Road Weather for Sochi 2014 Winter Olympics

1 - WMO/WWRP FROST-2014
   (Forecast and Research in Sochi Olympics Testbed)

2 - Celtic-Plus CoMoSeF

Pertti Nurmi

Head, Meteorological Research Applications, FMI

CoMoSeF Kick-Off, Tampere, 25 Sep 2012
Dear Dr. Pertti Nurmi,

Letter of Invitation

The next winter Olympic / Paralympic Games «Sochi-2014» will be held in Sochi, Russia in 2014. The Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet) is responsible for provision of hydrometeorological support and services for «Sochi-2014» Games. This activity implies both profound research and practical forecasting components. Roshydromet is interested in organization of a blended Research Development/Forecast Demonstration Project (RDP/FDP) associated with «Sochi-2014» Games under the auspices of the Nowcasting and Mesoscale Working Groups of the World Meteorological Organization’s (WMO) World Weather Research Program (WWRP).

This is a formal invitation for Dr. Pertti Nurmi as an expert of WWRP Working Group on Forecast Verification Research to attend the 1-st meeting of potential participants of the international project related to the «Sochi-2014» Games to share his experience and make recommendations on necessary activities for «Sochi-2014». The meeting will be held in Sochi 1-3 March 2011. Participants are expected to arrive on Monday, 28 February and depart on Friday, 4 March 2011.

Yours sincerely,

Deputy Director

Dr. D. Kiktev
With this group, how can you go wrong (mind the dog) ...
Road weather might be an Issue...?
Road weather is an Issue...?
Visibility might be an issue...?
Note the sign...! (Visibility is an issue)
I did mean the sign...!
No-show-snow might be an Issue...?
Exporting FMI’s ITS road weather know-how

Co-operative Mobility Services for the Future

Road weather application for Sochi 2014 Winter Olympics

pertti.nurmi @ fmi.fi

FMI R&D is the only meteorological partner in the consortium
Grid-to-Point version of Road Weather model

“En-route” RW forecasts

Olympic sites

Sochi sea coast
Background

- Road weather forecasts are based on the output of 3D NWP models and local measurements

- Currently, FMI exploits the High Resolution Limited Area Model (HIRLAM) operationally

- Model’s domain covers whole Europe, including the Black Sea - Sochi region
Input to the road weather forecast

To produce road weather forecasts with higher spatial resolution the road stretch is divided in segments (yellow pushpins)

Depending on available computer resources the scale of segments can vary from a few kilometres down to metre-scale.

Zooming in to the 3rd road stretch of the motorway 148.
Input to the road weather forecast

- NWP model output is interpolated from regular grid to the centre of each road segment (yellow pushpins)
- To predict road weather conditions, Road Weather Model simulations are performed for each road segment
- By default, the input to RWM are output of 3D NWP model
- RWM accuracy can be optimized by using local weather, traffic and road state observations
Road weather system output

<table>
<thead>
<tr>
<th>Time</th>
<th>Surface slipperiness</th>
<th>Surface weather conditions</th>
<th>Surface temperature</th>
<th>Precipitation amount</th>
<th>Wind speed</th>
<th>Other parameter s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time1</td>
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<td>X</td>
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</tbody>
</table>

**Note:**

- X indicates presence.
- ** indicates absence.

Source: 2012 Google Maps.
### Road weather system data base table

<table>
<thead>
<tr>
<th>Time</th>
<th>Road segment ID</th>
<th>Surface slipperiness</th>
<th>Surface weather conditions</th>
<th>Surface temperature</th>
<th>Precipitation amount</th>
<th>Wind speed</th>
<th>Other parameters</th>
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</tbody>
</table>

where “Road segment ID” is related to lat-lon coordinates in a separate table

<table>
<thead>
<tr>
<th>Road segment ID</th>
<th>Lon</th>
<th>Lat</th>
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<tbody>
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<td>1</td>
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<td>41.1696</td>
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<tr>
<td>2</td>
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<td>41.17511</td>
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<td>87</td>
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<td>41.32879</td>
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</table>
**RWS expansion to Sochi region**

Road weather stations (RWS)
- 3+ RWSs – Adler – Kr.Pol.
- ? – coastal road
- 6 RWSs – in Sochi
  - Mounting scheduled to start spring 2012
  - Road Administration building under construction
- ? RWSs – Sochi bypass
Pilot

Common understanding of project goals and collaboration agreement between local authorities, participants and players is a pre-requisite.

The Sochi pilot will focus on providing weather information (observations and forecasts) for the 40 km road stretch leading from the Black Sea Coast up to the mountainous area where the Olympics outdoor sports activities take place. Setup of a local road weather observing network is required as well as adjusting of the FMI road weather model in this particularly challenging area. CoMoSeF common pilot system will be constructed by all project partners. The pilot will combine the regional pilot systems together, within the limits of the physical infrastructure transportation of each sub-pilot. The common pilot will consist of C2X communications and co-operative systems between the pilot vehicles, the local weather station network implemented in the Sochi Olympics area as well as the weather forecasts originating from FMI forecasting systems. The eventual local weather observation network and the infrastructure will neither be hosted nor operated by CoMoSeF and therefore address a specific challenge to project logistics.

IEEE 802.11p, interfacing Sochi Olympics meteorological systems

FMI participates to the validation of the meteorological systems developed for Sochi Olympics.
Some early tasks, relating to meteorology

✓ Define locations of road weather observations and forecasts

✓ Define frequency of forecasts (present minimum is 1 hour)

✓ Define weather forecast time step (present minimum is 15 min)

✓ Define forecast lead time

✓ Define preferred weather-related parameters in addition to surface temperature, slipperiness, ice, snow amount, wind, visibility (e.g. classification of road surface conditions…)
Aware Today, Alive Tomorrow

The future of road weather research...

With past, present, and future research....
All-weather road hazard products will be developed and transferred directly to the driver that will save time, money and lives.
Coordinate forecast quality assessment activities \iff \ WMO

- Potentially utilize FMI verification software package to verify (some of) the forecast products / forecast providers
- Verification training activities

Run FMI HARMONIE forecasting system for Sochi area

- Establish a road weather piloting test bed along the roads leading to Olympics sports event locations \iff \ CoMoSeF
  - “En-route” road weather forecasts from the Black Sea to the mountains
  - Depends **highly** on the availability + quality of local observations

- Wireless communication techniques \iff Forecast output transmission

- Strong cross-collaboration with various stake-holders and end-users
  ( “owners” of observations, road authorities, Olympics operators, rescue and health services, city planning, telecom companies )

\iff Collaboration !