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An evaluation of the surface climatology over the Totten region (Antarctica) using COSMO-CLM2

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The Totten glacier is a highly dynamic outlet glacier, situated in E-Antarctica, that contains a potential sea level rise of about 3.5 meters. During recent years, this area has been influenced by sub-shelf intrusion of warm ocean currents, contributing to higher basal melt rates. Moreover, most of the ice over this area is grounded below sea level, which makes the ice shelf potentially vulnerable to the marine ice sheet instability mechanism. It is expected that, as a result of climate change, the latter mechanisms may contribute to significant ice losses in this region within the next decades, thereby contributing to future sea level rise. Up to now, most studies have been focusing on sub-shelf melt rates and the influence of the ocean, with much less attention for atmospheric processes (often ignored), which also play a key-role in determining the climatic conditions over this region. For example: surface melt is important because it contributes to hydrofracturing, a process that may lead to ice cliff instabilities. Also precipitation is an important atmospheric process, since it determines the input of mass to the ice sheet and contributes directly to the surface mass balance. In order to perform detailed studies on these processes, we need a well-evaluated climate model that represents all these processes well. Recently, the COSMO-CLM^2 (CCLM^2) model was adapted to the climatological conditions over Antarctica. The model was evaluated by comparing a 30 year Antarctic-wide hindcast run (1986-2016) at 25 km resolution with meteorological observational products (Souverijns et al., 2019). It was shown that the model performance is comparable to other state-of-the-art regional climate models over the Antarctic region. We now applied the CCLM^2 model in a regional configuration over the Totten glacier area (E-Antarctica) at 5 km resolution and evaluated its performance over this region by comparing it to climatological observations from different stations. We show that the performance for temperature in the high resolution run is comparable to the performance of the Antarctic-wide run. Precipitation is, however, overestimated in the high-resolution run, especially over dome structures (Law-Dome). Therefore, we applied an orographic smoothening, which clearly improves the precipitation pattern with respect to observations. Wind speed is overestimated in some places, which is solved by increasing the surface roughness. This research frames in the context of the PARAMOUR project. Within PARAMOUR, CCLM^2 is currently being coupled to an ocean model (NEMO) and an ice sheet model (f.ETISh/BISICLES) in order to understand decadal predictability over this region.