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Estimates of Construction-Related Climate Parameters and Extremes in Bergen–Hardanger Region

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Regional climate downscaling was performed with the Weather Research and Forecast Model (WRF) to investigate the variability of climate parameters relevant to the construction of infrastructures over very complex terrain of the Norwegian west coast. As the typical scales of the terrain variability are of order of one kilometer, the simulations were conducted at the horizontal resolution of 1km x 1km with the initial and boundary conditions provided by the Norwegian Earth System Model (NORESM1-M). The selected NORESM data (2.5° x 1.89°) range from 1990s-2000s, and from 2040s-2050s with the RCP8.5 radiative forcing scenario. To configure the WRF model, NCAR/NCEP reanalysis data used as the "perfect boundary conditions (PBC)". The results of the PBC simulation were compared with observations from meteorological stations near the construction sites. The analysis of simulation results revealed that the proper resolution was essential to the simulations of regional climate variables. An experiment with different landuse databases (USGS and MODIS) showed that biases in extremes of the surface wind speed was significantly reduced when the MODIS landuse data were utilized. In the simulation of the historical European windstorm in December 1999, it showed that in Hardanger Mountain area the WRF model cloud microphysics scheme can affect not only the precipitation significantly but also the down slope wind speed moderately. Maximum wind speed, maximum and minimum temperature, precipitation, temperature zero-crossing frequency, and freezing rain frequency are found within five to ten year return periods by the NORESM-WRF simulations. Statistical methods are used for extrapolation within a longer return period. An extreme wind speed was identified in the beginning of January 2000, a few days later than the real extreme storm at the end of December 1999. This suggests that NORESM-WRF simulation may help us gain more insights about how regional down scaling may add value to global model simulations.