

## **APPLICATION OF METEOROLOGY IN FOREST FIRE PROTECTION**

With the goal of contributing to the ORGANIZED FOREST FIRE PROTECTION, Republic Hydrometeorological Service of Serbia (RHMS) has started in the spring of 2008 to calculate **the assessed forest fire risk** on the territory of the Republic of Serbia. Canadian method of assessing the Fire Weather Index (FWI) is used for the assessment of forest fire risk. This method is based on the assessment of ignitability of forest fuel depending on past and current weather conditions. Meteorological elements that influence the risk are air temperature, relative air humidity, wind speed and precipitation quantity in the past 24 hours.

Weather index of the risk of the occurrence of forest fire, that is, Fire Weather Index-FWI is numerical indication of potential fire intensity in standard forest fuel. RHMS of Serbia calculates this Index daily as a consequence of actual and past weather conditions and as a forecast for the next day. This forecast depends on the accuracy of forecasted weather elements for given area, air temperatures, relative air humidity, wind speed and precipitation quantities. For the forecast of these elements, numerical model of the latest generation **WRF-NMM** is used for weather forecasting. Created in the NCEP (National Forecasting Center), WRF-NMM model is the mezzo-scale model with complex physics and new numerical applications. Horizontal resolution of the model is around 10 km and the number of numerical points is 92x118. The model is run twice a day in ECMWF (European Centre for Medium-range Weather Forecast) with lateral border conditions for forecasting 72 hours ahead. The domain covers the Balkan Peninsula and the area of the Adriatic Sea.

FWI represents orientation possibility of the risk of the forest fire occurrence. Higher value of the Index corresponds to the lower moisture content in forest fuel, and thus the higher possibility of the forest fire occurrence.

FWI consists of five components. The first three indices show the average moisture degree of the three classes of forest fuel and the remaining two show the degree of fire spreading and the quantity of available forest fuel. FWI components are:

-Fine Fuel Moisture Code- FFMC serves as an index for numerical assessment of the moisture content in the ground cover and other fine forest fuel. This index shows relative igniting and burning possibility of fine fuel.

-Index of the medium fuel moisture (Duff Moisture Code –DMC) serves for numerical assessment of average moisture of not sufficiently compact organic ground cover of moderate depth and woody matter of medium size.

-Index of the moisture of large fuel (Drought Code- DC) serves for the numerical assessment of average moisture content in the deep, compact organic layers in the floor of the forest. This code is also used for long-term assessment of fire risk for large areas.

-Index of initial spreading (Initial Spread Index-ISI) represents combined influence of wind speed and Fine Fuel Moisture Code-FFMC. On the basis of its value numerical assessment is made of the fire spreading risk immediately after its ignition.

-Index of total fuel (Buildup Index-BUI) is the combination of the -Index of the medium fuel moisture (Duff Moisture Code-DMC) and Index of the moisture of large fuel (Drought Code-DC). It is the numerical index of total fuel quantity available to spreading fire. This code is used for current orientation in undertaking measures for fire preventing and extinguishing.

Index of the fire occurrence risk (Fire Weather Index-FWI) is the combination of previous two indices, that is, Initial Spread Index –ISI and Buildup Index-BUI. This is the numerical index of potential fire intensity in standard fire fuel and denotes a degree of produced energy as per the unit of fire front length. **Obtained value shows for the given area the degree of forest fire occurrence in time interval around noon and that makes possible temporal and spatial comparability of this index.**

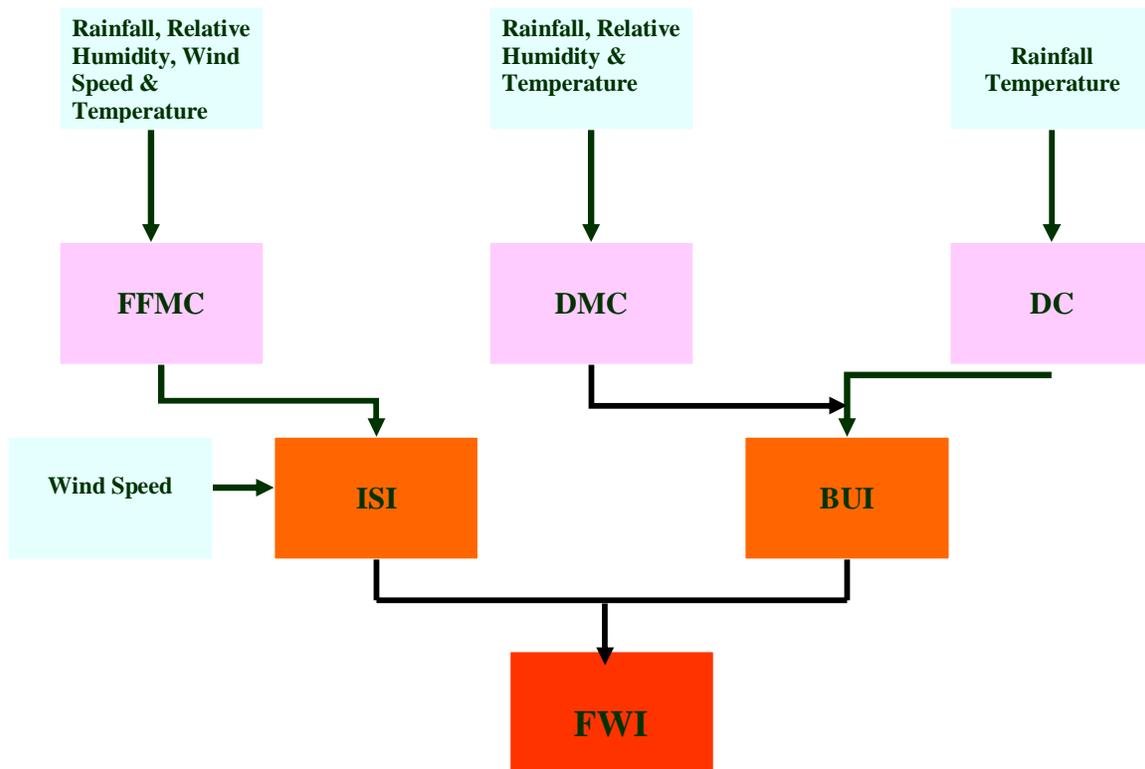


Fig. 1. Components of the Canadian Forest Fire Weather Index

Table 1: FWI classes

<b>FWI - Interpretation of classes</b>	
<b>Very Low</b>	There are no favorable conditions for fire ignition and the possibility of ignition is slight. If the fire occurs, it spreads slowly or extinguishes. Very little burning material is caught in fire and it is mostly the upper ground layer.
<b>Low</b>	Ignition can occur by lasting fire source, like the camp fires. Fire spreading through the woods is slow and medium in open areas. Thus, only leaves burn in small surface (low) fire with weak flames. Fire control is achieved easily and swiftly, so that less effort is needed for fire extinguishing.
<b>Moderate</b>	Fire control is not difficult, if the action is fast. A match can cause fire. Fire spreading is medium within the woods, but swift in the open area. The fire burns on the surface in medium flames.
<b>High</b>	A match can always cause fire and it spreads fast. Fire can be very hot when transported to the foliage of the trees. A lot of organic mass burns out. Fire control is very difficult.
<b>Extreme</b>	Fire can be ignited by a spark. Spreading of the fire is very fast. Fire is very swift and spreads to tree foliage in wider areas. Organic matter starts to burn in deeper layers and normally wet locations. Fire control is extremely difficult. In fire control, extraordinary efforts must be exerted and all available means employed.