

Supporting Information for

**Implementation and evaluation of SNICAR snow albedo scheme in Noah-MP (version 5.0)
land surface model**

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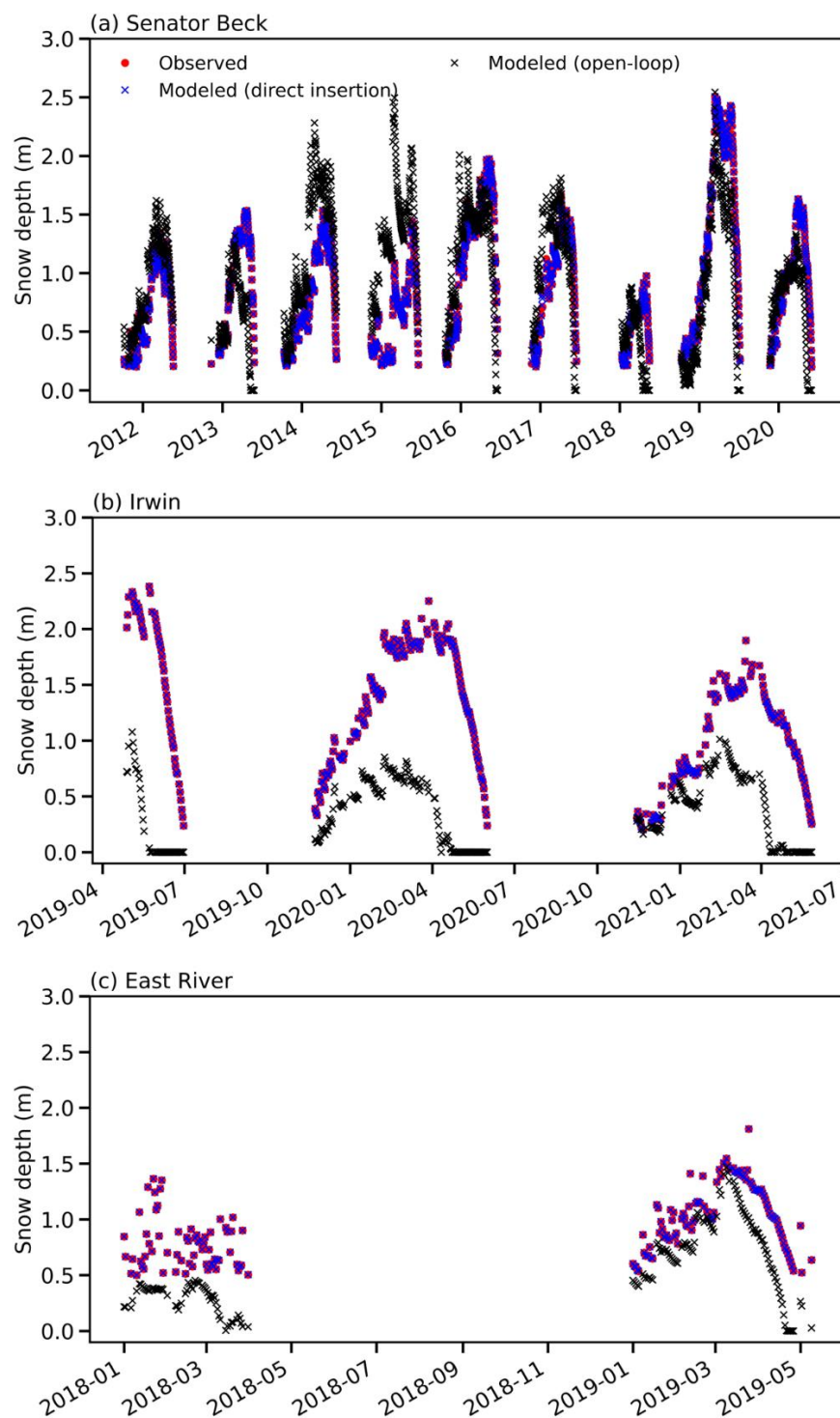


Figure S1. The comparison of the observed (red circles) and Noah-MP simulated snow depth from direct insertion (blue cross markers) and open-loop run (black cross markers) at three stations, (a) Senator Beck, (b) Irwin, and (c) East River.

Table S1. Information of three in-situ observational sites.

Site name	Elevation (m)	Latitude	Longitude	Albedo spectrum bands	Vegetation types	Observed climate variables	Model spin up period	Analysis period
Irwin	3168	38.8872°	-107.1084°	NIR, VIS, and broadband	sparse forest canopy and grass understory	Temperature and downward shortwave radiation	13 years (1 October 2015 to 30 September 2016, 10 times in series; then 1 October 2015 to September 2018)	October 2018 to August 2021
Senator Beck	3714	37.9069°	-107.7263°	NIR, VIS, and broadband	tundra	Temperature, downward shortwave radiation, downward longwave radiation, precipitation, wind speed, pressure, and specific humidity	11 years (1 October 2010 to 30 September 2019 then 1 October 2010 to 30 September 2011)	October 2011 to 2020 October
East River	2762	38.9224°	-106.9497°	Broadband	riparian grasses and willow galleries	Temperature, downward longwave radiation, and downward shortwave radiation	13 years (1 October 2015 to 30 September 2016, 10 times in series; then 1 October 2015 to 1 June 2017)	July 2017 to November 2019

Table S2. Conversion of the dust aerosol size (μm in diameter) used in MERRA-2 to Noah-MP/SNICAR. The values represent mass fraction of dust deposition from MERRA-2 into each size bin of dust in snow in Noah-MP/SNICAR.

MERRA-2 dust size bin	Noah-MP/SNICAR dust size bin				
	0.1-1.0 μm	1.0-2.5 μm	2.5-5.0 μm	5.0-10.0 μm	10.0-100.0 μm
0.2-2.0 μm	0.44	0.56	0	0	0
2.0-3.6 μm	0	0.31	0.69	0	0
3.6-6.0 μm	0	0	0.58	0.42	0
6.0-12.0 μm	0	0	0	0.67	0.33
12.0-20.0 μm	0	0	0	0	1