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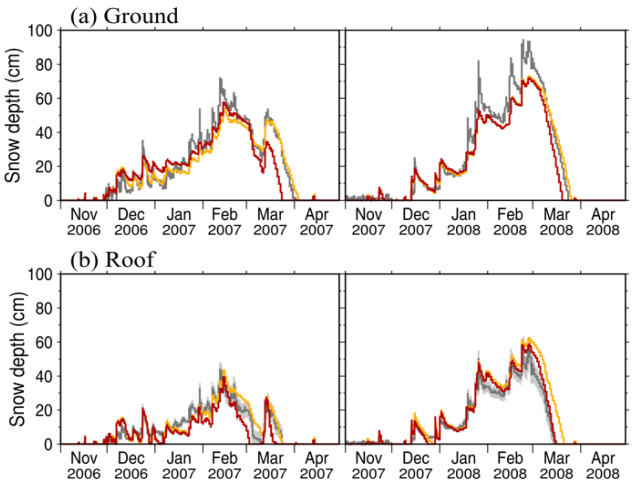

Figure 1. Seasonal variation in snow depth (a) on the ground around a building and (b) on the roof during two winters. Gray, yellow and red lines represent the observations, and our offline simulations using sSPUCdgn and sSPUCprg, respectively.

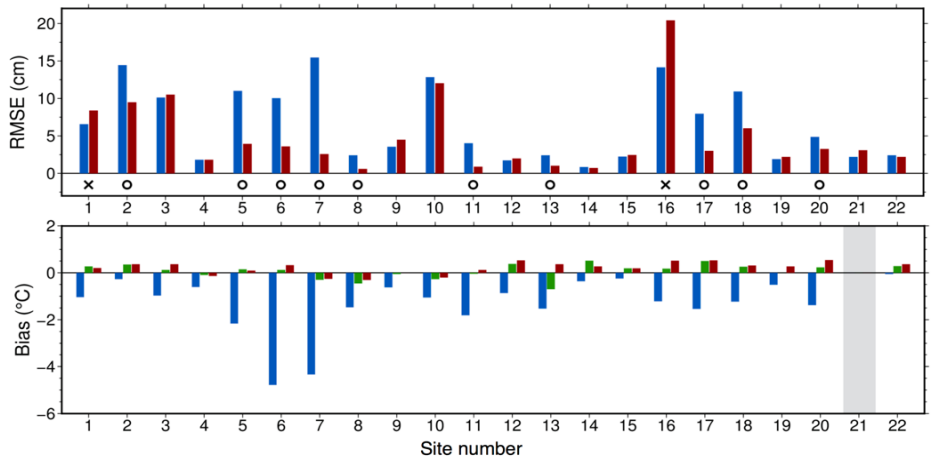

Figure 2. RMSE for seasonal variations in snow depth (upper) and averaged bias in daily mean surface air temperature over December to March (bottom) at urban sites where the annual maximum snow depth exceeds 5 cm. Bars indicate the simulations by iSiB (blue), SPUC without a snow scheme (green) and sSPUCprg (red), respectively. ○ in the upper panel denotes sites with a significant decrease in RMSE caused by the snowpack scheme.

- To represent seasonal variations in urban snow cover, we enhanced a square prism urban canopy (SPUC) model by introducing two new snowpack schemes: one based on a diagnostic approach (sSPUCdgn) and the other on a prognostic approach (sSPUCprg).
- Our offline experiments indicated that both schemes are useful for the reproduction of a seasonal variation in snow depth and its peak on the ground around a building and on the building roof (Fig. 1), but sSPUCprg is needed when we wish to consider the processes in the snow layer.
- Compared with iSiB, the new scheme enabled SPUC to reduce the error of seasonal variations in snow depth significantly at urban sites with a cold bias above 1℃ in iSiB (Fig. 2), by a different calculation method for the snow surface temperature from the method in iSiB and the inclusion of building walls without snow.