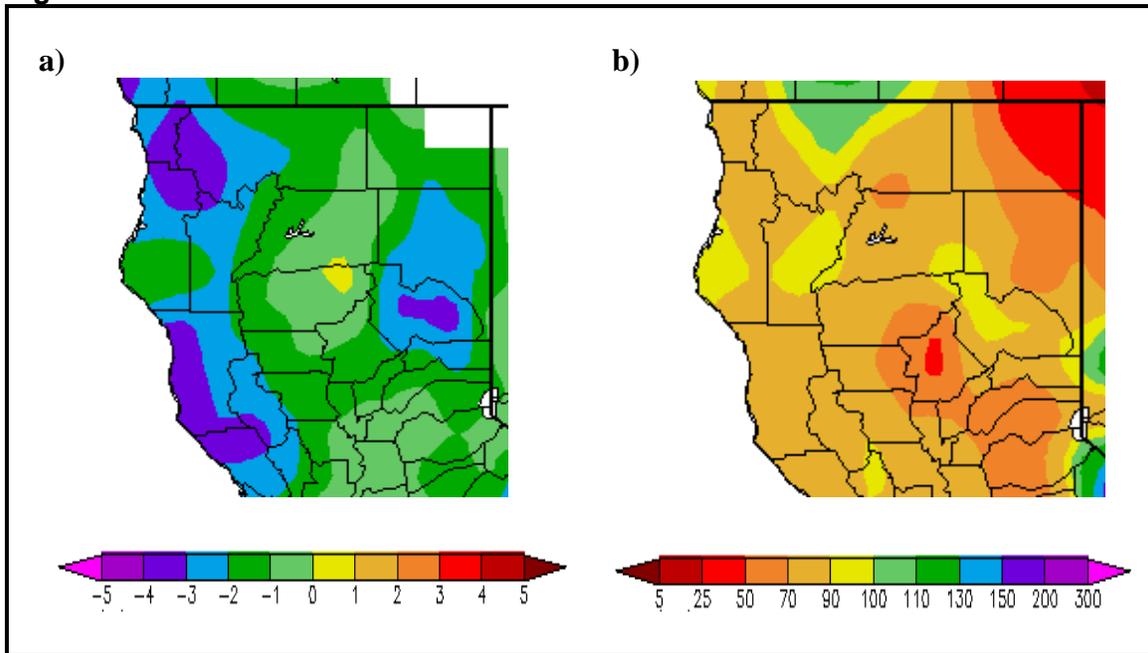
<sup>1</sup> **The Northwest California Lightning Event of June 20-21, 2008**  
 - Mark Burger, WFO Eureka

## II. WEATHER REVIEW

### Winter / Early Spring 2008 (Jan – Mar)

Figure 2.1 shows the three month period falling below normal for both precipitation and temperature. During the first week of January a very strong storm brought heavy rain to Mendocino and northern central Humboldt counties where total rainfall amounts ranged from 2.75 – 4.50 inches. The heavy rains were also accompanied by very strong winds ahead of the dragging cold front where sustained wind speeds along the coast ranged from 35-50 mph. Wind gusts peaked at 70 mph at Kneeland and Schoolhouse RAWS. The middle of the months were a bit more mundane as winter weather was characterized by some weak fronts and a period of clear skies and cold nights and mornings. However, by the end of the month more extreme weather was observed. A series of strong Alaskan storms moved across the Pacific Northwest providing another round of strong winds and heavy precipitation to the region. This was highlighted by a rare and extremely cold front on Sun Jan 27<sup>th</sup> where widespread snowfall was observed along the southern Redwood Coast including Eureka. On January 31<sup>st</sup> a band of very strong thunderstorms moved across the Humboldt bay coast providing enough wind to damage local businesses around Humboldt Hill. Later during the day nearly 1.5 inches of rain fell along the coast bringing the total rainfall for January to over 9 inches...roughly 4 inches above normal for January. February's weather was more benign ending with below normal temperatures and precipitation as high pressure was the dominant feature.

