SMHI

Local effects on icing for wind power in cold climate

presented at Winterwind 2018

5-7 Feb in Åre

Esbjörn Olsson

WeatherTech

UPPSALA UNIVERSITET

Introduction

- This project focus on how local surface details affect icing on wind turbines. Project start 1 jan 2018, ends 31 jan 2020.

- Distribution of land use, forest characteristics and snow cover influence vertical transport of heat and moisture, thus effecting the possibility and height distribution of icing.

- These effects will be studied using a state-of-the-art modelling chain; numerical weather prediction model – icing model – production loss model.

- The local effects will be implemented into a probabilistic forecasting system allowing for operational assessments of icing risks.

- WP1: Local effects of surface characteristics on wind power.

  - Detailed studies of how different surface parameters affect boundary layer processes; heterogeneous land use, snow characteristics and tree heights.
  - Sensitivity experiments with HARMONIE-AROME in order to analyze the impact of the surface parameters on atmospheric icing.
  - Experiments with very high horizontal resolution (500m) to resolve heterogeneous surfaces as detailed as possible.

- WP2: Probabilistic icing and wind power forecast.

  - Development of SMHI MEPS (MetCoOp Ensemble Prediction System) for wind power in cold climate.
  - SMHI publishes its data openly according to INSPIRE directive.
  - WeatherTech will test the benefit of the probabilistic system for commercial applications.
  - Deficiencies in the ensemble system will be addressed by developing perturbations for the surface parameters that were examined in WP1.

- MEPS (MetCoOp Ensemble Prediction System)

  o Joint SWE – NOR – FIN operational production of ensemble forecasts

  o HARMONIE-AROME version 40h1.1

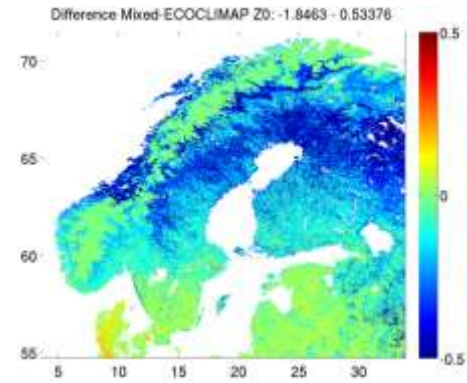 o 2.5 km horizontal resolution

  o 10 members

Topography MEPS
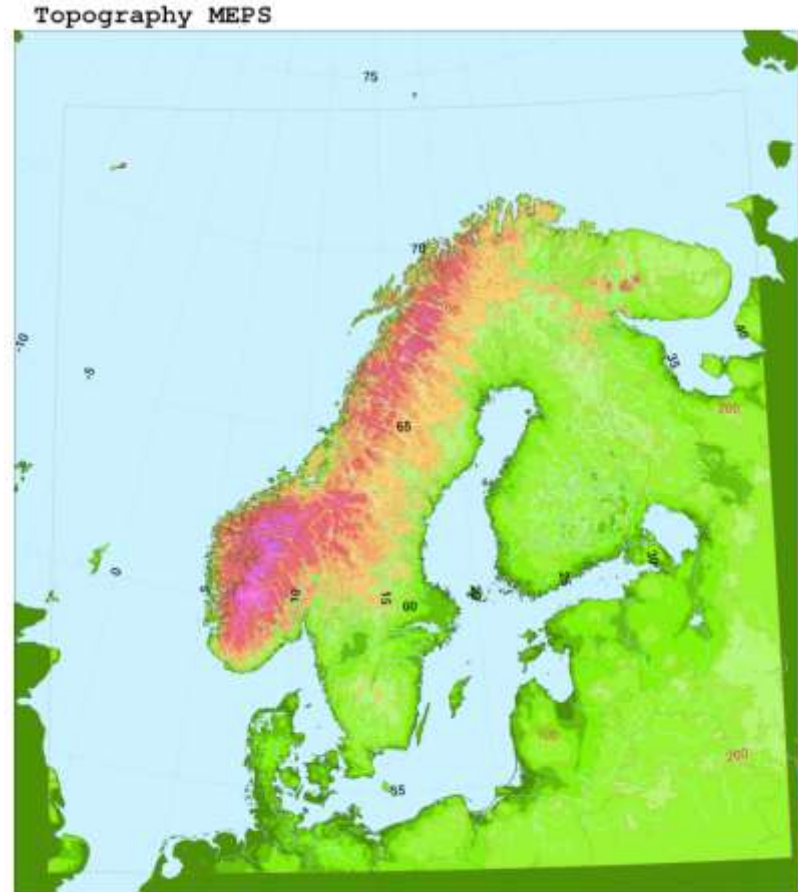
Tree heights

- New highly detailed database for tree height. (10m horizontal resolution).

- Better estimation of surface roughness, z0.

- Improved description of surface fluxes of heat and moisture.

- Improved forecasts of wind speed at the lower altitudes.

New

Default
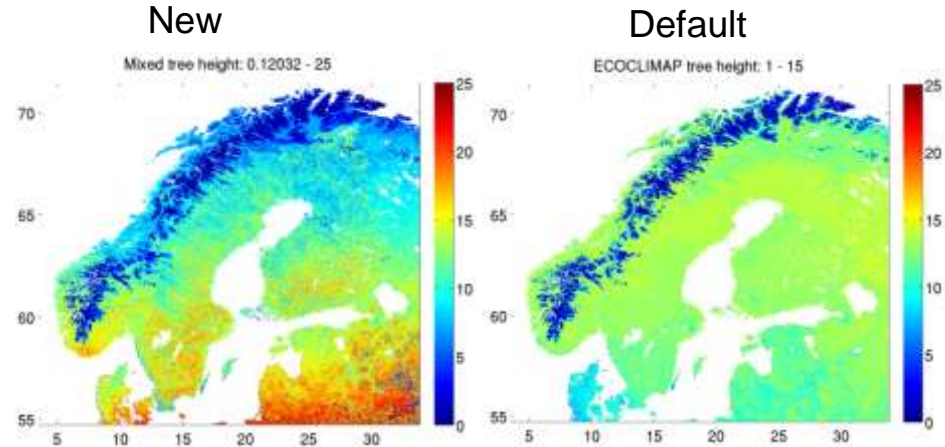
Difference in roughness

SMHI

- Dividing the nature part of each gridbox into two patches, separating forest and open land.

- Gives the opportunity to a better calculation of the snow processes for each patch.

- More realistic surface roughness over the open land snow.

1 patch

med-high z_0

Open land

Forest

Snow

2 patches

high z_0

low z_0