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Mobile observations as part of future road weather services

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Monitoring of wintertime road conditions is essential for road safety and for optimizing road maintenance operations. Quite recently it has become possible to gather weather information from vehicles, which remarkably increases the data coverage area and detail. The road conditions can considerably differ across the road network and obtaining information in dense spatial scale is highly relevant. Observations from vehicles can be integrated to road weather forecasting system to provide more accurate starting state for the road weather model forecast. With more information about the current road status, the future road conditions can be forecasted more accurately also for road stretches without fixed road weather stations. However, mobile observations are disturbed easily by the heat emitted by the car, exhaust fumes or drifting snow. The data quality should be carefully assessed before implementing these new observations to the forecasting system.

Currently there are usually not enough mobile observations available to provide continuous time series for a single point as is the case with road weather stations. Although modern vehicles are able to measure for example air temperature, this information is not usually publicly available. The goal of the research is to develop the forecasting system to optimally use the available mobile observations to generate accurate road condition forecast. Observations from winter period 2016-2017 are used to test different ways to take mobile observations into account. Measurements are done by Teconer RCM411 and RTS411 instruments attached to vehicles. RCM411 measures optically friction and road condition, whereas RTS411 measures road surface temperature. The model surface temperature cannot be directly forced to the observed temperature, because it would not necessarily fit to the heat balance in the model. One possible method is to adjust the heat balance in the simulation so that the model surface temperature fits to the mobile observations. It might also be possible to utilize previous observations from the same spot to optimize the model physical parameters, like asphalt heat capacity, to better fit the local conditions.

Finnish Meteorological Institute participates in several ongoing projects located in Northern Finland which aim to improve road safety by utilizing mobile observations in road weather services. Mining trucks driving frequently between Kemi harbor and Kevitsa copper and nickel mine act as data source in Intelligent Arctic Trucks project. WiRMa (Industrial Internet Applications in Winter Road Maintenance) is a larger scale project that covers the major roads in northern Norway, Sweden and Finland. The project aims to improve road condition forecasts and winter road maintenance by utilizing new sensor technology and vehicle based data. Two other projects, called 5G-Safe and Sod5G, test the use of high capacity 5G network in communication among vehicles and between vehicles and infrastructure. The meteorological aspects of the projects will be presented with the results of the study to find optimal ways to utilize car observations.