

A temporally consistent 8-day 0.05° gap-free snow cover extent dataset over the Northern Hemisphere for the period 1981–2019

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Table S1. Quality control descriptions of the AVHRR-SR CDR.

Bit	Description	Value=1	Value=0
15	polar flag (latitude > 60 degrees (land) or 50 degrees (ocean))	Yes	No
14	BRDF-correction issues	Yes	No
13	RHO3 value is invalid	Yes	No
12	Channel 5 value is invalid	Yes	No
11	Channel 4 value is invalid	Yes	No
10	Channel 3 value is invalid	Yes	No
9	Channel 2 value is invalid	Yes	No
8	Channel 1 value is invalid	Yes	No
7	Channels 1 - 5 are valid	Yes	No
6	Pixel is at night (high solar zenith)	Yes	No
5	Pixel is over dense dark vegetation	Yes	No
4	Pixel is over sunglint	Yes	No
3	Pixel is over water	Yes	No
2	Pixel contains cloud shadow	Yes	No
1	Pixel is cloudy	Yes	No

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Table S2. IGBP legend and class definitions of MCD12C1 product

Value	Name	Description
1	Evergreen Needleleaf Forests	Dominated by evergreen conifer trees (canopy >2m). Tree cover >60%.
2	Evergreen Broadleaf Forests	Dominated by evergreen broadleaf and palmate trees (canopy >2m). Tree cover >60%.
3	Deciduous Needleleaf Forests	Dominated by deciduous needleleaf (larch) trees (canopy >2m). Tree cover >60%.
4	Deciduous Broadleaf Forests	Dominated by deciduous broadleaf trees (canopy >2m). Tree cover >60%.
5	Mixed Forests	Dominated by neither deciduous nor evergreen (40-60% of each) tree type (canopy >2m). Tree cover >60%.
6	Closed Shrublands	Dominated by woody perennials (1-2m height) >60% cover.
7	Open Shrublands	Dominated by woody perennials (1-2m height) 10-60% cover.
8	Woody Savannas	Tree cover 30-60% (canopy >2m).
9	Savannas	Tree cover 10-30% (canopy >2m).
10	Grasslands	Dominated by herbaceous annuals (<2m).
11	Permanent Wetlands	Permanently inundated lands with 30-60% water cover and >10% vegetated cover.
12	Croplands	At least 60% of area is cultivated cropland.
13	Urban and Built-up Lands	At least 30% impervious surface area including building materials, asphalt, and vehicles.
14	Cropland/Natural Vegetation Mosaics	Mosaics of small-scale cultivation 40-60% with natural tree, shrub, or herbaceous vegetation.
15	Permanent Snow and Ice	At least 60% of area is covered by snow and ice for at least 10 months of the year.
16	Barren	At least 60% of area is non-vegetated barren (sand, rock, soil) areas with less than 10% vegetation.
17	Water Bodies	At least 60% of area is covered by permanent water bodies.

Table S3. Cloud detection tests and their threshold values.

Target	switch	Height (m)	SR ₁ (-)	SR ₂ (-)	SR ₃ (-)	SR ₁ -SR ₂ (-)	NDVI (-)	NDSI (-)	BT ₁₁ (K)	BT ₃₇ -BT ₁₁ (K)	BT ₁₁ -BT ₁₂ (K)
A	on	< 3000							≥ 240	> 8	
	on	≥ 3000							≥ 240	> 15	
B	on								< 240	> 20	
	on				>0.1	> -0.02		< 0.88			
	off						> 0.5		> 288		
	off								> 310		
	on					> -0.02			< 260	> 8	
	on					> -0.02			< 310	> 10	
	on		>0.3			> -0.02			< 293	> 9	
	on			>0.4		> -0.03			< 293	> 8	> -1
	on			>0.4					< 278	> 20	> -1
	on		> 0.3		>0.2				< 263		
	off							>0.5		> 288	
	off									> 310	
	off	> 1000	< 0.4			< -0.04				> 275	
	off					< -0.05				> 300	

This table comes from Hori et al. (2017). Target A indicates high and cold land (elevation > 300 m and BT11 < 260 K); Target B indicates other land. The cloud detection test was conducted from the top of the list to the bottom for each target. If the cloudy flag switch was "on", the pixel was set to cloudy when the threshold tests met the conditions listed on the right-hand side. If the switch was "off", the pixel identified as cloudy in the previous tests was reset to clear.

25 $NDVI = (SR_2 - SR_1) / (SR_2 + SR_1)$. $NDSI = (SR_1 - SR_3) / (SR_1 + SR_3)$.

Table S4. 8-Day Periods.

Period No.	Year Days	Period No.	Year Days
1	1-8	24	185-192
2	9-16	25	193-200
3	17-24	26	201-208
4	25-32	27	209-216
5	33-40	28	217-224
6	41-49	29	225-232
7	49-56	30	233-240
8	57-64	31	241-248
9	65-72	32	249-256
10	73-80	33	257-264
11	81-88	34	265-272
12	89-96	35	273-280
13	97-104	36	281-288
14	105-112	37	289-296
15	113-120	38	297-304
16	121-128	39	305-312
17	129-136	40	313-320
18	137-144	41	321-328
19	145-152	42	329-336
20	153-160	43	337-344
21	161-168	44	345-352
22	169-176	45	353-360
23	177-184	46	361-368*

This table comes from Riggs and Hall (2015). *Includes 2 or 3 days from next year, depending on leap year

References

- 30 Hori, M., Sugiura, K., Kobayashi, K., Aoki, T., Tanikawa, T., Kuchiki, K., Niwano, M., and Enomoto, H.: A 38-year (1978–2015) Northern Hemisphere daily snow cover extent product derived using consistent objective criteria from satellite-borne optical sensors, *Remote Sens. Environ.*, 191, 402-418, <https://doi.org/10.1016/j.rse.2017.01.023>, 2017.
- Riggs, G. A. and Hall, D. K.: MODIS/Terra Snow Cover 8-Day L3 Global 0.05Deg CMG Version 6 User Guide, Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. Center. <https://doi.org/10.5067/MODIS/MOD10C2.006>, Accessed on 30 January 2021, 2016.