JEFFERSON COUNTY SMOKE MANAGEMENT
PILOT BALLOON OBSERVATIONS, 2005

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Abstract

Pilot balloon (Piball) observations are a major component of the daily decision-making process used in allowing open-field burning of grass seed fields in Jefferson County. Piballs are used to track local wind direction and speed. Piballs are released daily from the Central Oregon Agricultural Research Center at 11:00 am and 1:00 pm. Piball releases at potential burn sites allow for more accurate decisions under marginal conditions when errors are most likely to occur.

Introduction

The piball program, started in 1998, incorporates the weather balloon information into the daily routine of the Jefferson County Smoke Management Program. The software program, Piball Analyzer, developed by the Oregon Department of Agriculture (ODA) was used in interpreting piball wind data and transmitting it to the smoke management coordinator. Emphasis was put on burning more acres on the better burn days (as determined by smoke dispersion) and not allowing burning on the marginal days.

Materials and Methods

Daily balloon releases occurred in the morning between 11:00 and 12:00 and, at the request of the smoke management coordinator, in the afternoon generally between 1:00 and 2:00. The piball was used to verify the burn forecast for upper level wind direction and speed and provide an indication of the mixing height. The software program, Piball Analyzer, developed by the ODA to aid in the analyzing of the piball information includes three components. The first is the Piball Sounding, a spreadsheet translating the azimuth and elevation readings from the piball into wind direction and average speed. The hodagraph visually charts the wind direction and the Profile page graphs wind speed. The Piball soundings are entered into the Piball Analyzer and transmitted to the Jefferson County Smoke Management website for the smoke management program coordinator, who then uses this data in conjunction with the aircraft soundings and the ODA burn forecast to determine the field burning status for the day.

Wind directions and speeds are determined at 1-minute intervals for a period of 10 minutes during each balloon release using an observation Theodolite System and 26-inch-diameter helium-filled balloons. Each minute corresponds with the following elevations in feet: 709, 1358, 2008, 2628, 3248, 3839, 4429, 5020, 5610, and 6201. Air temperature, relative humidity, surface wind direction and speed are documented for each day at the time of the piball releases using the Agrimet weather station at the Central Oregon Agricultural Research Center (COARC).

Results

The open field burning season was 42 days long in 2005. Daily balloon releases in the late morning were used to refine the weather forecast to minimize adverse smoke impacts on local communities. In addition to the daily balloon releases at the COARC, balloon releases were made on 7 days at the request of the program coordinator in the Culver area. The objective was to prevent smoke intrusion to the Crooked River Ranch and yet allow growers to burn their fields in a timely manner.

The piball was also a valuable tool for determining the mixing height for smoke during the optimal burn times. There was surface inversion extending from the surface up to as high as 5000 ft above ground level (agl) on 60 percent of the mornings, as indicated by the temperature readings provided by the airplane flights. A counter clockwise direction of travel by the piball indicates an inversion or stable air layer. The stable air layer was still in evidence 36 percent of the time as indicated by the morning piballs and 33 percent of the time for the afternoon piball sounding. On 2 days the morning piball indicated that there was no inversion layer present; however, the afternoon piballs showed that an inversion layer developed at about 1000 ft agl. Morning piballs indicated that 38 percent of the time the transport wind direction was different from that predicted. The transport wind speed was different on 23 percent of the mornings, while 47 percent of the time the afternoon piball release indicated transport wind direction and speed to be different than predicted. Actual surface wind directions were different than predicted 38 percent of the time at 11:00 am and 33 percent of the time at 2:00 pm.

The presence of subsidence inversions presented a new challenge this year. A subsidence inversion is caused by sinking air that is compressed and warmed as it descends, thus causing an inversion. A subsidence inversion does not affect the piball, so it is only detectable from smoke rising and then falling back to the ground. There were 5 days where a subsidence inversion was encountered.

The piball program is a necessary tool for the determination of real-time, on-site wind conditions. However, it is particularly helpful on marginal burn days to assist the program coordinator in making the decision whether to allow burning when conditions were either changing or hard to discern. It is on these marginal days, where the conditions are unclear, that the most risk for smoke intrusion into populated areas exists. To have the piball available for release at the site of the potential burn prior to making a final decision has proved to be a valuable tool.