EMS Annual Meeting Abstracts,
Vol. 6, EMS2009-81, 2009
9th EMS / 9th ECAM

9th EMS Annual Meeting
9th European Conference on Applications of Meteorology
High resolution meteorology
- applications and services

Improvement of Road Forecasting using Effects of Shadowing due to Terrain and Distance to Seashore

A. Mahura, K. Sattler, C. Petersen, and B. Sass
Danish Meteorological Institute, Research Department, Copenhagen, Denmark (ama@dmi.dk, +45-3915-7400)

The operational road weather forecasts performed by the DMI Road Weather Modelling (RWM) system is an important product for the end-user community. As input, the continuous observations from synoptic weather and road stations of the Danish national road network along with meteorological output from the DMI's numerical weather prediction High Resolution Limited Area Model are used in this system to generate forecasts every hour. The data assimilation produces a model state at the forecast initial time and atmospheric input data which are modified by observations. These data force the road condition model (RCM) during the forecast.

Since recently, the system provides forecasts not only at positions of the road stations (357 in total) but also at multiple points along the roads (almost 23 thousand road stretches located at distances of 250 m from each other). Previously, a description of physiographic conditions in RCM at a relatively low resolution was acceptable, but now such description should be done at finer scales and in more details. This became possible due to higher resolution modeling, faster supercomputers, and newly emerged detailed physiographic datasets. All these give a possibility to improve the quality of road modelling and especially during slippery road conditions.

Due to a new Danish database from the Kort og Matrikel Styrelsen (so-called Danish Height Model – Danmarks HøjdeModel) it became possible to access details of topography with a precision and much higher resolution compared with previously used datasets. This allows taking into account shadowing effects when forecasting the road surface temperature. These effects were estimated by scanning the surrounding terrain by sectors (32 sectors by 11.25 deg each) up to maximum distance of 10 km from the road station geographical position. The scanning was performed within 3 ranges of 0–100 m, –1 km, and –10 km with a horizontal step of 5, 10, and 20 m, respectively. For each sector, an average angle of the highest point was calculated as a horizon angle representing a shadowing effect due to terrain. It is planned that additional layers representing obstacles above the terrain level such as forest, urban, etc. will improve accuracy and representativeness of shadowing for the roads.

Since Denmark is surrounded by the sea waters, the modeled road conditions are highly affected by proximity of roads to the seashore line. So, for each point the distances within each sector were calculated, as well as the shortest distance to seashore with a corresponding direction. In total, 20% are placed (within a 1.5 km distance from a seashore) at coastal stations and large bridges connecting the Danish islands; 23% at pre-coastal stations (between 1.5–5 km), and 57% - at inland stations (farther than 5 km).

The cataloging of each road station individual characteristics was carried out. The catalog includes the GPS positioning (re-verified routinely through Google-Earth with respect to roads); altitude of location; sectoral distribution of horizon angle, shortest distance to seashore with corresponding azimuth; minimum distance to seashore with corresponding classification into coastal, pre-coastal, and inland stations; surrounding detailed land use types, especially with respect to forest, open fields, urban/suburban areas, closest water bodies and types of bridges (over other roads, rivers, channels). A similar cataloging with respect to road stretches is undergoing.