Upgrades to the Great Lakes Fire and Fuels System

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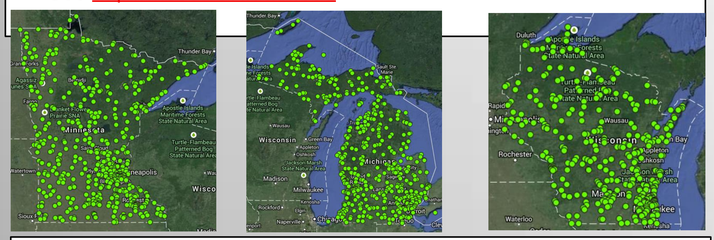
10th Symposium on Fire and Forest Meteorology, 15–17 October 2013, Bowling Green, KY

Great Lakes Fire and Fuels System

- **Objective: Provide retrospective, current, and forecast information on weather and fuel conditions in the Great Lakes**
- Great Lakes Fire and Fuels System is web-based set of tools developed to integrate weather, fire danger and fire behavior information for the Great Lakes region of the United States
- Weather parameters obtained from selected observational networks are combined with operational high-resolution gridded analyses and forecast products from the United States National Weather Service
- Fuel moisture codes and fire behavior indices from the Fire Weather Index subsystem of the Canadian Forest Fire Danger Rating System
- See http://glffc.utah.edu

Builds on MesoWest

- Cost effective: leverages investment in MesoWest software development since mid 1990's
- See http://mesowest.utah.edu

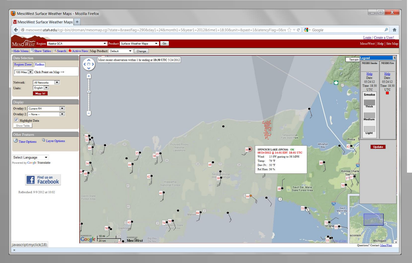


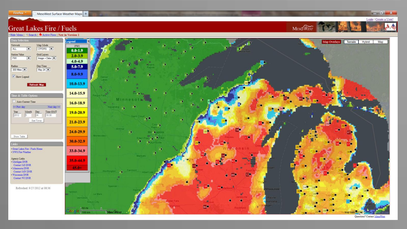
Weather Observations Available from MesoWest in the Great Lakes states

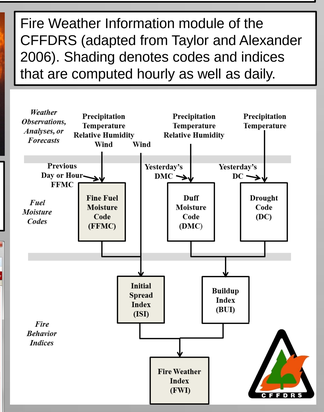
Critical Design Features

- Single web portal: weather integrated with fire danger and behavior
- Weather information: station observations and NWS gridded analysis (RTMA) and forecast (NDFD) products
- Canadian Forest Fire Danger Rating System (CFFDRS): fuel moisture codes and fire behavior indices
- Daily products valid at 1300 CDT (1800 UTC):
- Map displays, tabular listings, time series graphics
- State and local level control: initialize and adjust as needed fuel state information, wind speed multipliers, fire danger rating thresholds, update missing weather data

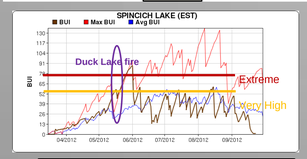
Duck Lake Fire MI
21,069 acres — largest wildfire in MI since 1980. Started by Lightning May 23, 2012. 136 structures lost







Fire Weather Information module of the CFFDRS (adapted from Taylor and Alexander 2006). Shading denotes codes and indices that are computed hourly as well as daily.



