Project: 105
Project title: ANDIVA (Analyse, Diagnose und Validation)
Principal investigator: Joaquim G. Pinto
Report for period 01.01.2018 - 31.12.2018

During the year 2018, our research focused on the modelling of a cold-season derecho over Europe at convection permitting resolutions. This work lead to a manuscript currently under review in the Quarterly Journal of the Royal Meteorological Society. In this report, we give a short overview of achieved and ongoing research projects.

Within the framework of master thesis, a Derecho over France, BeNeLux and Germany in January 2014 was analyzed with the help COSMO-CLM simulations. Compared to 2017, the resolution increased from 2.8 km to 1.1 km. The focus was on the development stage of the system. The effect of different initial and boundary data sets leading to diverse developments of the modelled derecho have been investigated in detail. Several sensitivity studies with slightly disturbed initial conditions was performed to analyze the sensitivity of the initial atmospheric conditions on the resulting modelled derecho event. The sensitivity studies indicate that the correct location of a short-wave through over the North Atlantic in combination with a tongue of enhanced low-level moisture plays an important role to realistically simulate the derecho. Moreover, the clear benefit of high resolution (1.1 km) simulations to capture the structure and intensity of the organized convection line was demonstrated.

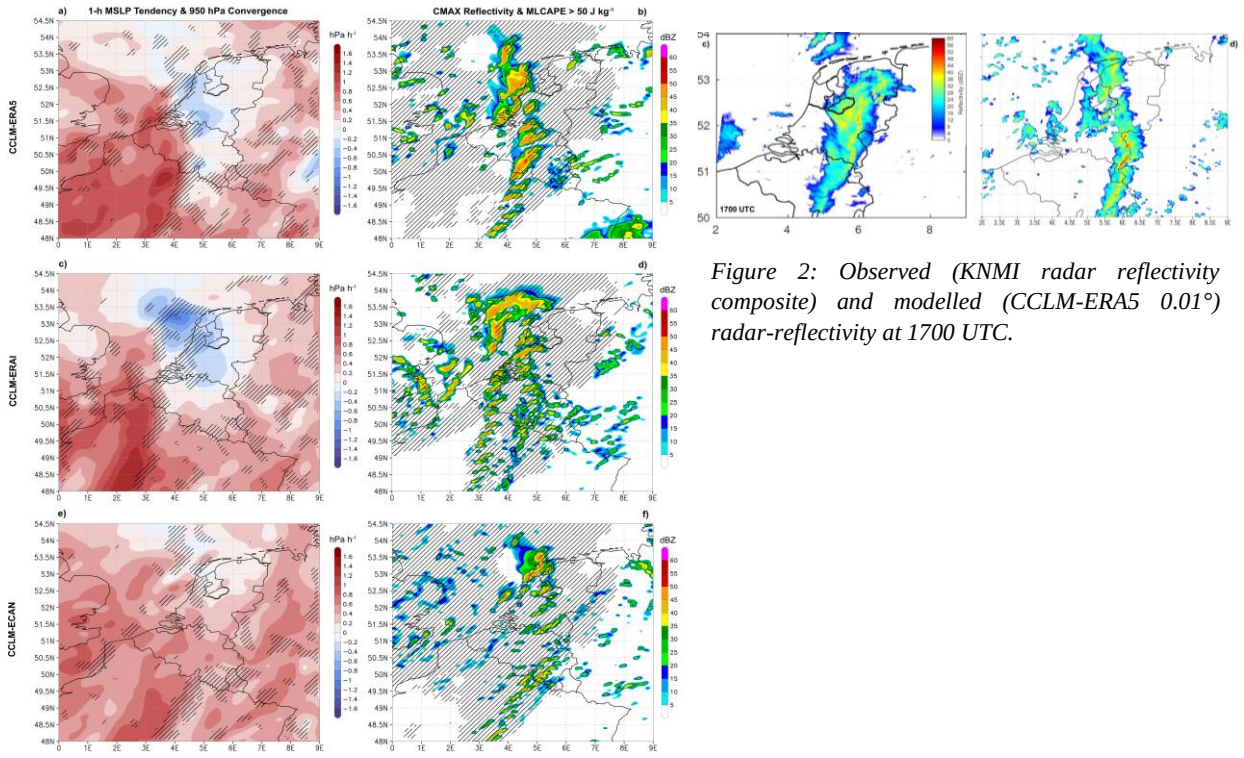

Figure 2: Observed (KNMI radar reflectivity composite) and modelled (CCLM-ERA5 0.01°) radar-reflectivity at 1700 UTC.

Fig.1: left: 1-hourly mean sea level pressure (MSLP) tendency (hPa h^{-1}; shaded) and 950 hPa convergence smaller than -5 x 10^{-5} s^{-1} (hatched areas) from 0.0625° simulation with different datasets for initial and boundary conditions. Right: simulated maximum reflectivity (dBZ; shaded) and 50-hPa mixed-layer CAPE > 50 J kg^{-1} (hatched) from the 0.025° simulation.

Mathias, L., Ludwig, P., and Pinto, J.G. (2018): Synoptic-scale conditions and convection-permitting hindcast experiments of a cold-season derecho on 3 January 2014 in Western Europe. Quart. J. of Roy. Met. Soc. (submitted)