**Fig. 2.1**

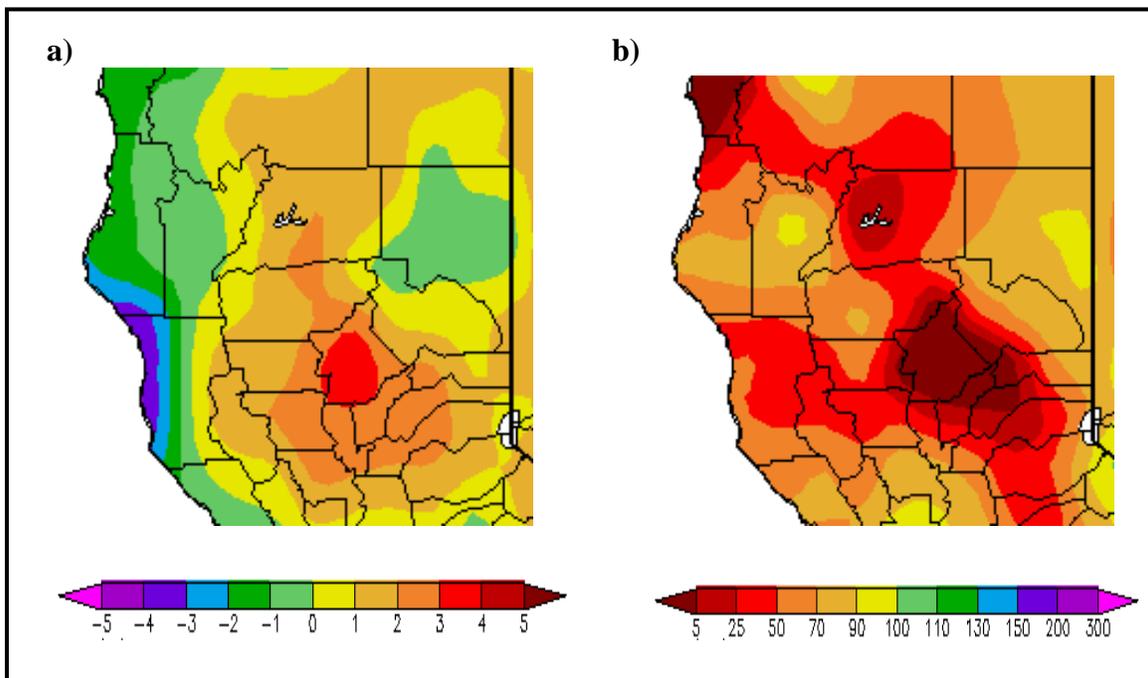


- (a) Departure from average temperature in degrees F for the period Jan 1, 2008 through March 31, 2008.
- (b) Departure from average precipitation in percent for the period Jan 1, 2008 through March 31, 2008.

## Spring / Early Summer 2008 (Apr – June)

The spring and early summer months were un-seasonably dry and a little cooler than normal as depicted by the charts below. The beginning of April saw a rather strong cold front move across northwest California providing strong winds to the coastal areas and the last good dose of rainfall the region would see until the following winter. A strong ridge of high pressure built over northern California and persisted through much of April. A weak front moved across the area late in the month but only light rain amounts were observed along the coast. May was extremely dry with only minimal amounts recorded at the coast. The result would lead to widespread and extremely dry fuels that would see very little help from any additional storms for the remainder of the summer. A strong ridge of high pressure was firmly established over northern California during late May... where record breaking high temperatures were experienced over many observing sites but especially along the coast where strong offshore flow was present. High temperatures recorded along coastal sites of Eureka, Arcata and Crescent City were in the mid 80's on May 16<sup>th</sup>. Although temperatures were slightly below normal during the month of June, precipitation was significantly below normal across the interior for the fourth straight month. A band of light thunderstorms that moved east across the north coast and northern interior zones early in the month and was the only weather feature that would provide less than a quarter inch of precipitation. As discussed in the previous section...the weather highlight of the year occurred on June 20<sup>th</sup> and 21<sup>st</sup> as an anomalous and extremely strong series of thunderstorms moved across a majority of the Eureka forecast area as well as the remainder of northern California.

**Fig. 2.2**



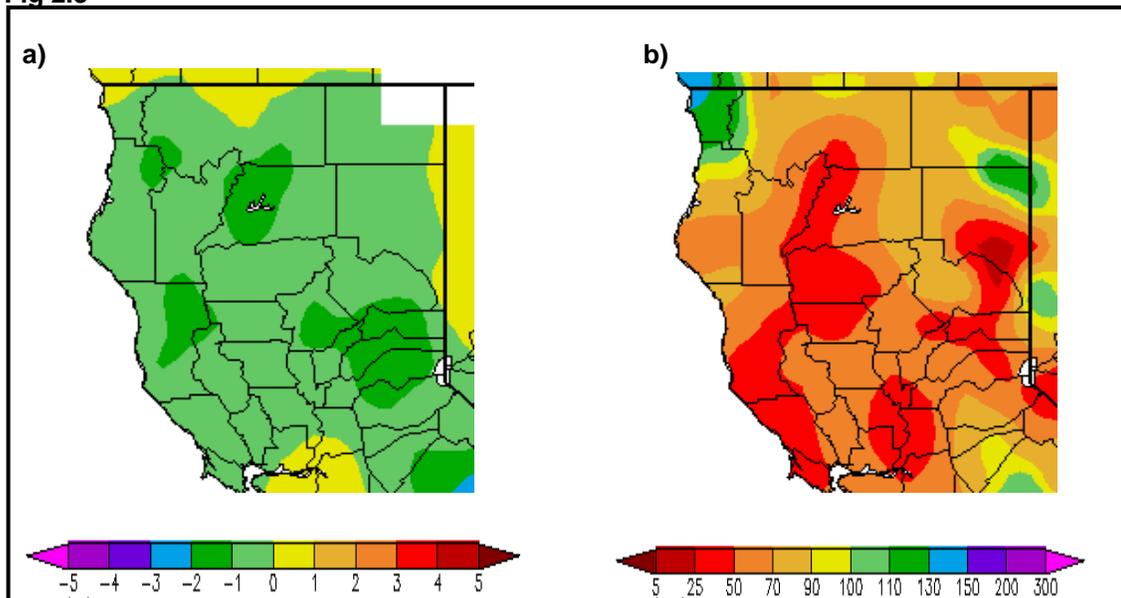
(a) Average temperature departure in degrees F for the period Apr 1, 2008 through June 30, 2008.

(b) Average precipitation departure in percent for the period Apr 1, 2008 through June 30, 2008.

