Verification of simulations in the Weddell Sea region in Antarctica

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COSMO model in Climate Mode (COSMO-CLM, CCLM, Rockel et al. 2008) was used to perform simulations the Weddell Sea region in Antarctica (see Fig.1) for the time period 2002-2015. The model (version cclm5.0_clm1) was modified by the use of a thermodynamic sea ice module (Schröder et al. 2011) with snow cover and an increased albedo for inland ice and sea ice. Furthermore a different topography (RTopo2 – Schaffer et al. 2016) was used, as the default WebPEP (GLOBE) data does not include ice shelves. The model was run with nesting in ERA-Interim data (Dee et al. 2011) in a **forecast mode for 30h every day** (allowing for a 6h spin up time). Sea ice concentrations were taken from satellite measurements (AMSR-E, SSMI/S, AMSR2 – Spreen et al. 2008) and were updated daily to allow for a close-to-reality hindcast. Simulations were done with 1.25° (=13.9 km) resolution **(C15) for the whole period 2002-2015** with the goal to force the sea-ice ocean model FESOM (Wang et al. 2014, Timmermann et al. 2012) with the atmospheric near-surface data. In a second step a 0.05° (=5.6 km) simulation **(C05) was performed for the winter period (April – September 2002-2015** , one-way nested). In the vertical there are 60 levels with the model top at 25 km and the lowest level between 0 and 10 m. For the model verification the available measurements of synoptic stations and radiosondes are used. In addition, high-resolution wind profiles measured with a wind LIDAR during a cruise with the icebreaker Polarstern during the austral summer 2015/16 are compared, and CCLM simulations with 1 km resolution were performed for case studies.

Verification using radio sounding

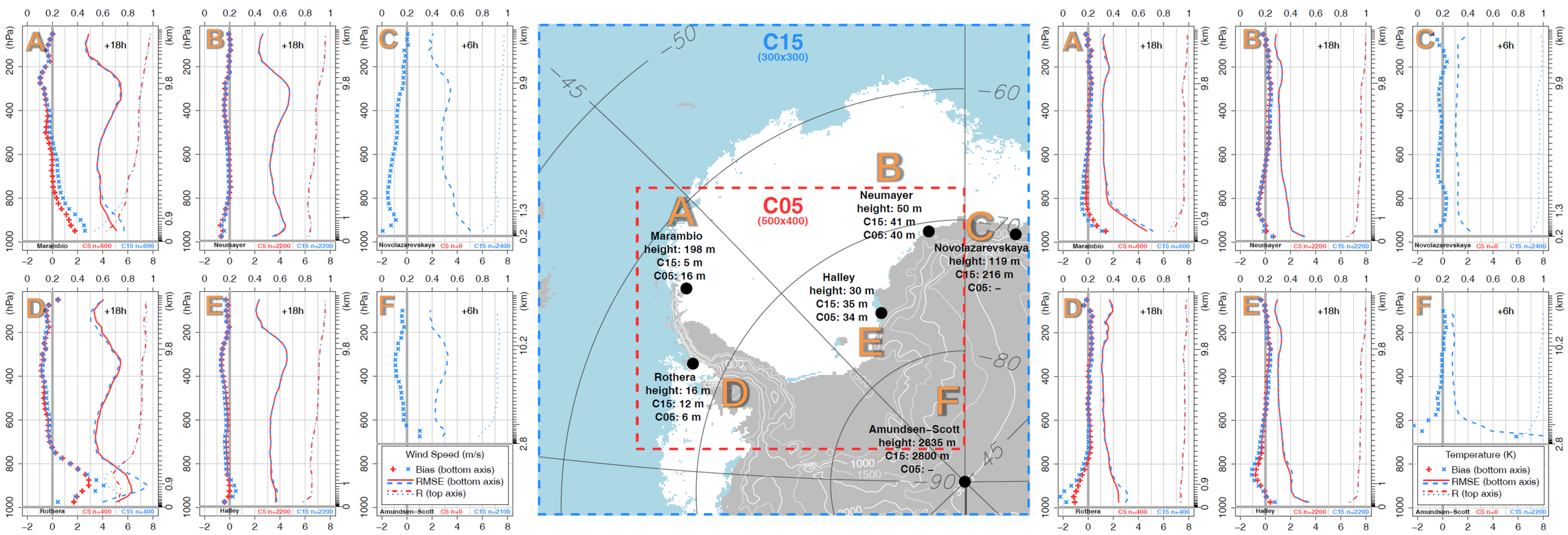
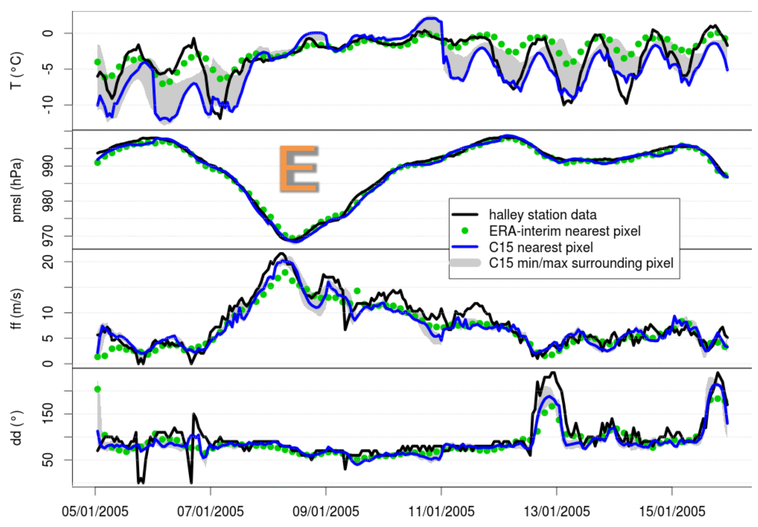


