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# FIRE WEATHER FORECAST APPLICATION FOR AWIPS

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## Introduction

The need for accurate and timely fire weather forecasts in the Intermountain West has become increasingly apparent in light of the record fire weather season of 2000. These forecasts are crucial to fire planning and suppression activities implemented by land management agencies. New software developed on the AWIPS platform for the Pocatello/Idaho Falls Weather Forecast Office allows the production of such forecasts, ready for dissemination to other National Weather Service (NWS) field offices, Interagency dispatch offices, and incident fire weather meteorologists. FIRE ZONE features graphical tools for generation of the fire weather zone forecasts and initialization of specific parameters using the NGM RAWS MOS (Gibson et al., 1999) numerical guidance and hourly ETA BUFKIT (Mahoney and Niziol, 1998) data. In brief, the software allows the operational forecaster to spend more time concentrating on pivotal decisions and less time on preparation mechanics.

## Background

FIRE ZONE (V2.0) is operational software that allows the generation of NWS fire weather zone products. It is written in TCL/TK and runs on the AWIPS D2D workstations in the UNIX OS. Figure 1 shows numerous options for initializing and generating fire weather zones. The graphic illustrates the zone boundaries and points of reference for the Pocatello/Idaho Falls, Idaho, fire weather districts.

## Installation of Software on AWIPS

The application requires TCL/TK (wish) which is located in the /usr/local/tk/bin/ subdirectory in AWIPS on ds1. The software can be downloaded from the national AWIPS Local Application Database website at this URL: http://isl715.nws.noaa.gov/LAD/index.php3. The user can then perform a search for FIRE ZONE (V2.0) by Thomas Andretta to retrieve the application, user documentation, and installation documentation.

## Configuration Utility

FIRE ZONE contains an extensive utility (Fig. 2) to configure the software for a given fire weather forecast region. Once the user directories are created and the software installed in AWIPS, the user can set up the number of fire weather zone groups, names of zones in groups, zone group headers, plus station information for RAWS MOS and ETA BUFKIT algorithms. The user can also execute several programs to initialize matrix files, template files, and transmission pathway scripts which send text products from AWIPS to the NWS gateway.

## Forecast Generation and Dissemination

The user can use either the matrix or the rollover techniques to generate fire weather zone packages.

Matrix Method

This approach uses initialization matrix files to create output template files; it relies on trigger variables to seed the matrix files. These input matrix files are associated with the morning and afternoon fire weather zone forecast products (FWF). The trigger variables are abbreviated using 2 to 4 letter identifiers followed by a zone group number and zone period number (e.g., WEA12: Sky/Weather for zone group 1 in zone period 2; TMP31: Temperature for zone group 3 in zone period 1). (A Toolbar may be used to initialize trigger variables in the matrix files; see section below.) This approach also features algorithms to initialize fire weather elements. The RAWS MOS algorithm uses 00 UTC and 12 UTC temperature and relative humidity data from the NGM model. The BUFKIT algorithm uses valley, ridgetop, and transport wind direction and speed fields based on the ETA model. The output template files are the first draft of the finished fire weather zone forecasts.

The key advantage of using this technique is the rapid initialization of the fire weather elements in the matrix files. Since the fire zone template files are generated based on these prescribed matrix files, the chances of making formatting errors are very small.

Rollover Method

This technique ingests an old morning (afternoon) zone package and creates a new afternoon (morning) package. The program scripts remove old zone forecast periods, reformat, and insert new periods while maintaining the existing forecast trends. The principal advantages of this technique are forecast continuity and rapid generation of the zones.

View or Transmit PIL

This options allows the user to view (edit) or transmit several fire weather products: Fire Weather Zone Forecast (FWF), Fire Weather Watch/Red Flag Warning (RFW), and Fire Weather Trends Forecast (FWM). Editing of forecast products is accomplished using a dtpad text editor in AWIPS. Forecast products are transmitted using several scripts configured during the installation phase of FIRE ZONE.

