

THE OKLAHOMA DISPERSION MODEL: USE OF THE GAUSSIAN PLUME MODEL AS AN OPERATIONAL SMOKE MANAGEMENT TOOL

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ABSTRACT

The Oklahoma Dispersion Model (ODM) represents a current innovative application of the classic Gaussian plume model in an operational setting. Using a statewide mesoscale network of 120 weather monitoring stations (the Oklahoma Mesonet) for current and past weather conditions and 84-hour forecast output from the North American Model (NAM), the ODM is a Web-based smoke management tool that can be used to assess current and future near-surface dispersion conditions across Oklahoma. The ODM is designed to qualitatively assess smoke concentrations at ground level near the plume centerline at downwind distances of up to several miles. The Gaussian plume model is used in conjunction with rural Briggs sigma-y and sigma-z coefficients to estimate horizontal and vertical dispersion. Pasquill stability class is calculated in two ways: for current conditions, Oklahoma Mesonet weather data are used in conjunction with EPA-recommended algorithms; for forecast conditions, NAM forecast data are used in conjunction with the Turner method. A method is then employed which assigns the atmosphere one of six dispersion categories, ranging from very poor to excellent. Products of the ODM are available on the OK-FIRE web site (<http://okfire.mesonet.org>) and include dynamic maps (capable of animation and zooming) and site-specific charts and tables. Dispersion conditions are shown, as well as wind conditions for plume transport. Mesonet-based products are updated every 5 minutes, while NAM-based products are for each full hour through the 84-hour forecast period and are updated every 6 hours with each new NAM model run. In summary, the Oklahoma Dispersion Model is an operational management tool that integrates the traditional Gaussian plume model with a mesoscale automated weather station network and 84-hour forecast output from the NAM model. The ODM has been used throughout Oklahoma to assess current and future dispersion conditions not only for smoke dispersal but for other applications such as pesticide application and animal odor drift. The presentation will discuss details of the model itself as well as present examples of its output from the OK-FIRE Web site.

Keywords: dispersion, forecasting, Gaussian plume model, modeling, operational smoke management systems, prescribed fire, smoke management, weather station networks, wildfire.

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