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Supplement of

Evaluating the utility of active microwave observations as a snow mission concept using observing system simulation experiments

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Figure S1. Maps of each Sturm's seasonal snow class with different TCF thresholds (0, 10, 20, 40, 60, and 80%).

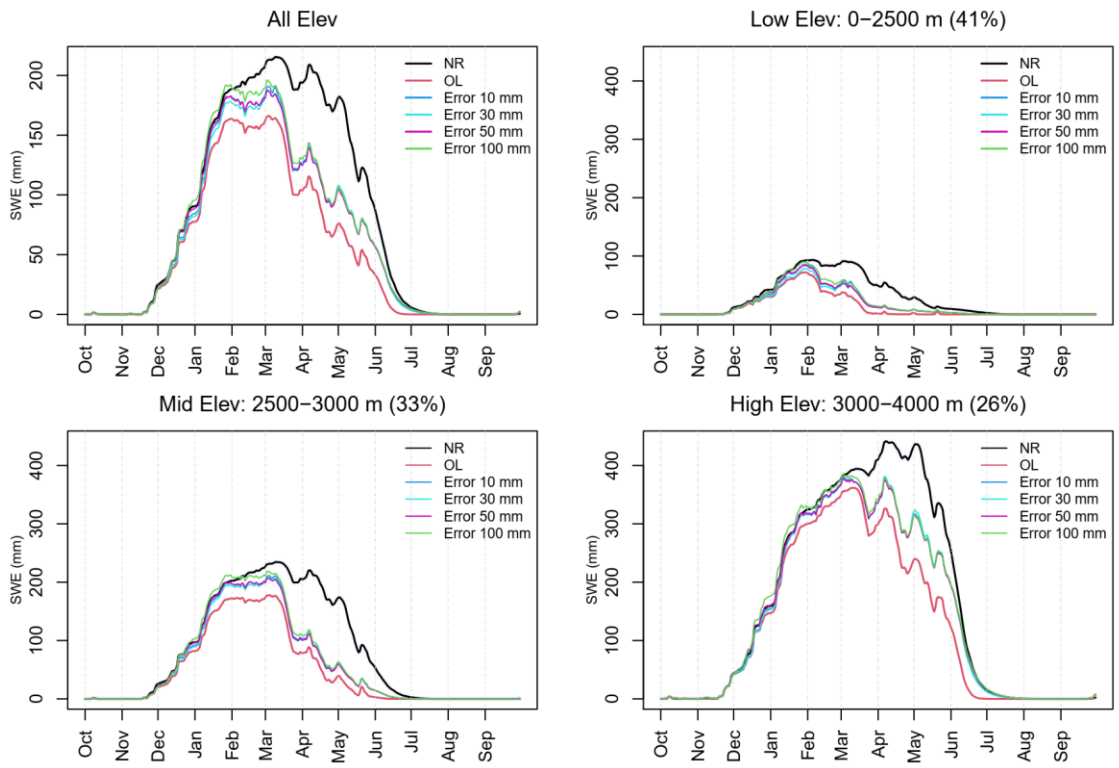

Figure S2. Domain-average SWE comparison between NR, OL, and DA experiments with different unbiased random error levels (10, 30, 50, and 100 mm of standard deviation) for the entire domain and subareas with three different elevation ranges. Note that the four DA scenarios have no deep snow and forest limits.