## Menubar

The Menubar (Fig. 3) contains all the relevant program information: User Files, Zone Initializations, Zone Packages, and Help information.

User Files

This menu includes initialization files and template files for the 9:00 a.m. and 4:00 p.m. zone packages. A Stations file includes the NGM RAWS MOS stations and elevations, ETA BUFKIT stations and elevations, and surface temperature data used in the parcel lifting algorithms.

Zone Initializations

This menu contains options to initialize the fire weather zone packages.

Zone Packages

This menu contains several scripts to generate the fire weather zone forecasts. Figure 4 is an example of a fire weather zone forecast product (BOIFWFPIH) for the eastern Idaho fire weather districts.

Help

The user may view an extensive readme file containing user instructions. A status log file contains real-time output of variables used in the algorithms.

## Toolbar

The Toolbar is a Graphical User Interface (GUI) used by the forecaster to seed the fire weather elements in the initialization matrix files. Figure 5 shows that the user has defined selections for the 9:00 a.m. (morning) zone package for zone group 1 and zone period 1. The selections for Weather Condition (Sky), Lightning Activity Level (LAL), and Haines Index (Haines) are Partly Cloudy, 1, and 3, respectively. The forecaster can initialize fire

weather elements multiple times if changes are needed. There is also an option to recall previously selected elements for review. The software also performs a series of tests to verify the meteorological consistency of the selections.

## RAWS MOS (NGM Model) Algorithms

This algorithm in FIRE ZONE ingests the 00 UTC and 12 UTC NGM RAWS MOS temperature and relative humidity data. The output data is indexed by fire weather zones, station names, and station elevations in a comprehensive table. Each fire weather zone is associated with two RAWS stations -- preferably a valley and a ridgetop site. This enables the forecaster to depict both lower and higher elevation trends in temperature and relative humidity in the input matrix files.

## BUFKIT (ETA Model) Algorithms

FIRE ZONE interacts with BUFKIT, a forecast profile visualization and analysis toolkit. The BUFKIT script in FIRE ZONE ingests ETA 00 UTC and 12 UTC hourly station sounding profiles and assimilates several data fields into the program: valley and ridgetop wind direction and speed, transport wind direction and speed, and mixing height. A unique station profile is associated with each of the fire weather zones. The data fields are stored in the input matrix files allowing the forecaster to obtain first guesses for critical wind elements.

Valley and Ridgetop Winds

The valley and ridgetop winds are computed based on the ~ 850 mb and ~ 700 mb levels in the selected station sounding, respectively.

Transport Winds and Mixing Heights

The transport winds and mixing heights are computed according to three algorithms (Fig. 6) which are related to the ambient atmospheric stability. The first algorithm uses the pressure level just below the Lifting Condensation Level to obtain these fields. The second method is based on the interception point of dry parcel ascent with the sounding profile. The third method keys on the interception point of moist parcel ascent with the sounding profile. The last two methods are very sensitive to the surface temperatures used in computing the lapse rate equations.

In addition, the user may select the mixing heights and transport winds for nighttime forecast periods associated with the ith {i = 1, . . ., 5} ETA model level of the station sounding. This option enables the forecaster to simulate a nocturnal inversion for a fire weather zone.

## Conclusion

The need for timely and accurate fire weather forecasts is crucial to fire weather planning and suppression activities. FIRE ZONE allows the production of fire weather zone forecasts, fire weather watches/red flag warnings, and fire weather trends forecasts. This new software contains a user interface to select fire weather forecast elements from a Toolbar. Moreover, FIRE ZONE contains RAWS MOS and ETA BUFKIT algorithms to initialize several fire weather elements. In sum, the program allows the operational forecaster to concentrate more resources on critical fire weather issues and less time on tedious compositional mechanics.