## Late Summer / Early Fall 2008 (July – Sept )

The three months of summer during 2008 were somewhat mundane weather wise. The images below depict cooler than normal temperatures across northwest California. This is likely in response to the massive amount of smoke that was generated by the hundreds of wildfires present across the region. Much of northern California, including the EKA CWA, was inundated with thick smoke well into August...inhibiting solar isolation...resulting in cooler afternoon temperatures but conversely higher minimum temperatures. The smoke may have also reduced the potential for convective development thus may have contributed to a lack of shower activity. During the first week of July a strong ridge of high pressure and resulting offshore flow brought another round of hot conditions to the coast and interior regions. A Red Flag Warning was issued for all interior zones to reflect the hot and dry conditions and the resulting easterly winds. Around the middle of the month strong on-shore flow returned, accompanied by a deep marine layer and cooler conditions to the interior zones. It was during this period that fire suppression efforts were maximized...resulting in many of the fires across Mendocino County to be contained. The remainder of July saw near normal temperatures and little to no precipitation. August saw fairly normal conditions as well except for a convective episode that saw approximately 1000 strikes across the northern central valley and eastern foothills of the Sierra. A few strikes were observed across the EKA CWA. The dry pattern continued into September with little or no shower activity despite the fact that an upper trough of low pressure persisted over the region for much of the month. This helped contribute to below average temperatures for the remainder of the month.

**Fig 2.3**



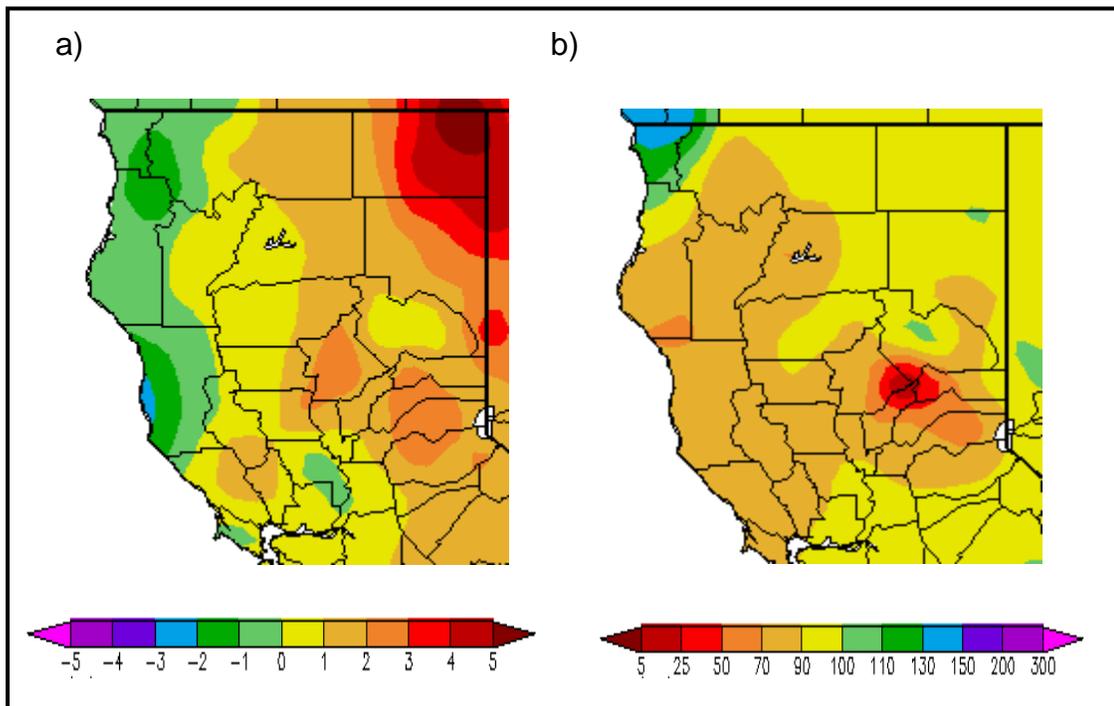
(a) Average temperature departure in degrees F for the period Jul 1, 2008 through Sep 30, 2008.

(b) Average precipitation departure in percent for the period Jul 1, 2008 through Sep 30, 2008.

## Late Fall / Early Winter 2008 (Oct – Dec)

The drought like conditions finally ended during the first week of October as the first winter type Pacific Storm rolled across northern California. This system dropped nearly an inch of rain across a majority of the CWA and helped extinguish what was left of the many fires previously burning across the region. High pressure returned through the middle of the month bringing very nice October weather to the interior but somewhat gloomy conditions to the coast as weak onshore flow supported a deep marine layer. The end of October saw another weak front bring light amounts of rain to mainly the coastal regions. What looked like the beginning of an early and wet winter quickly reverted back to a dry pattern as yet another ridge persisted through the first week of November. The pattern then shifted to a wetter more traditional “early winter” with a series of Pacific fronts providing much needed precipitation to northern California. High pressure returned for the latter portion of the month but precipitation amounts for November were near normal while temperatures were slightly below normal. December was very cool and wet with an abundance of rain and snow producing weather systems affecting a majority of the region. The total for the three month period, as depicted in the images below, was a combination of cooler than normal conditions...with above normal precipitation at the extreme northwest portion of the CWA and slightly below normal elsewhere. Despite above normal precipitation for the month the total for 2008 fell well below normal. Annual temperatures were slightly below normal as well.

**Fig. 2.4**



(a) Average temperature departure in degrees F for the period Oct 1, 2008 through Dec 31, 2008. (b) Average precipitation departure in percent for the period Oct 1, 2008 through Dec 31, 2008.

### III. RED FLAG WARNING VERIFICATION

Eureka Fire Weather issued 32 individual zone Red Flag Warnings during the 2008 fire season. Of the 32 warnings 19 were for Dry Lightning and 13 were for Wind and RH. All warnings were preceded by a watch. Four of the warnings issued during the June 20-21 lightning event were issued with no lead time. There were no events that were considered missed.

