National FCAMMS Smoke Dispersion Forecast Guidance

A Partnership Between the Desert Research Institute and the USFS AirFire Team

Website - http://cefa.dri.edu/FCAMMS

Atmospheric models

NCEP NAM (North American Mesoscale)

Grid: 12-km

Initialized: 00 and 12 UTC

Time step: 3-hourly

Forecast period: 72-hours

NCEP GFS (Global Forecast System)

Grid: 40-km

Initialized: 00 and 12 UTC

Time step: 3-hourly (days 1-3); 6-hourly (days 4-7)

Forecast period: 384 hours

Products

Mixing height: Calculated using Stull method (Stull 1988); for complete description and analysis in fire context see Fearon 2000. Method uses nonlocal static stability. This method involves displacing parcels of virtual potential temperature upward from the relative maxima and downward from the relative minima where parcel movement is based on buoyancy measured by comparing the virtual potential temperature of the parcel to the environment at the same height. Ascent or descent of the parcel is tracked until it intersects the environmental profile or becomes neutrally buoyant. Once all parcel movements have been tracked for the entire profile, the static stability is then determined for each portion of the sounding domain. The mixing height is the top of the unstable layer after assessing nonlocal static stability.

The Holzworth method is commonly used for mixing height determination utilizing the 00 and 12 UTC radiosonde measurements and the assumption of the surface temperature remaining dry adiabatic (e.g., constant potential temperature) through a well-mixed layer. The morning mixing height is defined as the level above ground at which the dry

adiabatic ascent of the morning minimum surface temperature plus 5°C intersects the vertical temperature profile measured at 1200 UTC. The afternoon mixing height is based on the level above ground at which the adiabatic ascent of the maximum surface temperature intersects the 0000 UTC temperature profile. This latter method is often applied to obtain a daily forecast of the afternoon mixing height utilizing the daily forecast maximum surface temperature and 1200 UTC sounding.

While for many cases the Stull and Holzworth method can yield a similar result, the Stull method is more comprehensive and can identify more days with actual higher mixing heights. This can be advantageous to know for burn operations and daily air quality assessment, especially given narrow windows of opportunity.

Mixing height is given in user-selected English or metric units.

Transport wind: Calculated as the mean wind speed from surface up to the mixing height. User-selected units are knt/ft or m/s.

Ventilation rate: Calculated as the mixing height times the transport wind speed. User-selected units are knt/ft or m/s.

Haines index: Calculated by determining the sum of the atmospheric stability index (term A) and the lower atmospheric dryness index (term B). The stability index is determined from measurements of the temperature difference between two atmospheric levels and the dryness index is determined from measurements of the dew-point depression. The index is calculated for three different pressure ranges: low elevation - 950-850mb; mid elevation - 850-700mb; and high elevation - 700-500mb. Also see http://info.airfire.org/haines/whatishaines.html. A pull-down menu allows for selection of low, middle or high elevation indices.

Forecast grid: A matrix of each product and its forecast time. User can select the time to see an individual map.

Comparison grid: A matrix of each product and its forecast time; selecting a time shows the NAM and GFS forecasts side-by-side.

Displays: A map loop appears by default. The user can control animation rate, rocking start/stop animation, and toggle frames on/off. Individual maps are displayed from the forecast grid. The menu provides clickable choices for the product, units and area. For all products, individual Geographic Area Coordination Center (GACC) maps are available.

Runtime schedule

00UTC

EVENT	Typical Start Time	Typical End Time
NAM Products	01:00 PDT	01:35 PDT
GFS Products	01:35 PDT	02:45 PDT

12UTC

EVENT	Typical Start Time	Typical End Time
NAM Products	12:00 PDT	12:35 PDT
GFS Products	12:35 PDT	13:45 PDT

Contacts

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Citations

Fearon, M., 2000: *The Use of Nonlocal Static Stability to Determine Mixing Height from NCEP Eta Model Output over the Western U.S.*, Masters Thesis, University of Nevada – Reno, 144 pp. Available at http://cefa.dri.edu/Publications/publications_home.php

Stull, R.B., 1988: *An Introduction to Boundary Layer Meteorology*. Kluwer Academic Publishers, 666 pp.