## References

Gibson, C. V., Gerber, M. E., and S. Ruiyu, 1999: Development of MOS equations for remote automatic weather stations. Second Conference on Fire and Forest Meteorology. pp. 111-115.

Mahoney, E. A. and T. A. Niziol, 1998: BUFKIT: A software application toolkit for predicting lake effect snow. Preprints, 13th Intl. Conf. On Interactive Info. and Processing Sys. (IIPS) for Meteorology, Oceanography, and Hydrology, Amer. Meteor. Soc., Long Beach, CA.

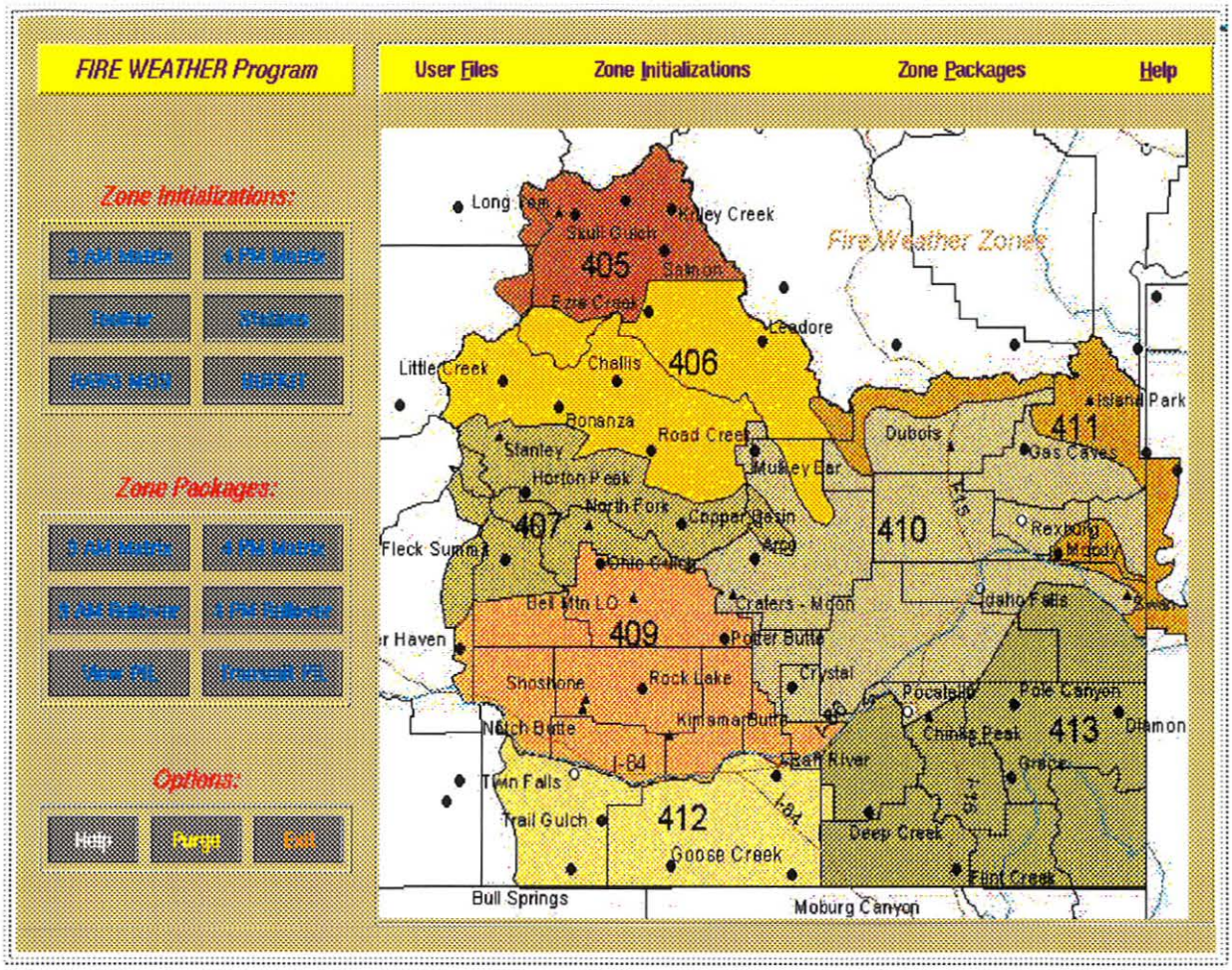


Figure 1: Main display panel of FIRE ZONE

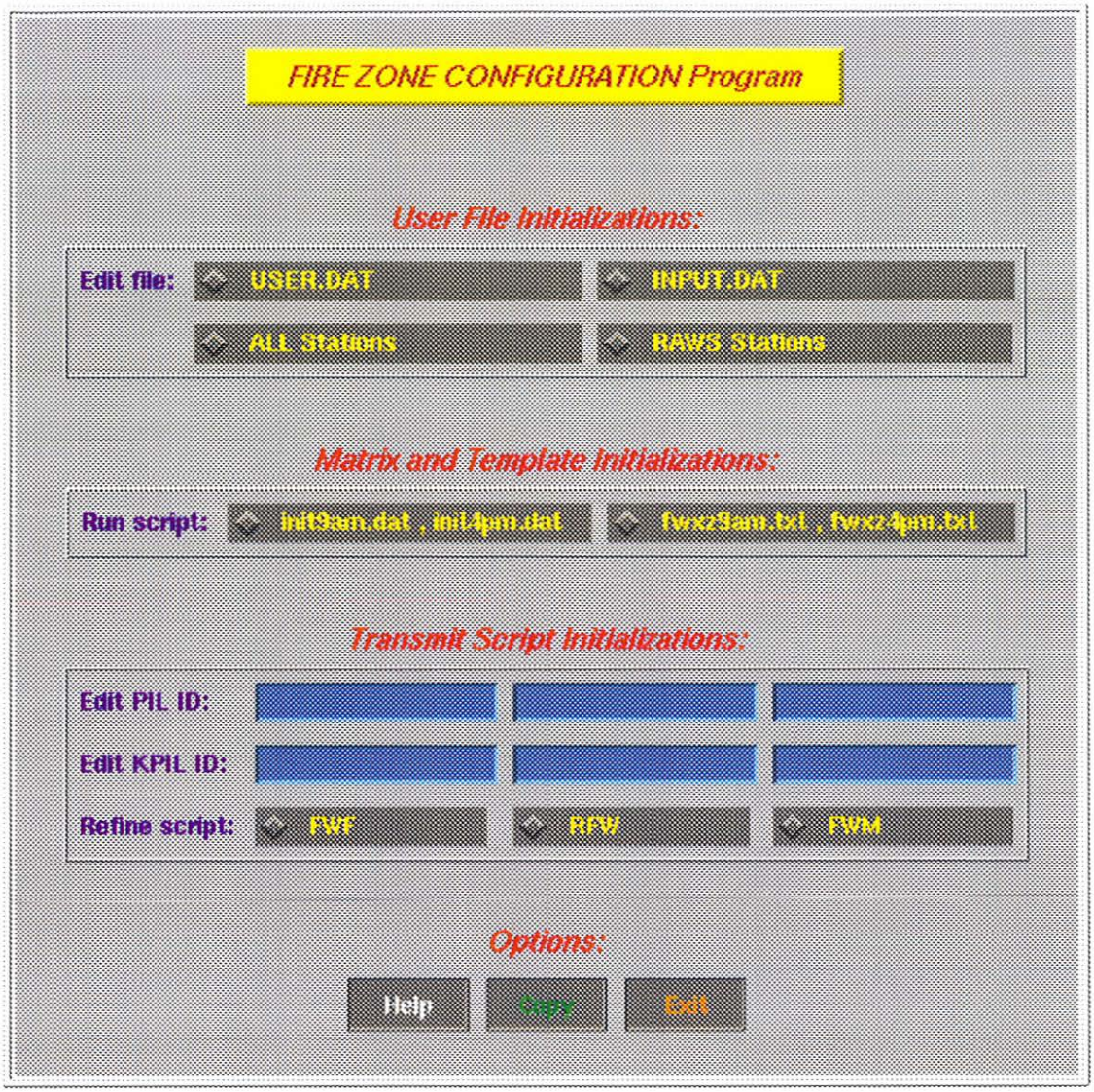


Figure 2: Configuration utility for FIRE ZONE

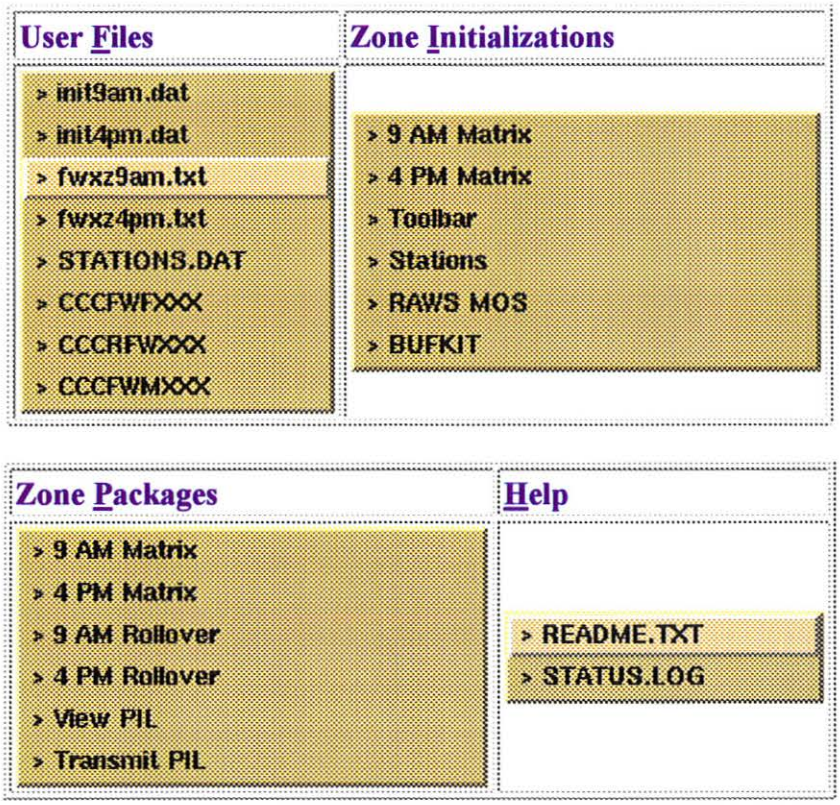


Figure 3: Menubar with pull-down menus

File Edit Format Options Help

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ZCZC BOIFWFPIH DEF
TTAA00 KPIH DDHHMM

FIRE WEATHER FORECAST FOR SOUTHEAST IDAHO
NATIONAL WEATHER SERVICE POCATELLO/IDAHO FALLS ID
400 PM MDT TUE AUG 14 2001

...DRYING TREND THE NEXT COUPLE DAYS...

.DISCUSSION...A DRIER NORTHWEST WIND FLOW ALOFT WILL PUSH THE MOIST
AND UNSTABLE AIRMASS AWAY FROM THE DISTRICT BY THURSDAY. IN THE
MEANTIME...IF ANY SHOWERS DEVELOP THEY WILL BE CONFINED MAINLY OVER
THE MOUNTAINS THIS EVENING AND OVER THE NORTHERN MOUNTAINS WEDNESDAY
EVENING. EXPECT DRY CONDITIONS LATER IN THE WEEK AND INTO THE WEEKEND
AS A DRY AND STABLE AIRMASS BECOMES ESTABLISHED OVER EASTERN IDAHO.

