

# **Pilot Balloon Observations, 2012 - Jefferson County Smoke Management**

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## **Abstract**

Pilot Balloon (Pibal) observations are a major component of the daily decision-making process used in managing open field burning of grass seed and wheat fields in Jefferson County. Pibals are used to track upper level wind direction and speed. Pibals are released daily from the Central Oregon Agricultural Research Center between 10:30 am and 3:30 pm. Pibal releases at potential burn sites allow for more accurate decision-making under marginal conditions when errors are most likely to occur. The Pibal is an essential tool in minimizing adverse smoke impacts on local communities.

## **Introduction**

The current Pibal program began in 1998 and incorporates weather balloon data into information received by the Jefferson County Smoke Management Coordinator receives the Oregon Department of Agriculture (ODA) Weather Center. Pibal data compiled with Real-Time Weather Data, courtesy of the US Bureau of Reclamation AgriMet Network, can be found on the Jefferson County Smoke Management website. The objective is to provide real time wind patterns, wind speed and wind direction information to allow the Smoke Management Coordinator to determine whether burning will be allowed based upon real time data.

## **Materials and Methods**

During the field-burning season from July 30<sup>th</sup> to September 24<sup>th</sup> 2012, daily balloon releases occurred on demand throughout the day. Release times and locations were requested daily by the Smoke Management Coordinator. Air temperature, relative humidity, and surface wind direction and speed are documented at the time of the Pibal releases using the AgriMet weather station at the Central Oregon Agricultural Research Center. Wind direction and speed are determined at one-minute intervals for a period of ten minutes using an observation Theodolite System and a twenty-six inch diameter helium filled balloon (Pibal). The Pibal is used to verify the forecast for the upper level wind direction, speed and mixing height. The software program, Pibal Analyzer, developed by the Oregon Department of Agriculture (ODA) analyzes Pibal information, which includes three components. The first is the Pibal Sounding, a spreadsheet translating the azimuth (azimuths are angles used to define the apparent position of an object in the sky, relative to a specific observation point) and elevation readings from the wind direction and average wind speed. The second is the Hodograph, which charts the wind direction. The Profile page, the third component, graphs the wind speed. Pibal soundings are entered into the Pibal Analyzer and transmitted to the Jefferson County Smoke Management website for use by the Smoke Management Program Coordinator. The Coordinator uses this data in conjunction with the aircraft soundings and the ODA Weather Center forecast to determine the field burning status for the day.

## **Results and Discussion**

The 2012 Smoke Management season was very hot and dry with many wildfires spread throughout Oregon and all of the Western United States. Wildfire smoke covered local communities from mid-August to October. During the 2012 burning season, there were a total of 10,923 acres burned. This included 3,388 acres of grass and 7,536 acres of wheat. Wind directions brought smoke from the surrounding fires impacting local communities, making the 2012 burn season a challenge. Emphasis was placed upon burning more acres on better burn days. In some cases, there were days when the smoke was so thick from wildfires that no burning was allowed.

