

FROST-2014 : FORECAST AND RESEARCH IN THE OLYMPIC SOCHI TESTBED

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ABSTRACT

The WWRP project FROST-2014 is targeted at nowcasting and short-term numerical prediction of high-impact winter weather events in complex terrain is presented.

1. INTRODUCTION

The Next Olympic / Paralympic Games «Sochi-2014» (hereinafter referred to as «Olympics») will be held in Sochi, Russia, on February 8-23 / March 7-16, 2014. Roshydromet (the Federal Service for HydroMeteorology and Environmental Monitoring) is responsible for provision of meteorological support and services to ensure the safety of the guests and participants and efficient work of involved bodies.

Meteorological support of winter Olympics in mountainous terrain implies both fundamental research and practical forecasting components. A blended Forecast Demonstration Project (FDP) and Research Development Project (RDP) under the auspices of the Nowcasting and Mesoscale Weather Forecasting Research Working Groups of the WWRP was initiated by Roshydromet. In April 2012 it was endorsed by the WWRP Joint Scientific Committee.

2. WEATHER CHALLENGES

Sharp weather contrasts and high spatial and temporal variability are typical for the region of the Sochi-2014 Olympics. Steep mountainous terrain and intricate mixture of maritime sub-tropical and Alpine environments make weather forecasting in this region extremely challenging. For the territory of Russia northern Caucasus is among the leaders with respect to the number of annually registered weather hazards. Precipitation intensity and type, gusting winds, visibility and cloud ceiling are

the primary critical weather elements for the Sochi Olympics.

3. GOALS OF FROST-2014 PROJECT:

- To develop a comprehensive information resource of alpine winter weather observations;
- To improve and exploit:

- nowcasting systems of high impact weather phenomena (snow levels, wind, visibility, precipitation type and intensity) in complex terrain;

- high-resolution deterministic and ensemble mesoscale forecasts in winter complex terrain environment;

- To improve the understanding of physics of high impact weather phenomena in the region;
- To deliver forecasts (nowcasts) to Olympic weather forecasters and decision makers and assess benefits of forecast improvement.

4. OBSERVATIONS

46 automatic meteorological stations (AMS) were installed in the region of Olympics by Roshydromet, by owners of sport venues and by Megafon corporation, provider of mobile communication services. The time resolution of AMS observations does not exceed 10 minutes. For a subset of the stations it is substantially higher.

Data from the new dual polarization Doppler weather radar WRM200 in Sochi will be available by winter 2012/2013.

Wind profiler, temperature/humidity profiler and two Micro Rain Radars (MRR) will supplement the network by winter 2012/2013.

Data storage with Internet access was organized for observation and forecast data exchange between the project participants. It will be used for operational data assimilation, forecasting and nowcasting, verification, for posterior diagnostic studies and analysis.

5. PROJECT CONTENT

Many issues should be tackled within the RDP project component, e.g.:

- Nowcasting of high impact winter weather and multiple weather elements (wind speed and direction, wind gust, visibility, precipitation intensity and type) in complex terrain;
- Improvement of blending procedures for NWP with time-extrapolated observations for winter;
- Radar retrieval of precipitation type and intensity;
- Diabatic and orographic effects on precipitation nowcasting in complex terrain;
- Assessment and account for observational uncertainty.
- Identification of local circulations and clouds controlled by effects of flow blocking, diabatic cooling due to melting snow, and evaporation of precipitation.

A major challenge is the development of nowcasting systems or mesoscale NWP systems to fill the gap in the 4-6 hour lead time and, probably, up to the 12 hour range. Nowcasting potential of participating NWP models (COSMO, HARMONIE, AROME, GEM, and WRF) should be assessed for direct and post-processed (e.g. Kalman filter, 1-D model, MOS) model forecasts. Several models are expected to be implemented for the Sochi region with resolution of 1 km or finer. Tentative list of specialized nowcasting systems participating in FROST-2014 includes ABOM, CARDS, INCA, INTW, MeteoExpert, STEPS, and WSDDM systems.

Due to the strong dependence of many winter sport events on weather conditions, targeted High-Impact Weather (HIW) in the context of winter Olympics is not necessarily linked with very intense or extreme meteorological phenomena. E.g. for outdoor sport events HIW forecasting also includes accurate representation of cross-zero temperature transitions, precipitation type and other sensible weather changes with respect to the prescribed decision-making thresholds.

The gridded fields will be verified mostly at the points with nearby observations. The precipitation fields will be also verified against radar QPE analysis. As for «Vancouver-2010» RDP/FDP SNOW-V10, it is of interest to quantify the added value of forecast refinement between:

- Global model;
- Regional model without and with its own data assimilation;
- High-resolution model with and without data assimilation;
- Post-processed model output;
- Nowcasting.

FROST-2014 is intended as an 'end-to-end' project. Its products will be used by local forecasters for meteorological support of the future Olympics and preceding test sport events.

6. CONCLUSION

SNOW-V10 was the first WWRP winter complex terrain nowcasting project. It remains to be demonstrated whether its results are universally applied and can be demonstrated in a different environment or with different observing network. FROST-2014 provides an excellent opportunity to extend the experience of SNOW-V10 project in the scientifically challenging area of winter nowcasting in a region with complex terrain.

The project is open for new interested participants. Additional information is available at <http://frost2014.meteoinfo.ru>.