- Correct Warnings (Verified) = **20**      POD = Probability of Detection
- Incorrect Warnings (not verified) = **12**      FAR = False Alarm Ratio
- Missed Events = **0**      CSI = Critical Success Index

2008 EKA Verification Summary				
	<u>POD</u>	<u>FAR</u>	<u>CSI</u>	<u>Lead Time (Hours)</u>
Wind/RH	1.0	0.15	0.85	20.50
Wind/RH Regional Goal	0.93	0.24	0.70	11.50
Dry Lightning	1.0	0.53	0.47	14.30
D L Regional Goal	0.74	0.50	0.53	7.00
Combined	1.00	0.38	0.63	12.90
Combined Regional Goal	0.85	0.37	0.64	10.00
Highest Accuracy	1.00	0.00	1.00	

2008 WARNING VERIFICATION BY ZONE								
ZONE	# RFW	Correct RFW	Incorrect RFW	Missed Event	POD	CSI	FAR	# Watch
201	0.0	0.0	0.0	0.0				0.0
202	1.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0
203	4.0	3.0	1.0	0.0	1.0	0.8	0.3	4.0
204	4.0	3.0	1.0	0.0	1.0	0.8	0.3	4.0
211	5.0	3.0	2.0	0.0	1.0	0.6	0.4	7.0
212	4.0	2.0	2.0	0.0	1.0	0.5	0.5	6.0
276	4.0	2.0	2.0	0.0	1.0	0.5	0.5	4.0
277	5.0	3.0	2.0	0.0	1.0	0.6	0.4	6.0
283	5.0	4.0	1.0	0.0	1.0	0.6	0.4	5.0
<b>TOTALS</b>	<b>32.0</b>	<b>20.0</b>	<b>12.0</b>	<b>0.0</b>	<b>1.0</b>	<b>0.63</b>	<b>0.38</b>	<b>36.0</b>

## IV. NFDERS FORECAST VERIFICATION

Verification was performed by comparing forecasted values for each zone then compared against the zone averaged observation at 1300 PDT the following day. The absolute mean difference is then compared to persistence. Persistence is defined as the absolute mean difference between the observation at 1300 PDT the day the forecast was issued and the observation at 1300 PDT the following day. Each zone is comprised of several RAWS observations that are used to calculate the zone averaged values. The zones and RAWS locations are depicted in the map below.

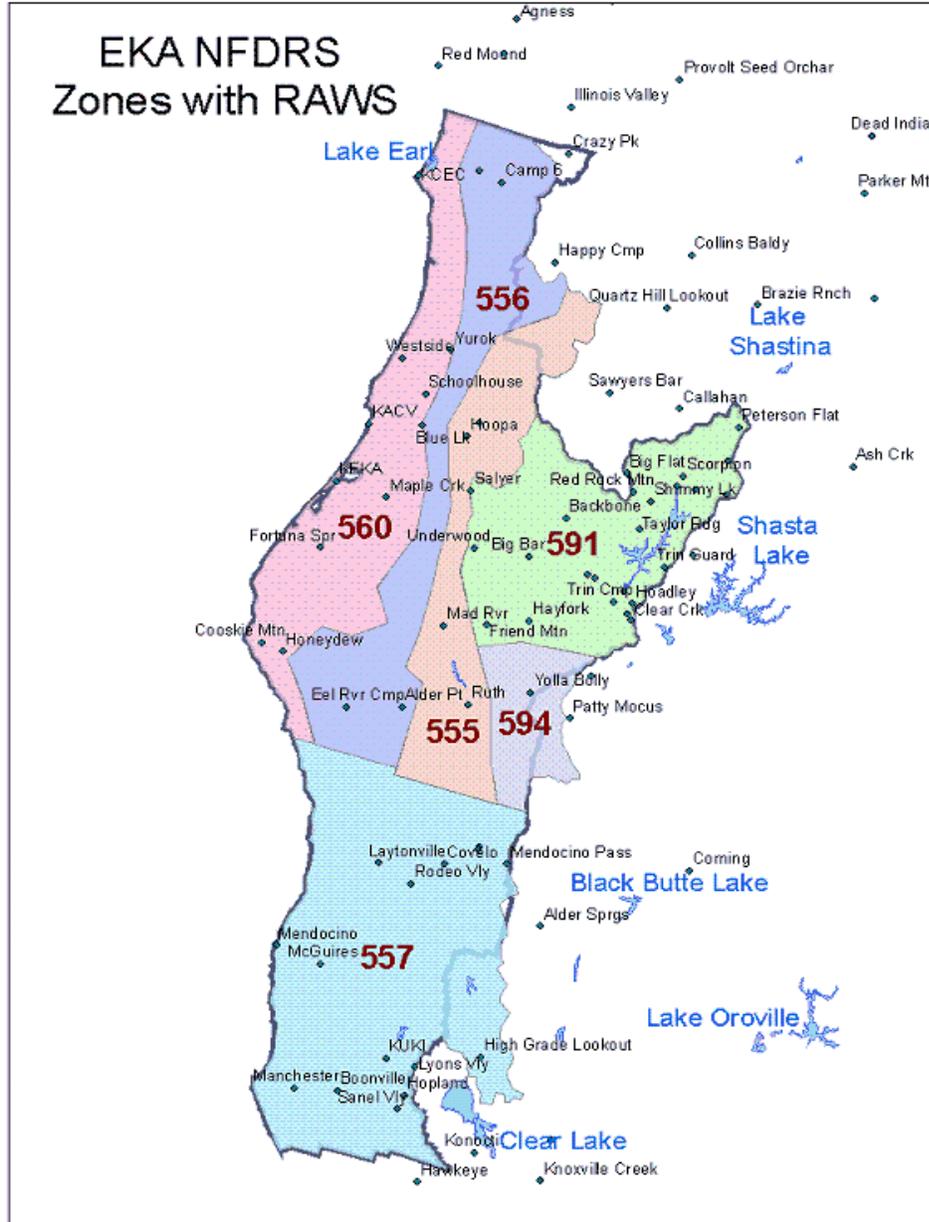


Fig. 4.2 shows that an improvement in temperature forecasts over persistence ranged from 20-30% for all zones last summer, while relative humidity forecasts showed a

