



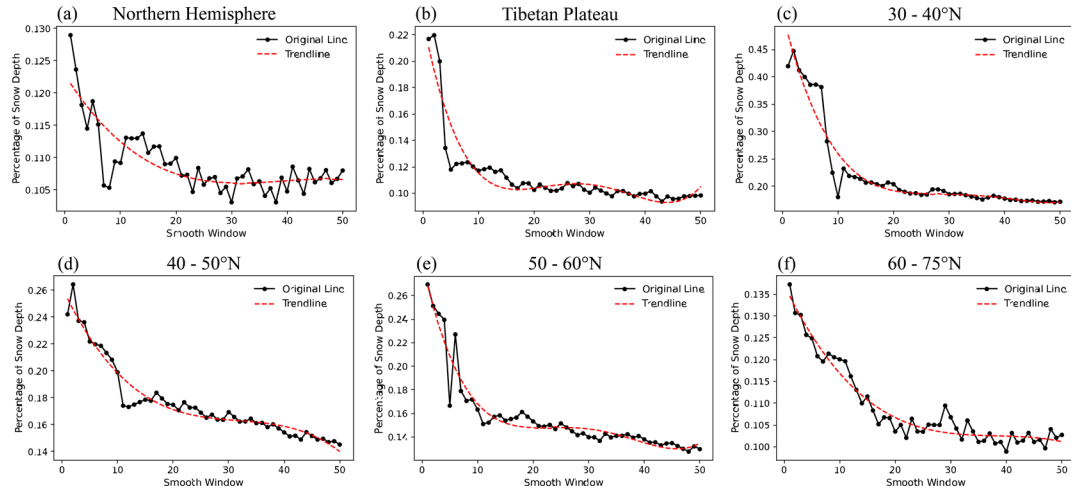
*Supplement of*

## **Dynamic identification of snow phenology in the Northern Hemisphere**

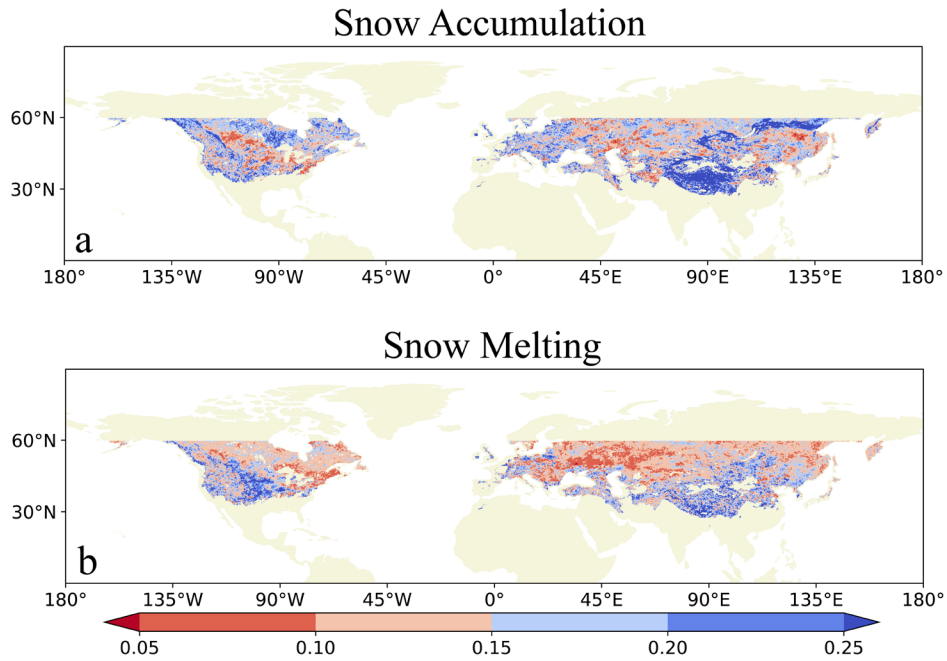
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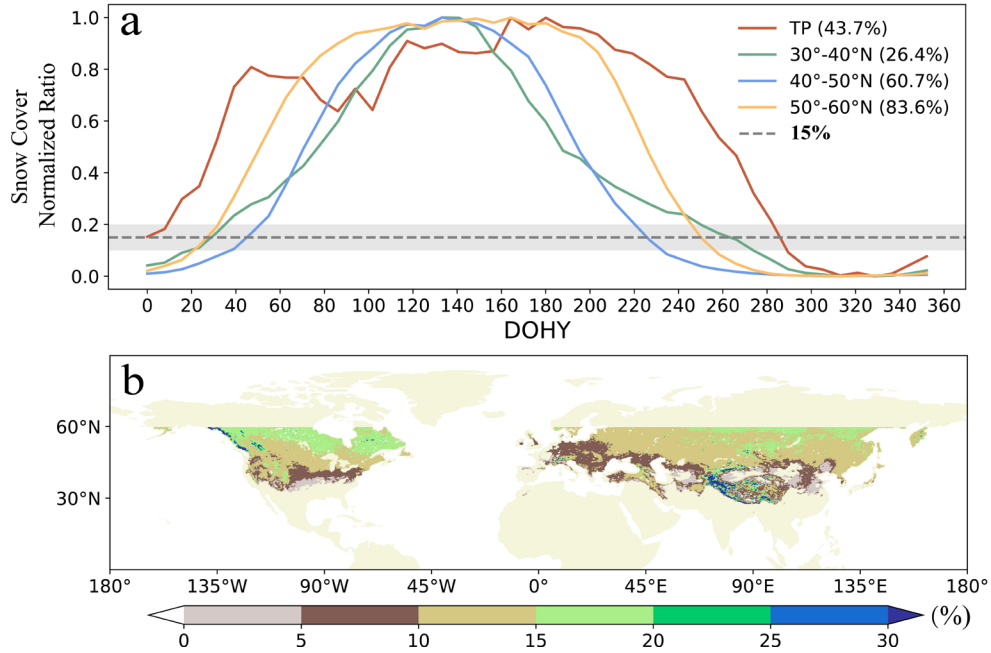
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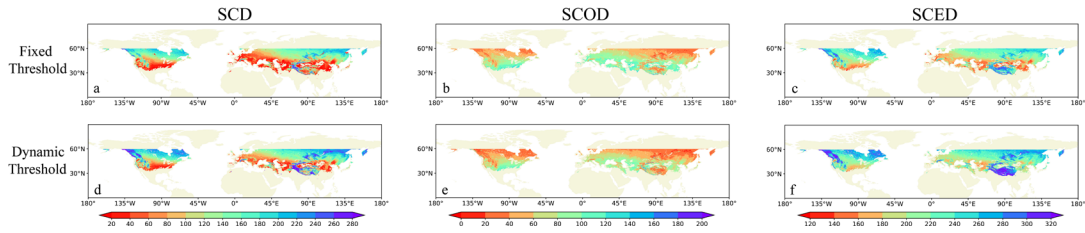
**Figure S1.** The relationship between the percentage of snow depth (dynamic threshold) and smooth window in (a) the Northern Hemisphere, (b) the Tibetan Plateau, (c) 30°N–40°N, (d) 40°N–50°N, (e) 50°N–60°N, and (f) 60°N–75°N. The black line is the original line, the black dot is the specific value for each year, and the red line is the trend line.