Fig.1: (MIDDLE) Domain of the C15 and C05 simulation and location of 6 stations (actual heights and height in the model as indicated). Topography contours are plotted every 500 m and sea ice concentration >70% for the 01.06.2015 is shown in white. (LEFT/RIGHT**) Bias, RMSE and correlation coefficient** R for **wind speed** (left panels) and **temperature** (right panels) between C05(red)/C15(blue) and radio soundings. **Statistics were computed over winter months (Apr.-Sept.)** for the years 2002-2015 for 12:00 UTC (A,B,C,D) or 0:00 UTC (E,F) which corresponds to 18 hours or 6 hours after simulation start. Average number of radio soundings used is indicated by n in the lower right corner.

Surface observations

Fig.2: Comparison of **Halley station observations** (black), ERA-Interim (green) and C15 (gray and blue) for 11 days in austral summer (05/01/2005-15/01/2005). From top to bottom: Temperature (T), mean sea level pressure (pmsl), wind speed (ff) and wind direction (dd).



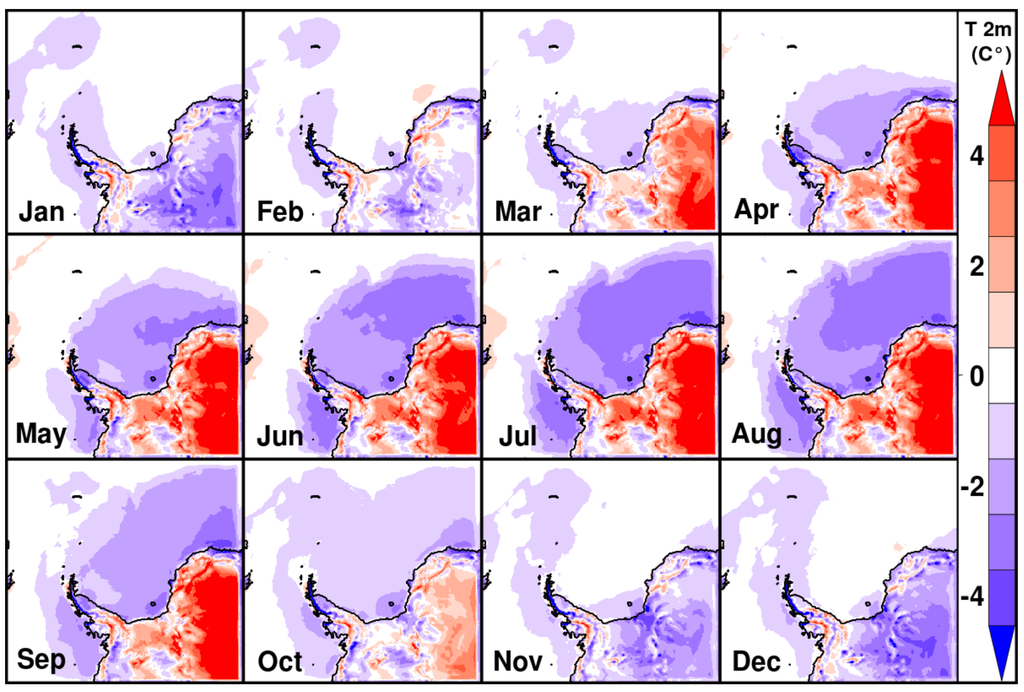


Fig.3: **Bias of 2 m temperature** (2002-2015) for **C15 compared to ERA-Interim**.