general improvement of 10 to 15% over persistence. Although wind speed forecasts remain generally poor compare to persistence, there was significant improvement during 2008 compare to previous years. In addition, forecasters beat persistence in wind forecasts for Zone 560, the coastal zone. Persistence beat the forecasted wind speeds...for the remaining zones while a strong negative bias resides across the interior zones, However, significant improvement was made in this category compared to 2007 as evidenced in Fig. 4.3.

Fig. 4.2

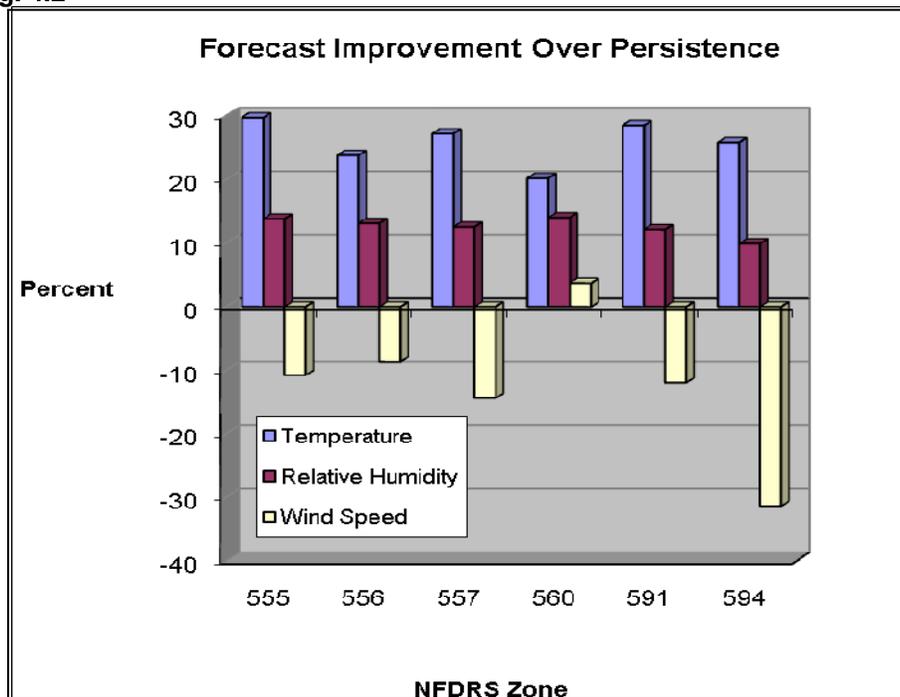
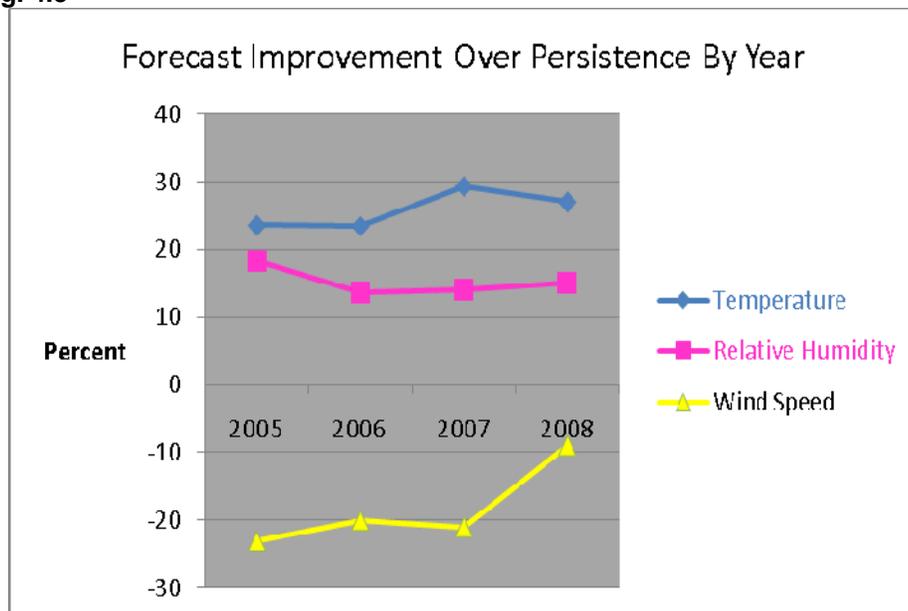


