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A combined road weather forecast system to prevent road ice formation in the Adige Valley (Italy)

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Road ice is a dangerous meteorological hazard to a nation's transportation system and economy. By reducing the pavement friction with vehicle tyres, ice formation on pavements increases accident risk and delays travelling times thus posing a serious threat to road users' safety and the running of economic activities. Keeping roads clear and open is therefore essential, especially in mountainous areas where ice is likely to form during the winter period. Winter road maintenance helps to restore road efficiency and security, and its benefits are up to 8 times the costs sustained for anti-icing strategies [1]. However, the optimization of maintenance costs and the reduction of the environmental damage from over-salting demand further improvements. These can be achieved by reliable road weather forecasts, and in particular by the prediction of road surface temperatures (RSTs).

RST is one of the most important parameters in determining road surface conditions. It is well known from literature that ice forms on pavements in high-humidity conditions when RSTs are below 0°C. We have therefore implemented an automatic forecast system to predict critical RSTs on a test route along the Adige Valley complex terrain, in the Italian Alps. The system considers two physical models, each computing heat and energy fluxes between the road and the atmosphere. One is Reuter's radiative cooling model, which predicts RSTs at sunrise as a function of surface temperatures at sunset and the time passed since then [2]. One is METRo (Model of the Environment and Temperature of Roads), a road weather forecast software which also considers heat conduction through road material [3].

We have applied the forecast system to a network of road weather stations (road weather information system, RWIS) installed on the test route [4]. Road and atmospheric observations from RWIS have been used as initial conditions for both METRo and Reuter's model. In METRo observations have also been coupled to meteorological forecasts from ECMWF numerical prediction model. Overnight RST minima have then been estimated automatically in nowcast mode. In this presentation we show and discuss results and performances for the 2014-2015 and 2015-2016 winter seasons. Using evaluation indexes we demonstrate that combining METRo and Reuter's models into one single forecast system improves bias and accuracy by about 0.5°C.

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