Case study (LIDAR)

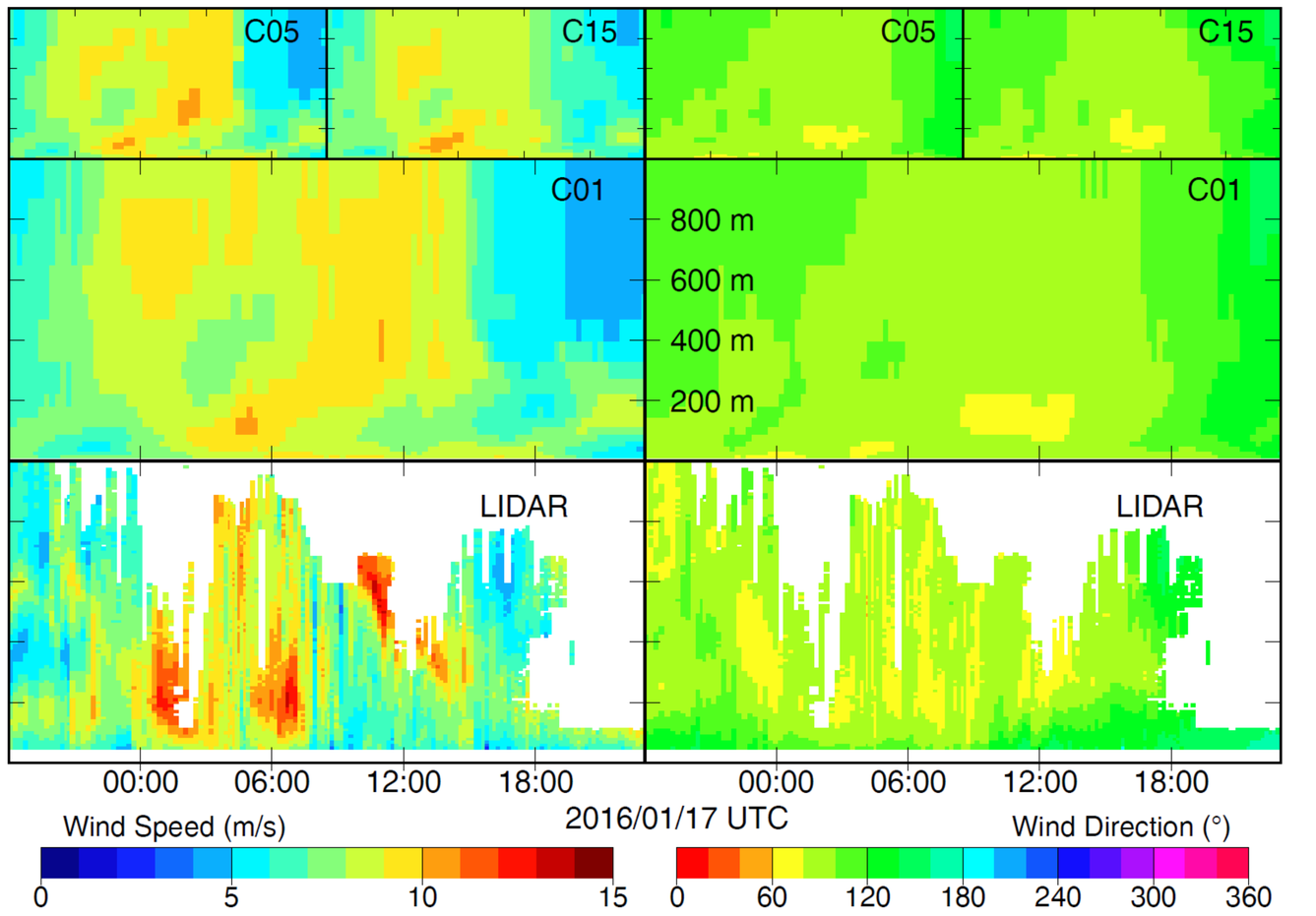


Fig.4: Comparison of **simulated** (top panels) **and measured** (bottom) **wind speed** (left) **and direction** (right). The LIDAR was installed on the RV Polarstern during the PS96 cruise in the Weddell Sea. Y-axis indicates height above sea level and the X-axis indicates the measuring period 16.01.2016 18:00 - 17.01.2016 23:00 UTC. The ship moved with up to 5 m/s (18km/h); thus different COSMO pixels are plotted each time.

Fig.5: Wind LIDAR on Polarstern.

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Acknowledgements

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