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Improving surface condition forecasting using SNOWTAM data

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Surface conditions are usually predicted based on meteorological data and if available measured pavement temperatures. At some roads also observed surface condition data are available. The use of these observed surface conditions can significantly improve the predicted surface condition. Airports operating in winter conditions have a procedure to regularly check and report the surface condition in a report called SNOWTAM. In these reports, the surface conditions are described as one or a combination of the following conditions: dry, moist, wet, rime, dry snow, wet snow, slush, ice or compacted snow. The frequency of these reports varies between airport and increases when the condition changes rapidly or when icy conditions are expected. In order to prevent traffic delays these inspections cannot be carried our too frequently. At the airports in Norway an integrated runway information system provides information about the surface condition on runways to winter maintenance personnel. Based on the SNOWTAM data, measured weather data and pavement surface temperatures a description of the current surface condition is given.

A case study is done for a runway at Oslo Airport in Norway during the winter of 2010-2011. A surface temperature and condition prediction model is built which predicts the surface condition a couple of hours ahead of time. The model takes into account the effect of the weather, air traffic, pavement properties and winter maintenance measured such as snow ploughing and salting. The following heat fluxes are taking into account: the conductive heat flux through the pavement, the longwave and shortwave radiative heat fluxes, the convective heat flux, the heat fluxes of rainfall and snowfall, the heat flux for evaporation and condensation and the heat flux due to sublimation and deposition. The effect of air traffic is included in the convective and latent heat fluxes. The effect of chemicals on the melting temperature is included in the latent heat fluxes.

The model is run in now-casting, where the surface temperature and condition were predicted three hours ahead of time and in long term mode, both with predicted and observed surface conditions. When running the model with SNOWTAM data in "now-casting mode" the average error of the surface temperature during the entire winter season, which is one of the main input parameters for the surface condition prediction, is 0.25 °C and the RMSE is 1.65 °C. The surface prediction model is in almost half on the times predicted accurately. The prediction is most accurate for dry and icy conditions. The results show that the use of the observed surface conditions (SNOWTAM data) increases the accuracy of the surface condition with 30% and the accuracy of the RMSE of the temperature prediction with 13% compared to using predicted surface conditions.