Above: Buildup Index near location of Duck Lake Fire during 2012 Season. BUI: Moisture content of fuels on forest floor

Left: Fire Weather Index on 24 May 2012 computed from observations and RTMA

An Evaluation of Fire Danger and Behavior Indices in the Great Lakes Region Calculated from Station and Gridded Weather Information

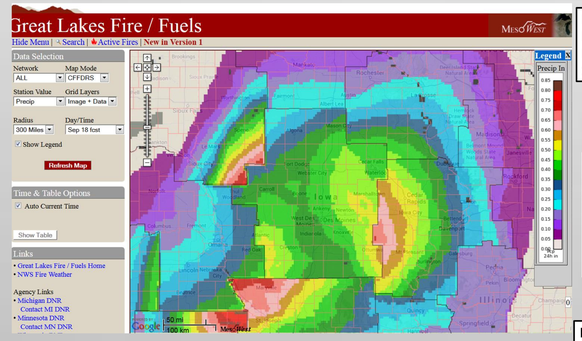
J. Horel, R. Ziel, C. Galli, J. Pechmann, X. Dong: *International Journal of Wildland Fire.* In Press

User Feedback

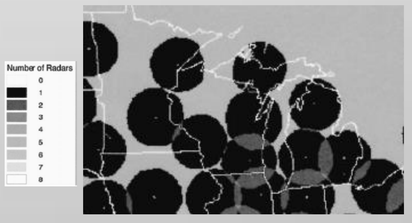
- "…GLFF gives me more tools to help set staffing and the associated activities with fire danger ratings".
- "I use the GLFF system extensively as a guide for when to staff helicopters … to assess the potential for fire ignition and spread for an extended period of time… Another benefit of this system is that it helps greatly in justifying expenditures for fire preparedness".
- "I opened the site you sent and heard angels singing, THANK YOU! And you actually have Grand Junction MI on the map!! WOW."
- "The major drawbacks I see are the forecast area boundaries. Little Falls Area sits on the 3 main NWS forecasting boundaries for Minnesota. If you add in Aberdeen, I see four different forecasters drawing lines on a map."

Known Issues

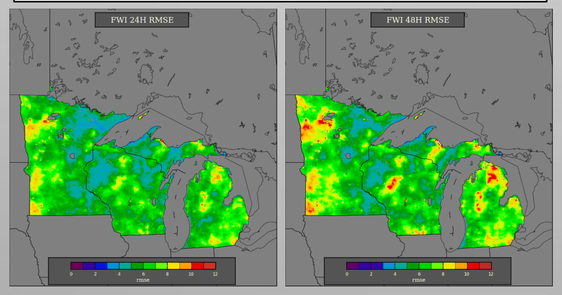
- Wind speeds differ among stations/networks due to siting
- Higher wind speeds from gridded products (analyses and forecasts) than from observations
- Forecast discontinuities across NWS County Warning Area boundaries for wind, temperature, relative humidity, and rainfall
- Sensitivity to precipitation totals
- Representativeness of station observations
- Missing RTMA grids
- Incomplete radar coverage affecting RTMA grids



Left: Precipitation Inconsistencies Across CWA borders: Day 2 Forecast Grids from NDFD
Below: Radar Coverage at 2 km MSL from Maddox et al. (2002)



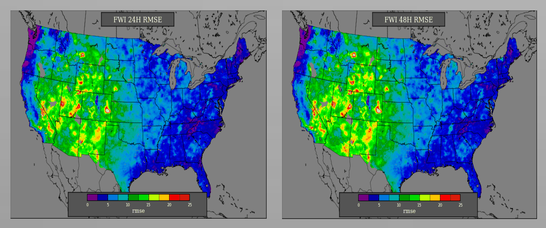
Below: FWI Root Mean Squared Error between RTMA and 24 h & 48 h Forecasts for 1 April – 15 Sept 2012. Low error cool colors; high error warm colors



Below: **How good are the RTMA analysis grids?** Joint distribution of daily FWI from observations (o) and RTMA analyses (a) in percent of the total number of analysis-observation pairs (N= 24195) over the period 1 April – 15 September 2012. Also shown are the marginal distributions of the analyses p(a) and observations p(o) and the overall Hit Rate (HR).

