**Rock Creek Fire**

**WindWizard Modeling**

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**Modeling Objective**

The IMT was interested in exploring the effects of terrain induced effects on wind patterns within the fire area as a result of expected high wind speeds with a dry cold front passage. These high winds have been experienced by local fire personnel during the fall months.

 Two fine scale gridded wind modeling programs exist to investigate these questions, WindNinja and WindWizard. The WindWizard program is generally more accurate at depicting channeling and recirculation zones in lee areas in hilly or mountainous terrain than WindNinja.

**WindWizard Model Description**

**WindWizard** is a **gridded wind model** which can provide information about the effect of topography on local wind flow at the 100-300 feet scale. The wind simulations are not forecasts but rather simulations of what the wind flow would be under different general (synoptic) wind speed and direction scenarios based on a user specified general flow and direction of air into the modeling domain. It uses computational fluid dynamics to calculate the surface wind flow everywhere within the specified domain. The result from this set of calculations is a predicted wind speed and direction at a user specified height above the ground (i.e., 20 feet) within the modeling domain from which a map of surface wind speed and direction can be produced.

WindWizard assumes a neutrally stable environment and constant temperature and is generally most representative of strong windy conditions. Additionally, WindWizard does not account for the effects of convective ground heating and interactions with a fire and their effect on wind speed or wind direction. WindWizard cannot accurately mode downdraft windspeeds from a thunder storm cell located directly over a specific location. Because of these factors, the modeled windspeeds from WindWizard in this instance are likely to be lower than those actually experienced within the area of interest.

**Modeling Assumptions**

Winds associated with a frontal passage were estimated based on past experience by local fire management personnel. The closest RAWS station Timbercrest (#245607), does show peak gust speeds in excess of 20mph in the observation record 2001-2012 in months of September and October.

Information regarding wind direction and wind speeds from IMT and local fire management were used to develop all WindWizard simulations.

The DEM data used in the modeling is included and is called ww\_dem2\_dem.zip. While a projection file is not included with the GIS ready outputs all WindWizard generated output is in the same projection as the DEM data: UTM Zone12, WGS84

All simulations assumed that the dominate vegetation in the modeling domain was trees. The spatial resolution of all generated outputs was 180 feet (60 meters).

A total of 28 separate wind scenarios were run. The primary emphasis was on high wind speeds coming from an S-SW direction (Table 1).

Table 1. Matrix of input wind speed and directions used in WindWizard modeling scenarios. Input windspeed represents the direction the wind is coming from in degrees. Input wind speed is in miles per hour. Completed scenario (X).

|  |  |
| --- | --- |
|  | **Input Wind Direction (degrees)** |
| **Input Wind Speed (miles per hour)** | 225 | 270 |
| 10 | **X** | **X** |
| 12 | **X** | **X** |
| 15 | **X** | **X** |
| 20 | **X** | **X** |
| 25 | **X** | **X** |
| 30 | **X** | **X** |
| 35 | **X** | **X** |
| 40 | **X** | **X** |
| 45 | **X** | **X** |
| 50 | **X** | **X** |
| 55 | **X** | **X** |
| 60 | **X** | **X** |
| 70 | **X** | **X** |
| 80 | **X** | **X** |

**Results**

Windspeed output represents the windspeed at twenty-feet above the assumed vegetation (trees) in miles per hour. Wind direction outputs represent the direction the wind is coming from in degrees. Simulation results were provided to the Fire behavior/Weather personnel for the fire in the following formats: GoogleEarth KMZ files, GIS ready shapefiles, and ASCII Grids.

All modeling in WindWizard was conducted by Charles W. McHugh, Fire Spatial Analyst and Long Term Fire Analyst of the Missoula Fire Sciences Lab. Specific questions regarding this analysis should be directed to the analyst.

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