Adapting COSMO-CLM^2 for Antarctic climate representation

Alexandra Gossart (1), Niels Souverijns (1), Stef Lhermitte (1,2), Irina V. Gorodetskaya (1,3), Matthias Demuzere (1,4), Hendrik Wouters (1), and Nicole P.M. van Lipzig (1)

(1) Department of Earth and Environmental Sciences, KU Leuven, Leuven, Belgium (alexandra.gossart@kuleuven.be), (2) Department of Geosciences and Remote sensing, Delft University of Technology, Delft,The Netherlands (S.Lhermitte@tudelft.nl), (3) Centre for Environmental and Marine Sciences, Department of Physics, University of Aveiro, Portugal (irina.gorodetskaya@ua.pt), (4) Department of Forest and water management, University of Ghent, Belgium (Matthias.demuzere@UGent.be)

Understanding the surface mass balance (SMB) of the Antarctic ice sheet (AIS) is crucial to understand Antarctica's contribution to 21st century sea level rise. Recent studies investigated the SMB over the AIS and the interaction between accumulation and clouds, precipitation and other meteorological variables by use of observations or climate models. However, the spatial coverage of observations over the AIS is low, while the number of regional climate simulations is still limited.

In the CORDEX framework, an ensemble of climate simulations over the AIS is still missing. Our goal is to provide reliable COSMO-CLM^2 simulations that can contribute to this effort and to the understanding of the climate over Antarctica.

In this respect, the performance of the coupled COSMO CLM and Community Land Model over the AIS was evaluated. The model was executed using ERA-Interim as its initial and lateral boundaries for a time period of 1 year (excluding 3 months of spin-up time) at an horizontal resolution of 0.22° by 0.22° over the whole Antarctic continent.

In this poster, we present several modification applied to the model. As this model is not adapted to the specific Antarctic conditions, some serious biases are observed, i.e. temperature at the surface and upper levels, wind speed precipitation, stability of the lower atmosphere and snow characteristics. These biases are addressed by adapting several parameters in the model, e.g. the ozone concentration in the upper levels, the roughness length and the snow parametrisation, among others.

As such, an improved model over the AIS is obtained. In future steps, COSMO-CLM^2 can be used to perform a long-term climate simulation over Antarctica and to obtain a better idea of the processes influencing the (local) SMB, including sea level rise. In turn, it can contribute to the CORDEX effort and be part of the ensemble of climate models over the AIS.