Fig. 4.3



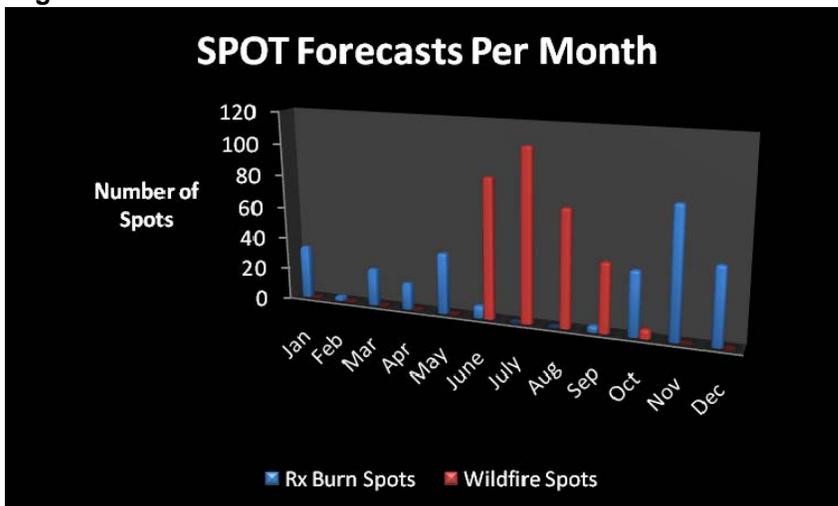
## V. SPOT FORECASTS

The National Weather Service Office in Eureka issued a total of 612 site specific or spot forecasts during the calendar year 2008. This amount represents nearly 100% increase over 2007 and is slightly more than 4 times the '03 – '07 average amount of 164 spots. The continued trend of increasing spot forecast requests is primarily attributed to Forest Service regulations requiring spot forecasts for all burn activity. However another major factor attributing to the striking difference during 2008 was the impact of wild fires that plagued the region last summer. Roughly half of all spot requests were associated with fires burning in late June and most of July. Most prescription forecast requests were for small burns or pile burns for the Forest Service. The average “turn-around-time” for all spot forecasts was 32 minutes. The turn around time showed a decrease of 3 minutes from 2007. The reduction in turn around time may be attributed to an increase in forecaster experience with new and faster technology.

**Table 4.1**

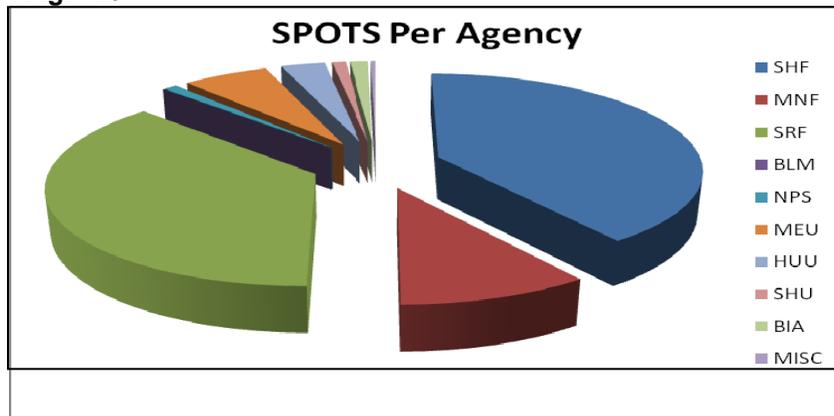
Spots for Wildfires	<b>316</b>
Spots for Project Burns	<b>296</b>
Spots for Hazmat	<b>0</b>
Misc. / Training Spots	<b>0</b>
Average Turnaround Time For All Spots	<b>31 minutes</b>
Total Spots	<b>612</b>

**Fig 4.2**



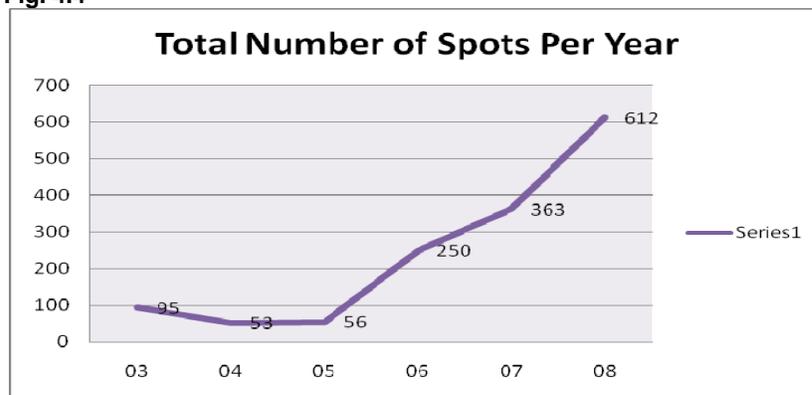
Turn around time is defined as the elapsed time between a spot forecast request receipt (or notification) and forecast transmission. Similar to previous years, the majority of spot forecast requests came from the USFS and CAL Fire with less than 5% distributed between the national and state parks and BIA.

Fig. 4.3



One interesting note in reference to the 2008 distribution between agencies was that the Shasta-Trinity NF (SHF) requested more spot forecasts than the Six Rivers NF (SRF) which, traditionally, leads requests within the Eureka CWA. The main reason for the shift was that 2 of the larger fires (Lime Complex and the Iron Alps Complex) were managed by the SHF and required many spot forecasts both prior and after IMETs were dispatched to the assigned incident management teams. In addition, however, the number of spot forecast requests for prescription burns showed a marked increase over previous years. On average the SHF requested about 10 Rx spots per year from WFO Eureka...but during 2008 that number spiked to 31.

