Project: 958 Title: Weddell Sea Ice

Project lead: **Günther Heinemann,** Report period: **2019-01-01 to 2019-12-31**

In the last years, we used the regional climate model COSMO-CLM (CCLM) to run simulations on Mistral with a horizontal resolution of 15 and 5 km over the Weddell Sea in the Antarctic. We made a reference run (C15/C05) and another run (T15/T05) with a changed turbulence parametrization (Zentek and Heinemann 2019). In the report period we extended the C15 and C05 data sets further to cover the Year of Polar Prediction (YOPP) period 2017-2019. In addition, we added simulations with a 2 km horizontal resolution (T02) for the Larsen Ice Shelf of the Antarctic Peninsula (Fig.1) for the period 2013-2016. For these runs we used the changed turbulence parametrization as the atmospheric stable boundary layer is simulated more realistically (Zentek and Heinemann 2019, see also last report). The T02 domain covers the Larsen-C Ice Shelf where in 2017 a part of the ice shelf collapsed.

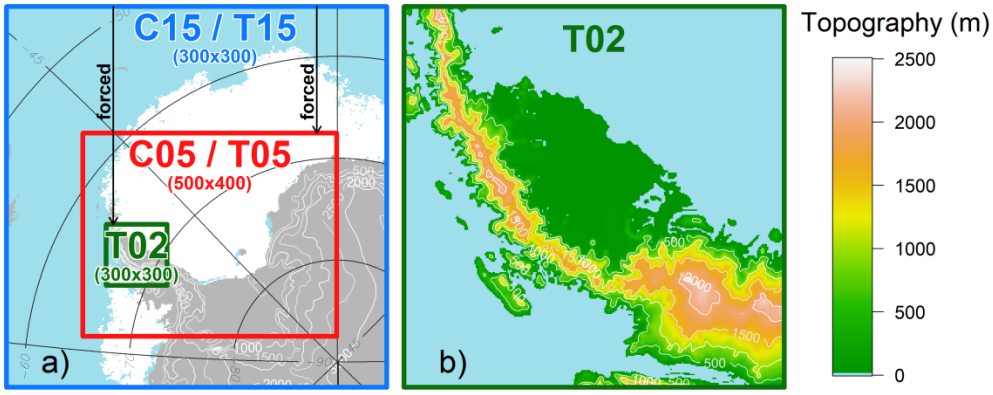

Fig.1: a) *Domains of the old C15/T15 and C05/T05 simulations as well as the T02 simulations. The number of grid points are shown in brackets. b) Topography of the T02 domain.*

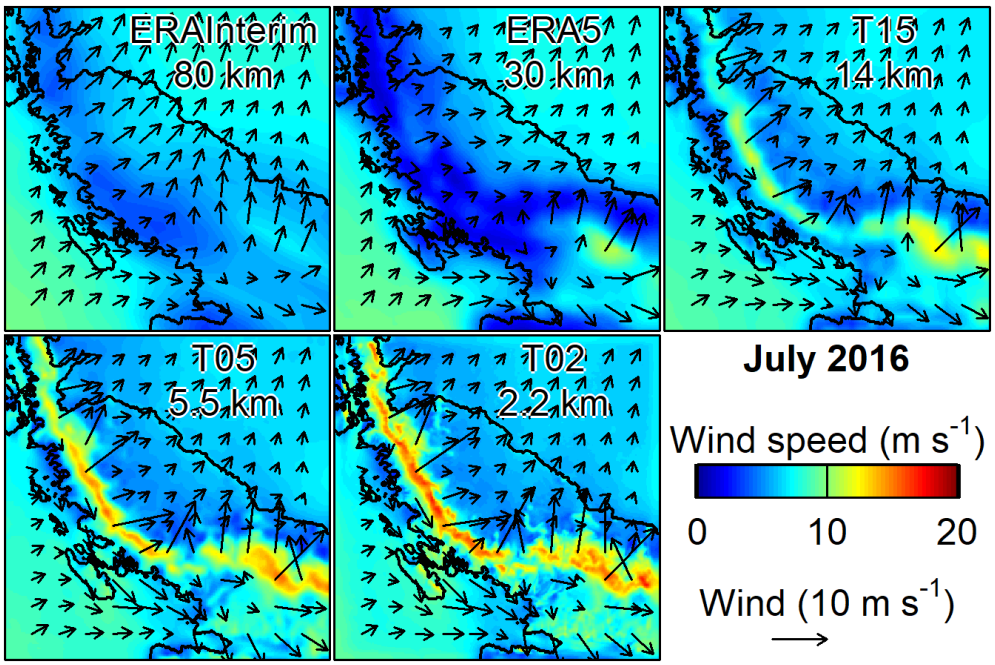

Fig.2: *Mean wind for July 2016 for the region of the Larsen-C Ice Shelf for ERA-Interim, ERA5, and CCLM with different resolutions (vectors selected on the ERA-Interim resolution).*

A comparison between the coarser CCLM simulations, the new T02 and the reanalysis ERA-Interim with 80 km and ERA5 with 30 km horizontal resolution (see Fig.2) shows the reanalyses are not able to account for the topographic effects of katabatic winds and foehn in that region. With 15km resolution these effects are simulated, but largely underestimated. This is in accordance with the findings of Elvidge et al. (2014) and Turton et al. (2017), who concluded that foehn effects over Larsen C Ice Shelf are best represented for a model with 1.5km resolution.

A long-term verification of the 15 and 5 km CCLM simulations was published (Zentek and Heinemann, 2019). Overall CCLM shows a good representation of temperature and wind for the Weddell Sea region. A comparison with measurements over the sea ice of the Weddell Sea by three AWS buoys for one year showed small biases for temperature around 1 K and for wind speed of 1 m/s. Comparisons of radio soundings for 2002-2016 showed a model bias around zero and a RMSE of 1-2 K for temperature and of 3-4 m/s for wind speed. Besides the standard data sets of radiosondes and surface measurements, this includes comparisons to Doppler wind LIDAR measurements (Zentek et al., 2018). The comparison of CCLM simulations at resolutions down to 1 km with wind data from Doppler Lidar measurements during December 2015 and January 2016 yielded almost no bias in wind speed and RMSE of ca. 2 m/s.

References:

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Zentek, R., Kohnemann, S. H. E., and Heinemann, G.: Analysis of the performance of a ship-borne scanning wind lidar in the Arctic and Antarctic, Atmos. Meas. Tech., 11, 5781–5795, https://doi.org/10.5194/amt-11-5781-2018, 2018.

Zentek, R. and Heinemann, G.: Verification of the regional atmospheric model CCLM v5.0 with conventional data and Lidar measurements in Antarctica, Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2019-141, in review, 2019.