NHM-SMAP v1.0 for the Antarctic Ice Sheet

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The polar regional climate model NHM-SMAP (Non-Hydrostatic atmospheric Model and the Snow Metamorphism and Albedo Process) (Niwano et al., 2018; Fettweis et al., 2020) forced by the Japanese latest reanalysis JRA-55 (Kobayashi et al., 2015) is applied in the Antarctic ice sheet using the same model configuration as Niwano et al. (2018) except only for horizontal resolution and ice sheet surface conditions: The Antarctic version of NHM-SMAP sets the value to 12 km with 508 × 472 grid points over Antarctica. The ice sheet mask as well as surface elevation are given from Slater et al. (2018).

The model evaluation in terms of the ice sheet surface mass balance (SMB) is performed during 1979–2014 utilizing in-situ measurements compiled by Wang et al. (2021). The comparison (Fig. 1) shows that the model performance is permissible, because bias, which is used to give uncertainty of the SMB estimates following Noël et al. (2017), and root mean square (RMSE) are much better than those obtained in the Greenland ice sheet (Niwano et al., 2018; Fettweis et al., 2020). At some points, clear discrepancies are found (Fig. 1). Overestimation is enhanced (blue dots in Fig. 1) in Bruce Plateau, Antarctic Peninsula, whereas underestimation is pronounced in James Ross Island near Antarctic Peninsula (red dots in Fig. 1). Because these clear discrepancies are found near relatively warm Antarctic Peninsula, there is a possibility that spatial patterns of accumulation and ablation (surface melt and surface sublimation/evaporation) are not well captured by the model around Antarctic Peninsula.

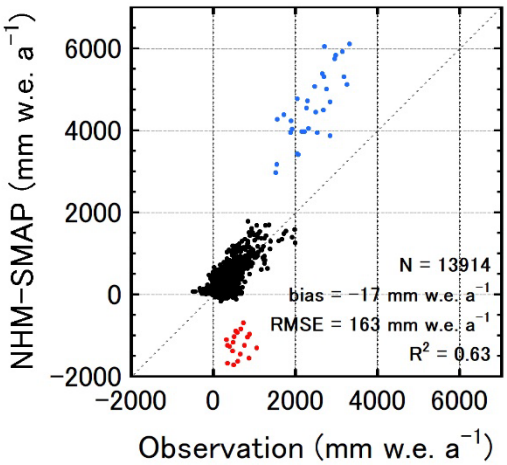

Figure 1. Comparison between observed and simulated Antarctic ice sheet surface mass balance. In-situ measurements are taken from Wang et al. (2021).

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