	0 ≤ a <5	5 ≤ a <14	14 ≤ a < 21	21 ≤ a <33	a ≥ 33	p(o)
0 ≤ o <5	**27.0**					31.4
5 ≤ o <14		**17.7**				27.8
14 ≤ o <21			**7.9**			19.0
21 ≤ o <33				**7.2**		16.2
o ≥ 33					**2.1**	5.5
p(a)	33.8	31.1	18.1	13.6	3.3	HR= 61.9 %

Below: FWI Root Mean Squared Error between RTMA and 24 h & 48 h Forecasts for 1 April – 15 Sept 2012. Low error cool colors; high error warm colors

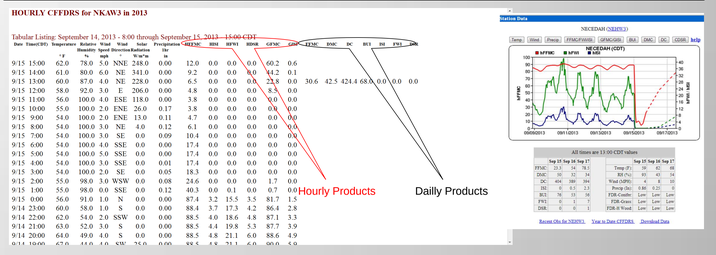


	0 ≤ f <5	5 ≤ f <14	14 ≤ f < 21	21 ≤ f <33	f ≥ 33	p(o)
0 ≤ o <5	**22.4**					31.4
5 ≤ o <14		**14.5**				27.8
14 ≤ o <21			**7.1**			19.0
21 ≤ o <33				**7.1**		16.2
o ≥ 33					**2.6**	5.5
p(f)	32.8	30.3	17.7	14.5	4.6	HR= 53.6 %

Recent and Future Upgrades

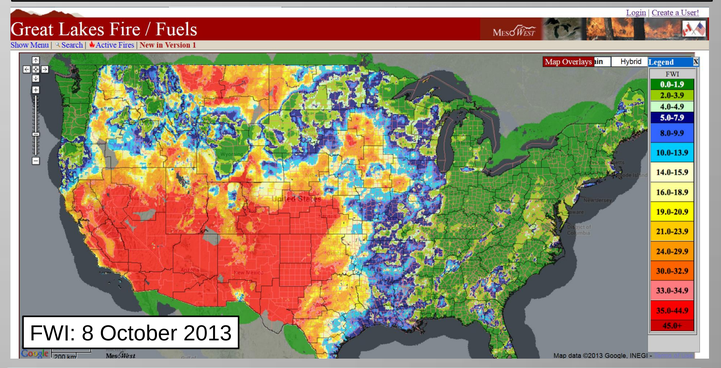
Design Team Recommendations and Needs

- Calculate and display station and gridded analysis and forecast products at hourly intervals for CFFDRS Indices sensitive to rapidly changing weather
- CFFDRS Indices at hourly intervals from station data already available:FFMC, ISI, FWI, DSR
- Grass fuel model indices now available: Grass FMC, Grass ISI (Wolton 2009)
- Need hourly updates of forecasts at stations and at all grid points with lead times of 3-48 h
- Probabilistic weighting of precipitation
- Time series and tabular graphics of hourly forecasts at stations with lead times of 3-48 h
- Maps with 3-48 h slider to select forecasts at all grid points synced with station values

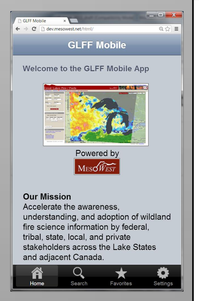


Extending to CONUS

- Observations, RTMA and NDFD grids available for lower 48 states and Alaska
- CFFDRS Indices being computed for lower 48 states now
- Capabilities developed for the Lakes States applicable nationwide and in Canada but requires regional calibration of initial values and appropriate thresholds for fire danger ratings



Mobile Apps in Developments



- Provide seamless access to GLFF products whether at office or in the field
- Use GPS to identify closest observing site
- Return current and forecast conditions for that location
- Display conditions in surrounding area from gridded analysis and forecast products

Leftt: **How good are the NDFD 48 h forecast grids?** Joint distribution of daily FWI from observations (o) and 48 h forecasts (f) in percent of the total number of analysis-observation pairs (N= 24195) over the period 1 April – 15 September 2012. Also shown are the marginal distributions of the analyses p(a) and observations p(o) and the overall Hit Rate (HR).