METEOROLOGICAL FIRE WEATHER FORECASTS

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Fire hazard assessment

- Fire weather index (FWI) – numerical rating of fire intensity
- Correlated with BUI → Fire danger classes

**Fire weather index (FWI)**

<table>
<thead>
<tr>
<th>FWI</th>
<th>0-4</th>
<th>5-8</th>
<th>9-16</th>
<th>17-32</th>
<th>33+</th>
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</thead>
<tbody>
<tr>
<td>0-48</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>49-85</td>
<td>2</td>
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<tr>
<td>86-118</td>
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<td>3</td>
<td>3</td>
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<tr>
<td>119-158</td>
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<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>159+</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>5</td>
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</tbody>
</table>
Fire danger classes

- High and very high classes ➔ increased risk of fire occurrence and potential for spreading
Extreme fire behavior depends on meteorological parameters:

- Strong wind
- Wind shear
- Instability in dry air

Monitored by meteorological products:
- Prognostic wind speed field
- Turbulent kinetic energy
- Haines index
Special fire weather forecasts

- Indicate the weather conditions that can influence the fire behavior
- Textual form,
- valid for 36 hrs
Criteria for issuing the forecast

**BASIC CRITERION:**
High/Very high fire danger classes on a larger area
Criteria for issuing the forecasts

1. Synoptic situation with strong wind of longer duration – \( v > 6 \text{ m/s} \)
Criteria for issuing the forecast

2. Turbulent kinetic energy:
   \[ \text{TKE} > 3 \, \text{m}^2/\text{s}^2 \]
   - indicates the energy contained in the turbulence
   - (wind shear, thermally driven)
Criteria for issuing the forecast

3. Haines index: HI=6
   - Termic stability measure

<table>
<thead>
<tr>
<th>Heines Index</th>
<th>Extreme behavior potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 or 3</td>
<td>Very small</td>
</tr>
<tr>
<td>4</td>
<td>Small</td>
</tr>
<tr>
<td>5</td>
<td>Moderate</td>
</tr>
<tr>
<td>6</td>
<td>High</td>
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</table>
Weather types and fire weather forecasts

- Period 2013 to 2018
- Surface pressure field and upper air charts (AT500 hPa i AT 850 hPa)
- The 5 most common weather types:
  a) Type 1: Cold front passage with the strengthening of the high pressure field
  b) Type 2: Cold front passage
  c) Type 3: Non-gradient pressure field with the instability in dry air
  d) Type 4: Front side of the cold front with dry jugo
  e) Type 5: High pressure ridge descending from northern Europe
Type 1: Cold front passage with the strengthening of the high pressure field

Surface and upper air (AT 500hPa) analysis for 17 June 2017, 00 UTC. Deutscher Wetterdienst.
Type 2: Cold front passage

Surface and upper air (AT 500hPa) analysis for 30 June 2017, 00 UTC. Deutcher Wetterdienst.
Type 3: Non-gradient pressure field with the instability in dry air

Surface and upper air (AT 500hPa) analysis for 23 August 2017, 00 UTC. Deutscher Wetterdienst.
Weather type analysis for period from 2013 to 2018

<table>
<thead>
<tr>
<th></th>
<th>Forecast number</th>
<th>Total duration (days)</th>
<th>Average duration(days)</th>
<th>Relative frequency (%)</th>
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<tbody>
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<td>43</td>
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<td>34</td>
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<tr>
<td>type 2</td>
<td>13</td>
<td>18</td>
<td>1-2</td>
<td>22</td>
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<tr>
<td>type 3</td>
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<td>27</td>
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<tr>
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<td>6</td>
<td>1</td>
<td>9</td>
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<tr>
<td>type 5</td>
<td>9</td>
<td>18</td>
<td>1-2</td>
<td>16</td>
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Analysis by year

Broj vremenskih tipova po godini

<table>
<thead>
<tr>
<th>godina</th>
<th>tip 1</th>
<th>tip 2</th>
<th>tip 3</th>
<th>tip 4</th>
<th>tip 5</th>
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<td>18</td>
<td>12</td>
</tr>
<tr>
<td>2014</td>
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<td>10</td>
<td>18</td>
<td>12</td>
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<td>12</td>
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<tr>
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<td>18</td>
<td>12</td>
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<td>2017</td>
<td>18</td>
<td>12</td>
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<td>2018</td>
<td>12</td>
<td></td>
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</tbody>
</table>
Comparison of forecasts with fire data for 2017

- 41 major fires → source DUZS (National Protection and Rescue Directorate)
- 50,551 ha of burned area
- Comparison with issued forecasts:
  a) 34 fires (83%) - accompanied by forecasts; – 2 fire incidents happened outside of the area designated by the forecast (neighboring county), and one issued for the wrong area (Dalmatian inlands instead of Kvarner region).
  b) For 2 situations no major fires happened
  c) 4 fires (1%) not accompanied with the forecast - September and October
Conclusion

- Purpose – verification of the forecasts;
  - identification of the synoptic situations when the forecasts are issued
- 3 most common weather types with conditions favorable for extreme fire behaviour were identified
- Comparison with recorded fire showed the good coverage of the fires with the fire weather forecasts
- Goal:
  - improvement of the criteria for the issuing of forecasts
  - determination of the criteria for the differentiated meteorological warnings
Thank you for the attention !!!