WEATHER INFORMATION: 2012 WATER YEAR, POWELL BUTTE, OREGON (SOURCE: AGRIMET)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
<b>AIR TEMPERATURE (°F)</b>												
Avg. Maximum	62	50	47	47	45	51	59	66	70	83	86	78
Avg. Minimum	34	28	22	27	25	30	34	35	42	47	46	41
Mean	48	39	34	37	35	40	47	52	56	66	67	60
<b>AIR TEMP (no. of days)</b>												
Max. 90°F or Above	0	0	0	0	0	0	0	0	0	5	9	0
Max. 32°F or Below	0	0	1	2	2	0	0	0	0	0	0	0
Min. 32°F or Below	8	21	27	26	26	19	14	18	2	0	0	3
Min. 0°F or Below	0	0	0	0	0	0	0	0	0	0	0	0
<b>SOIL TEMP (°F at 4 in.)</b>												
Avg. Maximum	55	44	38	38	38	42	49	57	62	70	71	63
Avg. Minimum	52	43	36	36	37	40	46	52	57	64	66	61
<b>SOIL TEMP (°F at 8 in.)</b>												
Avg. Maximum	55	45	39	38	39	41	47	55	60	66	68	62
Avg. Minimum	54	45	38	38	38	40	46	52	58	64	66	61
<b>PRECIPITATION (in.)</b>												
Monthly Total	0.36	0.15	0.52	0.95	0.56	0.80	1.60	0.69	1.86	0.20	0.06	0.16
<b>EVAPORATION (in.)</b>												
Daily Avg.	0.08	0.06	0.03	0.04	0.05	0.09	0.13	0.20	0.24	0.32	0.28	0.20
<b>WIND SPEED (mph)</b>												
Daily Avg.	3.1	5.1	4.4	5.6	4.6	6.1	4.6	4.8	5.3	5.0	4.3	3.7
<b>SOLAR RADIATION (langley)</b>												
Daily Avg.	234	155	122	125	190	274	385	537	600	681	571	487
<b>HUMIDITY (% relative humidity)</b>												
Daily Avg.	6.7	63	62	62	72	62	64	54	60	50	43	44
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<b>GROWING SEASON</b>	<b>Last Day Before</b>				<b>First Day After</b>				<b>Total Number of Days</b>			
	<b>July 15</b>				<b>July 15</b>				<b>Between Temp. Mins.</b>			
Air Temp Min.												
32°F or Below	June 10				Sept 11				93			
28°F or Below	May 11				Oct. 3				145			
24°F or Below	May 10				Oct. 4				147			

WEATHER INFORMATION: 2012 WATER YEAR, MADRAS, OREGON (SOURCE: AGRIMET)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
<b>AIR TEMPERATURE (°F)</b>												
Avg. Maximum	62	50	44	46	44	52	60	67	70	86	89	80
Avg. Minimum	38	28	22	28	27	31	36	38	44	50	49	44
Mean Temp.	50	40	32	37	35	41	48	53	57	68	69	62
<b>AIR TEMP (no. of days)</b>												
Max. 90°F or Above	0	0	0	0	0	0	0	0	0	8	14	0
Max. 32°F or Below	0	0	1	2	0	0	0	0	0	0	0	0
Min. 32°F or Below	6	24	28	24	24	15	9	7	0	0	0	0
Min. 0°F or Below	0	0	0	0	0	0	0	0	0	0	0	0
<b>SOIL TEMP (°F at 4 in.)</b>												
Avg. Maximum	56	46	38	38	40	44	51	63	70	85	83	76
Avg. Minimum	53	43	36	36	38	41	47	56	59	66	68	60
<b>SOIL TEMP (°F at 8 in.)</b>												
Avg. Maximum	57	47	39	39	40	43	49	58	66	73	75	67
Avg. Minimum	55	45	38	38	39	42	47	55	62	68	71	63
<b>PRECIPITATION (in.)</b>												
Monthly Total	0.44	0.21	0.74	1.37	0.46	1.33	1.28	0.66	2.11	0.02	0.00	0.06
<b>EVAPORATION (in.)</b>												
Daily Avg.	0.1	0.07	0.03	0.04	0.05	0.11	0.15	0.22	0.21	0.31	0.32	0.33
<b>WIND SPEED (mph)</b>												
Daily Avg.	4.7	5.4	5.2	4.8	6.3	7.6	7.5	6.0	5.8	4.6	4.8	4.6
<b>SOLAR RADIATION (langley)</b>												
Daily Avg.	265	170	135	133	200	317	442	573	498	550	584	461
<b>HUMIDITY (% relative humidity)</b>												
Daily Avg.	67	76	85	77	69	66	59	62	59	55	48	43
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<b>GROWING SEASON</b>	<b>Last Day Before</b>				<b>First Day After</b>				<b>Total Number of Days</b>			
	<b>July 15</b>				<b>July 15</b>				<b>Between Temp. Mins.</b>			
Air Temp Min.												
32°F or Below	May 19				Oct. 4				138			
28°F or Below	May 10				Oct. 4				147			
24°F or Below	May 6				Oct. 7				150			