Fig. 4.4

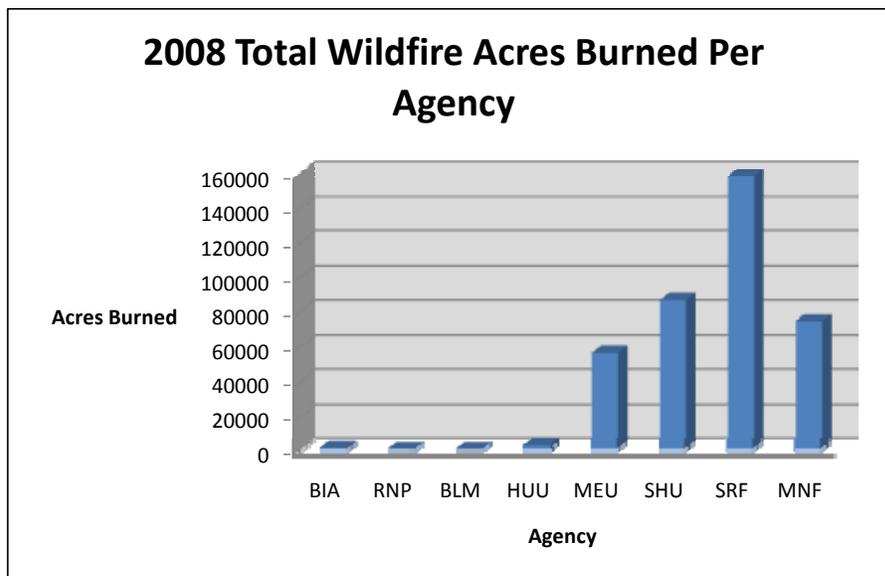


The annual trend of increasing spot forecasts requests at WFO Eureka is significant. Spot forecast records for WFO Eureka began in 2003. Between 2003 and 2007 the average number of spot forecast requests showed little variation until 2006. At that time the combination of administrative requirements on be half of the Forest Service and a higher number of large wildfires within the CWA were primarily responsible for a marked increase. As shown in the graph above, since 2005 the number of requests have continued to steadily climb. The average number of spot requests during the 2003-2007 period was 164 per year. Including the staggering increase during 2008 boasts a new yearly average ('03 – '08) of 238.

## VI. WILDFIRE BURN ACTIVITY

Considering the amount of wildfire activity across the region during the 2008 summer prescription spot requests and the number of acres burned were nearly identical to the previous year. Wildfire acres burned was a much different story as discussed in previous sections. The following table illustrates the major fires within the Eureka CWA and the amount of acres burned.

<u>Incident</u>	<u>County(s)</u>	<u>Acres</u>	<u>Dates</u>
Iron/Alps Complex	Trinity	106,000	June-Sept
Yolla Bolly Complex	Trinity	90,000	June-Aug
Lime Complex	Trinity	65,000	June-Aug
Mendocino Complex	Mendocino	53,000	June-July
Bear Wallow	Del Norte/Sisikou	44,500	June-Sept
Ukonom Complex	Humboldt	29,000	June-Aug
Hells Half	Humboldt/Trinity	15,000	June-July
Blue 2	Del Norte/Sisikou	10,000	June-July
Mad	Humboldt/Mendo	8,700	June-July
Soda Complex	Mendocino	8,600	June-July
SRF Lightning Complex	Humboldt	1,500	June-July
Humboldt Complex	Humboldt	1,300	June-July
<b>Total</b>		<b>432,000 acres</b>	



The graph above depicts the total acres burned by wildfires during 2008 delineated by agency responsibility. Some direct protection areas such as MNF and SHU overlap into the Sacramento CWA, thus not all of the acres shown above were solely within the Eureka CWA.

## VII. ON-SITE METEOROLOGICAL SUPPORT

Due to the extreme and extensive fire activity within Eureka's area of responsibility numerous incident meteorologists (IMET) were requested by the Type 1 and Type 2 teams managing suppression activities. Incident Meteorologist (IMET) support from WFO Eureka totaled 48 days. Eureka currently has two certified IMET's, Jeff Tonkin and Mark Burger. IMET Jeff Tonkin was dispatched to 3 separate incidents while Mark Burger was dispatched to 1 incident. (Fig. 7.1). Table 7.2 lists the IMETs from other National Weather Service WFO's that were dispatched to fires within the CWA during 2008.

**Table 7.1**

<b>WFO Eureka IMET Dispatches</b>				
<u>IMET</u>	<u>Incident Name</u>	<u>Location</u>	<u>Dates</u>	<u>Local WFO</u>
Jeff Tonkin	MEU Complex	Ukiah, CA	Jul 7 - Jul 19	EKA
Mark Burger	Hells Half Complex	Willow Creek, CA	Jul 9 - Jul 23	EKA
Jeff Tonkin	Hells Half Complex	Willow Creek, CA	Jul 23 - Jul 30	EKA
Jeff Tonkin	Lime Complex	Hayfork, CA	Jul 31 - Aug 13	EKA

