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Fine-Scale Road Stretch Forecasting along Main Danish Roads

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The DMI has in collaboration with the Danish Road Directorate (DRD) for almost two decades used a Road Condition Model (RCM) system (based on a dense road observations network and the numerical weather prediction model - HIgh Resolution Limited Area Model, HIRLAM) to provide operational forecasts of main road conditions at selected road stations of the Danish road network. As of Jan 2009, there are 357 road stations (equipped in total with 456 sensors), where measurements and forecasts of road surface temperature, air and dew point temperatures are conducted. Forecasts of other important meteorological parameters such as cloud cover and precipitations as well as radar and satellite images are also distributed to the users through the web-based interface vejvejr.dk and through DMI and DRD web-pages. For icing conditions, new technology has made it easy to vary the dose of spreaded salt, making it possible to use salt only on the parts of the road network where it is really needed.

In our study measurements of road surface temperature from road stations and salt spreaders have additionally been used to examine both road stations and road stretches forecasts along the main roads of the Danish Road Network (accounting almost 23 thousand points located at distances of 250 m). These results showed critical importance of availability of detailed characteristics of the roads surroundings. To make local forecasts in a specific point all possible local detailed information is needed. Since high resolution models running at faster supercomputers as well as detailed physiographic datasets now are available, it is possible to improve the modelling and parameterization of significant physical processes influencing the formation of the slippery road conditions. First of all, it is based on a new dataset available from Kort og Matrikel styrelsen, the so-called Danish Height Model (Danmarks Højdemodel) which is a very detailed set of data with horizontal resolution of a few meters and fine height accuracy.

The main aim of this study is to research, analyze, develop, and improve the quality of the road condition forecasts by refining, detalization, setting up, and running the fine-scale resolution numerical weather prediction (NWP) model with integration (from high resolution databases) of characteristics and derived parameters of surrounding roads the land-use, terrain, positioning and road properties at road stations/ stretches. The objectives include, at first, research and development of the existing road model based on input from a fine-scale NWP modelling. At second, it is analysis and integration of detailed data and derived parameters at road stations/stretches into the RCM based on available detailed Danish datasets on terrain, GPS positioning, land-use, and road properties. And at third, it is elaboration, testing, evaluation, and implementation of the methods and approaches suitable for forecasting and verification of the RCM performance for fine-scales.

The results of this study are applicable for improvement of quality of detailed forecasts at road stretches. This will facilitate the use of data from the road stretch forecasting to automatic adjustment of control of the dosage spread by salting spreaders (i.e. for optimization of the salt amount spreaded in order to prevent the icing/freezing and better timing of salting schedule). It will lead to improvement of the overall safety of the winter road traffic. It will contribute to further development and improvement of the visualization tools for the road stretches forecasting. And it may reduce the environmental impact in the road surroundings due to an optimized spreading of the salt.