

## ICEWARN – ROAD WEATHER FORECASTING FOR PRAGUE CITY

Zacharov Petr<sup>a</sup>, Bližňák Vojtěch<sup>a</sup>, Pešice Petr<sup>a</sup>, Pop Lukáš<sup>a</sup>, Sedlák Pavel<sup>a</sup>, Sokol Zbyněk<sup>a</sup>

<sup>a</sup>*Department of Meteorology, Institute of Atmospheric Physics, Czech Academy of Sciences, Boční II 1401,  
Prague 14131, Czech Republic  
petas@ufa.cas.com*

### I. INTRODUCTION

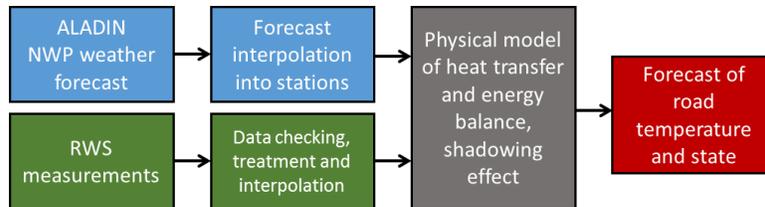
The Institute of Atmospheric Physics (IAP) CAS, Prague, and the Czech Hydrometeorological Institute (CHMI) have developed and currently run FORTE model for Road Surface Temperature (RST) and Road Surface Condition (RSC) forecasts within the ICEWARN project. The goal of the project is to develop a method for a linearly continuous forecast of RST and RSC in Prague city. The model stems from the METRo model (METRo, Crevier and Delage, 2001) and is based on solving the energy balance and heat conduction equations. The FORTE model differs mainly in detailed check of input data (i.e., data quality control) and that radiation fluxes are calculated taking into account shadowing of direct sun radiation by obstacles along the roads. In addition, the model is run every hour in nowcasting mode, when a potential risk on roads is expected. The model uses measured data from road weather stations (RWS), and forecasts of the numerical weather prediction (NWP) model ALADIN as inputs to prepare temperature, radiation and precipitation forecasts (Sokol et al., 2014, 2017). The model utilizes detailed topography, such as parameters of buildings, woods and orography, which can influence direct solar radiation.

### II. DATA DESCRIPTION

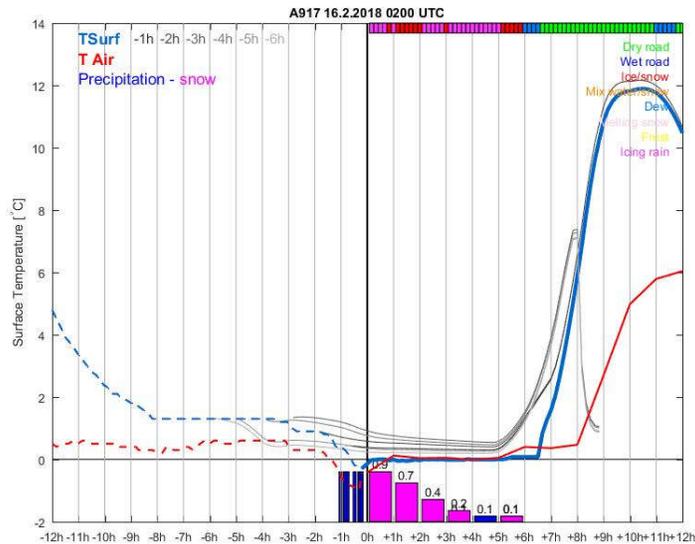
The RWS data consists of 21 RWS managed by the Technical Administration of Roadways of the Capital of Prague and about 20 RWS managed by Road and Motorway Directorate of the Czech Republic. The RWS measure mainly road surface and air temperature, often also wind speed, subsurface temperature, humidity and precipitation. Data forecasted by the NWP model ALADIN, which is operated by the CHMI, are available every 6 hours in a horizontal resolution of 4.7 km and 1-h temporal resolution. Data used for the model run include air temperature and humidity at 2 m, wind speeds at 10 m, pressure at the ground, cloud cover and accumulated precipitation and its type (rain/snow).

### III. DATA FLOW

Before the model run, ALADIN data are linearly interpolated to the positions of RWS and, at the same time, the RWS data are checked by set of procedures correcting and/or eliminating erroneous measured data values. The most common errors include abrupt jumps of the temperatures, measuring only zero temperatures or switched sensors of subsurface temperatures in 5 and 30 cm depth. An overview of the data flow is shown in Fig. 1.



**Fig. 1.** Block diagram of ICEWARN forecast process.



**Fig. 2.** Measurements (dotted lines) and forecasts (full lines) of model FORTE from 16 February 2018, 0200 UTC at the A917 RWS. Blue line depicts RST, red line shows air temperature at 2 m, and grey lines show previous model forecasts of RST so that the lighter is the colour the older is the forecast (see legend in the upper left corner). The bars on the bottom show observed (binary format, before 0h) and forecasted precipitation (total 1-h amount, after 0h) in a state given by colour (see legend in the upper right corner). The forecast of RSC is marked by small rectangles on the right top (see legend in the upper right corner).

#### IV. MODEL FORECASTS

An example of the model forecast from 16<sup>th</sup> February 2018, 0200 UTC at the station A917 is shown in Fig. 2. Snowfall and temperatures around 0°C caused slippery roads and transport complications in Prague. One of the goals of the presented contribution will be an objective evaluation of this event with observations on several RWS using various verification scores (i.e., bias and/or RMSE). A linear forecast of the RST and RSC will be presented as well.

#### V. CONCLUSIONS AND OUTLOOK

The forecasting system ICEWARN enabling a 1-h linear forecast of the RST and RSC has been successfully developed for Prague city roads and its operational run is planned in the near future. The next step is implementation and assessment of the impact of sky-view factor.

Acknowledgement:

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References:

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