**Table 7.2**

<b>Other WFO IMETs Dispatched Within WFO Eureka's CWA</b>				
<u>IMET</u>	<u>Home WFO</u>	<u>Incident Name</u>	<u>Location</u>	<u>Dates</u>
Colleen Decker	Boise, ID	Ukonom	Orleans, CA	June 24-July 9
Dennis Gettman	Medford, OR	Lime Complex	Hayfork, CA	June 23-July 8
Steve Ippoliti (Trainee)	Elko, NV	Lime Complex	Hayfork, CA	June 23-July 8
Mark Struthwolf	Salt Lake City, UT	Lime Complex	Hayfork, CA	July 3-July 17
Julia Ruthford	Portland, OR	Iron / Alps Complex	Junction City, CA	June 23-July 8
Mark Pelleritio (Trainee)	Charleston, WV	Iron / Alps Complex	Junction City, CA	June 23-July 8
Chris Jordan	Reno, NV	MEU Complex	Ukiah, CA	June 23-July 8
Dave Lipson	Riverton, WY	Hells Half Complex	Willow Creek, CA	June 28-July 11
Pat Gilchrist	Glascow, MT	Iron / Alps Complex	Junction City, CA	July 5-July 9
Jim Wallman	Reno, NV	Iron / Alps Complex	Junction City, CA	July 9-July 23
Jennifer Via (Trainee)	Missoula, MT	Iron / Alps Complex	Hayfork, CA	July 10-July 20
Chuck Redman	Boise, ID	Soda Complex	Upper Lake, CA	July 3-July 17
Mike Richmond	Fairbanks, AK	Soda Complex	Upper Lake, CA	July 11-July 17
Dan Borsum	Billings, MT	Lime Complex	Hayfork, CA	July 14-July 30
Joel Rothfus	Miami, FL	Lime Complex	Hayfork, CA	July 25-Aug 8
Jennifer Via (Trainee)	Missoula, MT	Lime Complex	Hayfork, CA	July 21-July 29
Andy Church	Riverton, WY	Ukonom	Orleans, CA	July 17-Aug 1
Dan Harty	Hanford, CA	Panther Fire	Orleans, CA	July 29-Aug 13
Dan Bird	Jackson, MS	Iron / Alps Complex	Junction City, CA	Jul 23-Aug 4
Steve Goldstein (Trainee)	Sacramento, CA	Lime Complex	Hayfork, CA	Aug 2-Aug 12
Larry Vanbussum	Boise, ID	Iron / Alps Complex	Junction City, CA	Aug 4-Aug 19

## VIII. EUREKA FIRE WEATHER PROGRAM SUMMARY

The following table illustrates a comparison of activity and performance for the period 2003 through 2008.

ANNUAL COMPARISON TABLE									
	2003	2004	2005	2006	2007	2008	2009	Total	average
Red Flag Warnings Issued:	14	5	3	16	2	32		72	12
Dry Lightning:	1	0	0	3	2	19		25	4.1
Wind/RH	13	5	3	13	0	13		47	7.8
Average Lead Time (hr)	13	16.1	9	13.6	0	17		58.7	9.78
Fire Wx Watch	5	4	4	10	2	36		61	10.2
Dry Lightning:	4				2	19		25	4.2
Wind/RH	1	4	4	10	0	17		36	6
Average Lead Time (hr):	16	33.5	14.5	29.5	0	59.5		153	30.6
POD	1.0	1.0	1.0	1.0	0.0	1.0		4.0	0.83
CSI	0.71	1.0	1.0	0.86	0.0	0.63		4.20	0.70
FAR	0.29	0.0	0.0	0.14	1.0	0.38		0.86	0.30
Spots Issued	95	53	56	250	363	612		1429	238
Wildfire Spots	85	17	14	91	57	316		580	96
Rx Spots	10	34	39	158	306	296		843	141
Turn-Around Time (min.)	70	56	37	52	35	31		281	47
Total IMET Days	45	28	23	106	63	48		313	51
Mark				53	28	14		95	32
Jeff	33	28	23	53	35	34		206	34
Total IMET Days in CWA	11	6	0	127	7	?		?	?

## IX. TRAINING, EDUCATIONAL, OUTREACH AND FIELD ACTIVITIES

The following table summarizes various fire weather activities which the Eureka fire weather staff participated in during the 2008 calendar year.

Dates	Activity	Agency/User/Audience	Representative	Location
Mar 10	Agency Meeting	SHF	Mark, Jeff	Redding, CA
Mar 17	Taught RX-300	SRF	Nancy	Eureka, CA
Mar 17-21	IMET Workshop	NWS	Mark, Jeff	Boise, ID
Mar 25-26	CA AOP Meeting	Multiple Agency	Nancy, Jeff	Redding, CA
Apr 8-9	Taught S-290	CALFIRE	Jeff	Arcata, CA
Apr 23-24	User Meeting	SRF, SHF	Jeff	Mad River, Weaverville
Apr 23-24	SONCAL	Multiple Agency	Mark	Ferndale, CA
May 1	User Meeting	Multiple Agency / Fortuna ECC	Mark	Fortuna, CA
May 13	Familiarization Trip	SRF / Rx Burn	Bryan, Rebecca	Willow Creek, CA
May 13	Start Fire Season	EKA	Staff	Eureka, CA
May 13-15	HAZMAT Oil Drill	Multiple Agency	Jeff, Rebecca	Crescent City, CA
May 28	RDD Station Visit	EKA Staff	Brenda Belongi	Eureka, CA
June 19-20	User Meeting	MNF, BLM, CALFIRE	Mark	Mendocino County
July 7-19	IMET Dispatch	MEU Complex	Jeff	Ukiah, CA
July 9-23	IMET Dispatch	Hells Half Complex	Mark	Willow Creek, CA
July 23-28	IMET Dispatch	Hells Half Complex	Jeff	Willow Creek, CA
July 31 - Aug 14	IMET Dispatch	Lime Complex	Jeff	Hayfork, CA
Aug 4	Familiarization Trip	Lime Complex	Treena, Brian, Mike	Hayfork, CA
Sep 16	RDD Station Visit	EKA Staff	Basil N.	Eureka, CA
Nov 12-13	CA UAT Meeting	Multiple Agency	Mark, Jeff	Sacramento, CA