IDZ009-010-013-018-031-032-151500-
EAST CENTRAL IDAHO MOUNTAINS...(ZONES 405, 406, 407)
INCLUDES SALMON-CHALLIS NF, NORTHERN SAWTOOTH NF

.TONIGHT...
        SKY/WEATHER...PARTLY CLOUDY. ISOLATED EVENING THUNDERSTORMS
                      ZONES 405 AND 406.
        TEMPERATURE...LOWS 48 TO 60 VALLEYS AND RIDGES...EXCEPT LOWS
                      32 TO 38 HIGHER BASINS.
        24-HOUR TREND...LITTLE CHANGE.
        HUMIDITY...MAX 65 TO 80% VALLEYS AND 40 TO 55% RIDGES...
                   EXCEPT MAX 80 TO 95% HIGHER BASINS.
        24-HOUR TREND...LITTLE CHANGE...EXCEPT DOWN 5% RIDGES.
        WIND - 20 FT...
                  VALLEYS...UPSLOPE 5 TO 15 MPH BECOMING DOWNSLOPE UP
                            TO 8 MPH.
                  RIDGES...VARIABLE UP TO 10 MPH.

        LAL...2 ZONES 405/406...1 ZONE 407
        HAINES INDEX...4 LOW.

        SMOKE DISPERSAL
              MIXING HEIGHT...LOWERING TO 1000 TO 2000 FT AGL.
              TRANSPORT WINDS...VARIABLE UP TO 10 MPH.

.WEDNESDAY...
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Figure 4: Fire Weather Forecast (BOIFWFPIH)

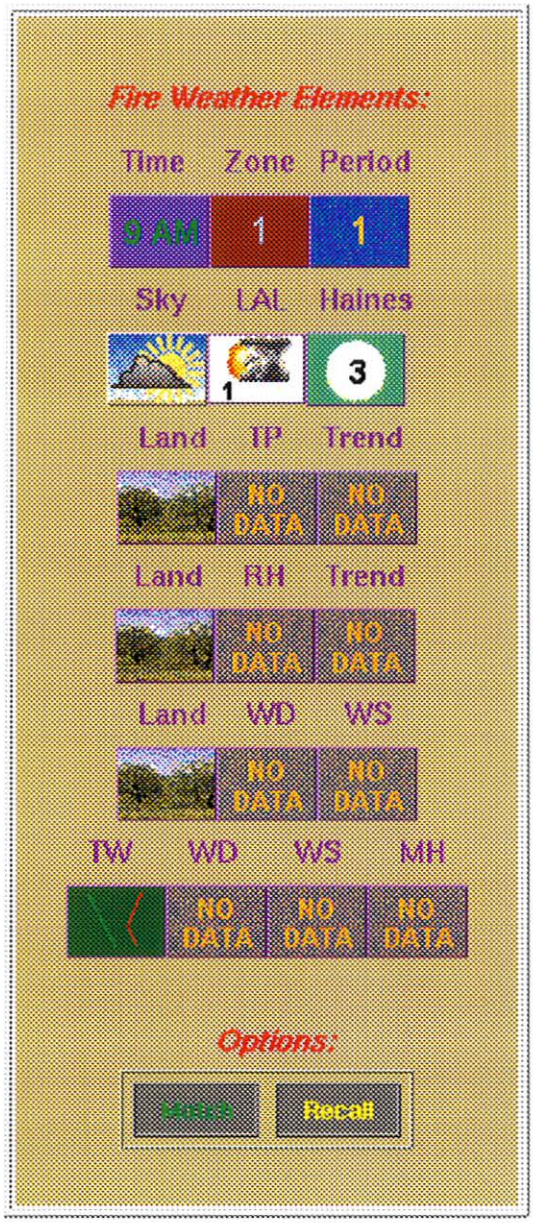


Figure 5: Toolbar with selected fire weather elements