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Southern Hemisphere Storminess under recent and anthropogenic climate conditions based on a multi model ensemble analysis

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This study investigates Southern Hemisphere (SH) cyclone development around Antarctica and the Southern Ocean, the variability and extremes under present climate conditions and the possible shift in an anthropogenic changed climate. Therefore reanalysis data and the data of a multi-model ensemble are analysed by applying an objective cyclone identification and tracking algorithm for simulations of the recent climate and the 21st century period according to the IPCC SRES A1B scenario.

Validation with NCEP-Reanalysis reveals partly large underestimation of the number of tracks from individual models, although the overall spatial distribution patterns are well represented in most of the models. Special focus is laid on a validation period later than 1979, when satellite products were incorporated in re-analysis data, leading to a higher representativeness especially over the Southern Hemisphere.

With respect to the climate change signal at the end of this century, a poleward shift of the cyclone track density with positive changes up to 20% around 60°S is identified in all analysed models (7 AOGCMs with totally 9 simulations). The climate change pattern may vary from model to model in detail but in an ensemble mean perspective increasing track density is identified south of about 55°S.

For the identification and classification of intensity of the cyclones the quasi-geostrophic relative vorticity (equivalent to Laplacian of MSLP) and central pressure are investigated. With respect to central pressure a systematic deepening up to 20 hPa around 60°S is analysed in the ensemble mean. A more heterogeneous result is found for the Laplacian of pressure with maximum intensification signal over the South-Indic, the South-east Pacific and the Tasman Sea.