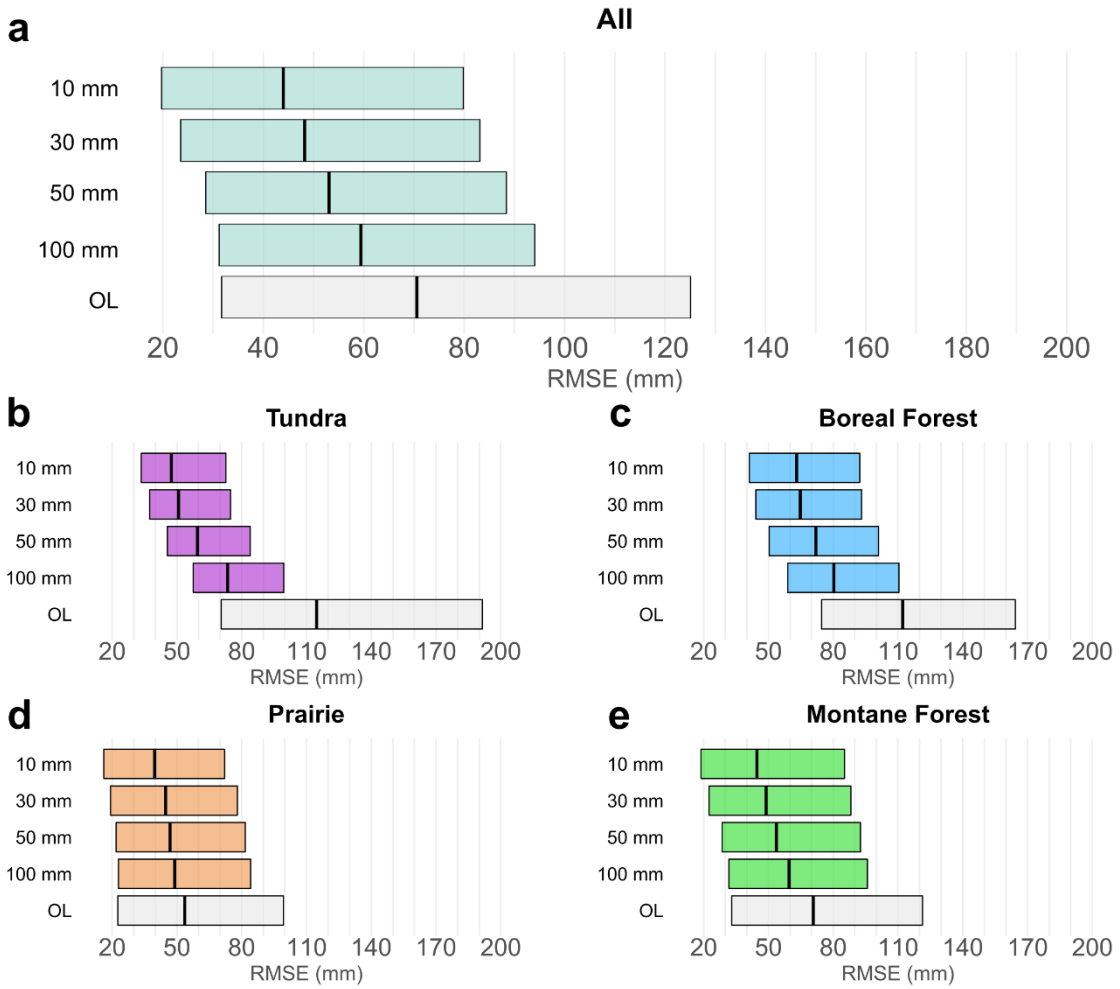

Figure S3. Boxplots of RMSE (mm) from all grid cells between four DA experiments with different unbiased random error levels (10, 30, 50, and 100 mm of standard deviation) and the Nature run (NR) relative to the open loop (OL) simulation for four seasonal snow classes, respectively. Note that the four DA scenarios have no deep snow and forest limits.

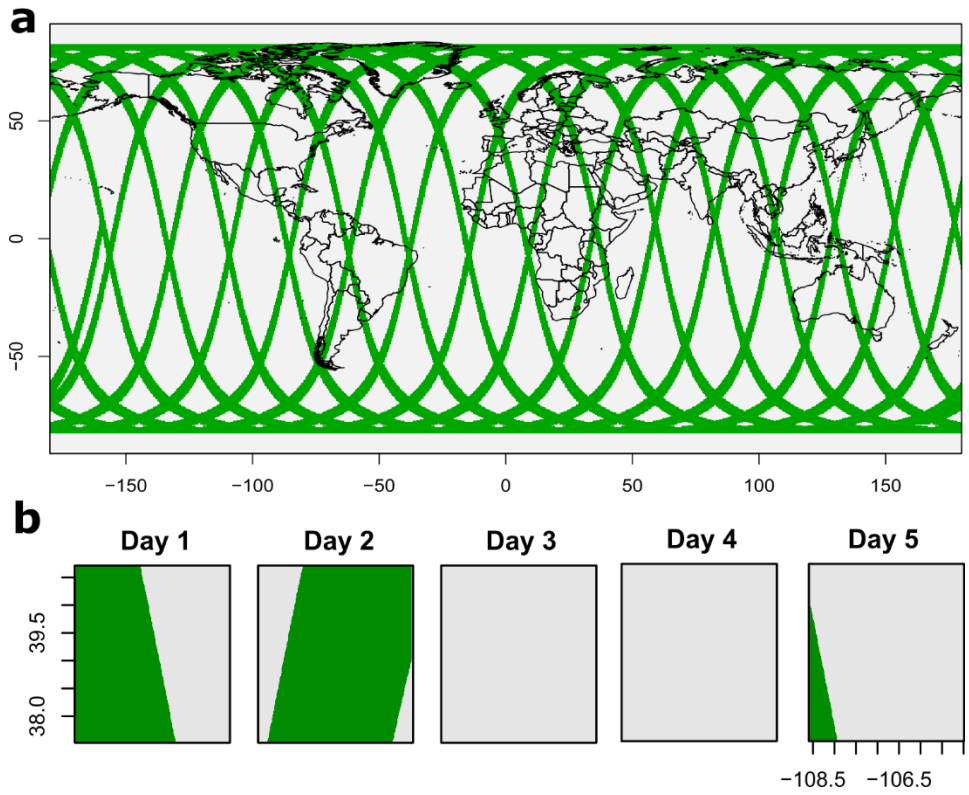

Figure S4. (a) an example of global daily TAT-C masked swath map and (b) examples of consequent five day TAT-C masked swath maps over the study domain

Table S1. Perturbation parameters applied to Noah-MP prognostic state variables and meteorological forcing fields during the OL and DA scenarios

Variable	Types	Standard deviation	AR1*	Cross correlations		
Noah-MP variables				*SWE*	*SD*	
SWE	multiplicative	0.01	3 hr	–	0.9	
Snow depth (*SD*)	multiplicative	0.02	3 hr	0.9	–	
Forcing variables				*SW*	*LW*	*P*
Shortwave radiation (*SW*)	multiplicative	0.3	1 day	–	-0.5	-0.8
Longwave radiation (*LW*)	additive	50 W m^{-2}	1 day	-0.5	–	0.5
Precipitation (*P*)	multiplicative	0.5	1 day	-0.8	0.5	–

*AR1: first-order autoregressive temporal correlation

Table S2. The areal proportion of the different TCF ranges for three elevation ranges

	Low elev. (0-2500 m)	Mid elev. (2500-3000 m)	High elev. (3000-4000 m)
TCF = 0%	14	3.5	0.6
TCF up to 10%	76	36	25
TCF up to 20%	86	49	39
TCF up to 40%	96	73	69
TCF up to 60%	99	93	93
TCF up to 80%	100	100	100