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Recent and near future climate change in the Antarctic Peninsula

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This study assesses the recent (1990-2015) and near future (2020-2045) climate change in the Antarctic Peninsula. For the recent period, we make the use of available observations, ECMWF's ERA5 and its predecessor ERA-Interim, as well as regional climate model simulations. Given the different climate characteristics at each side of the mountain barrier, we principally assess the results considering the windward and leeward sides. We use hindcast simulations performed with Polar-WRF over the Antarctic Peninsula on a nested domain configuration at 45 km (PWRF-45) and 15 km (PWRF-15) spatial resolutions for the period 1990-2015. In addition, we include hindcast simulations of KNMI-RACMO21P obtained from the CORDEX-Antarctica domain (~ 50 km) for further comparisons. For the near future climate change evaluation, we principally use historical simulations and climate change projections (until 2050s, RCP85) performed with PWRF (forced with NCAR-CESM1) on the same domain configuration of the hindcast simulations. Recent observed trends show contrasts between summer and autumn. Annual warming (cooling) trend is notable on the windward (leeward) coasts of the peninsula. Unlike the reanalysis, numerical simulations indicate a clear pattern of windward warming and leeward cooling at annual time-scale. These temperature changes are accompanied by a decreasing and increasing trend in sea ice on the windward and leeward coasts, respectively. An increasing trend of precipitation is notable on the central and northern peninsula. High resolution climate change projections (PWRF-15, RCP85) indicate that the recent warming trend on the windward coasts tends to continue in the near future (2020-2045) and the projections exhibit an increase in temperature by ~ 1.5°C and 0.5°C on the windward and leeward coasts, respectively. In the same period, the projections show an increase in precipitation over the peninsula (5% to 10%). The more notable warming projected on the windward side causes more increases in surface melting (~ +20% to +80%) and more sea ice loss (-4% to -20%) on this side. Results show that the windward coasts of central and northern Antarctic Peninsula can be considered as "hotspots" with notable increases in temperature, surface melting and sea ice loss.