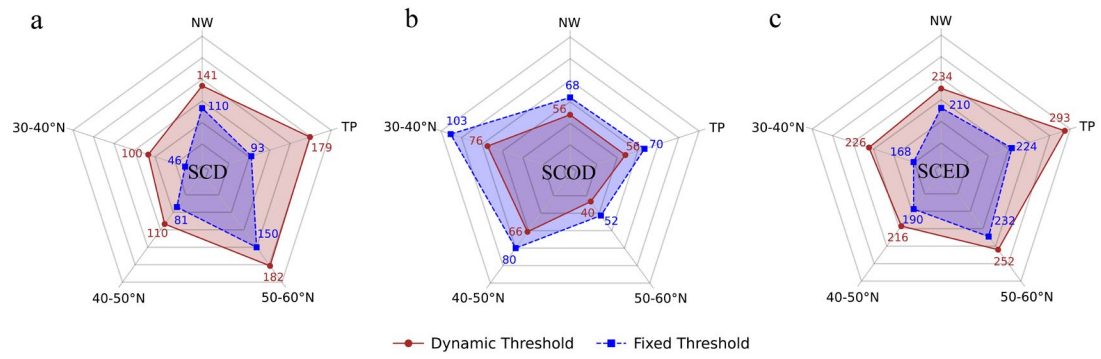
**Figure S2.** Spatial distribution of Northern Hemisphere threshold percentages extracted from the first-order derivatives using MOD10C2 data. (a) Percentage thresholds associated with snow accumulation (SCOD) from the first half of the first-order derivative maximum value. (b) Percentage thresholds associated with snow melting (SCED) from the last point of half of the first-order derivative minimum value.



**Figure S3.** The dynamic threshold of the MOD10C2 dataset across the Northern Hemisphere. (a) Intra-annual variability in the normalized MOD10C2 data for four latitudinal zones. Shading represents the interval 10%-20%, and the dashed line represents the dynamic threshold of 15%. The actual maximum snow cover for each latitude band is in parentheses. The unit DOHY is an abbreviation for day of the hydrological year. (b) Spatial distribution of multi-year average snow cover thresholds in the Northern Hemisphere extracted using the snow dynamics threshold method.



**Figure S4.** Spatial distribution of snow phenology extracted by MOD10C2 data over the Northern Hemisphere for the hydrological years 2000-2018. (a) Multiyear averaged snow cover duration (SCD), (b) snow cover onset day (SCOD), (c) snow cover end day (SCED) extracted by the fixed threshold method. (d, e, f) Same as (a, b, c) but for the dynamic threshold method.



**Figure S5.** Comparative of (a) snow cover duration (SCD), (b) snow cover onset day (SCOD), and (c) snow cover end day (SCED) extracted by MOD10C2 data using the snow dynamic threshold method and the traditional fixed threshold method in five regions. The solid red line represents the dynamic threshold method, and the blue dashed line represents the fixed threshold method.