Supplementary Material for

Disentangling the effect of geomorphological features and tall shrubs on snow depth variation in a sub-Arctic watershed using UAV derived products

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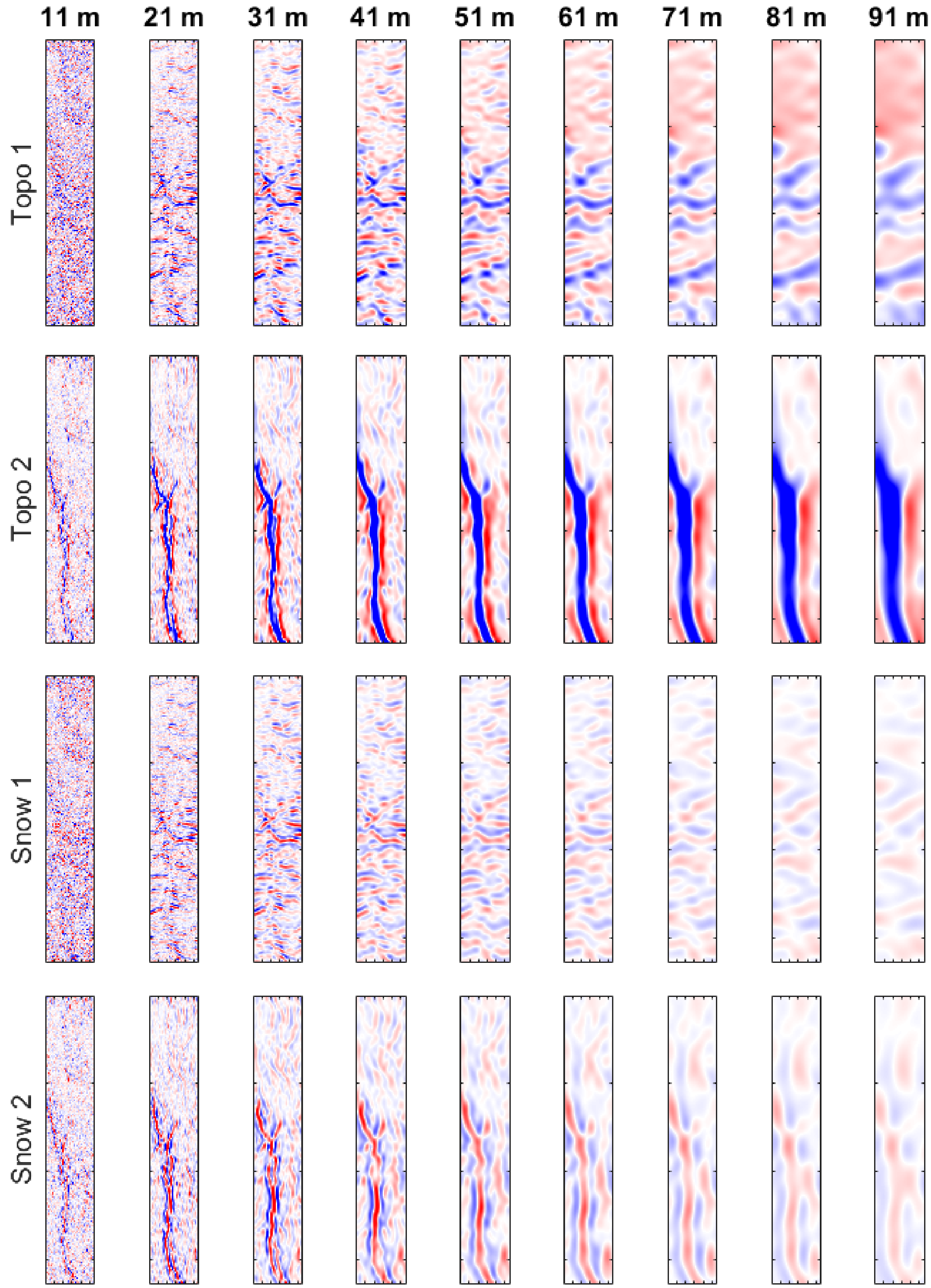

Figure S1. Filtered maps of topography and 2019 snow depth. Maps generated using stacked directional filtering (Methods) of topography and snow depth are shown for directions 1 and 2 and scales up to 91 m.

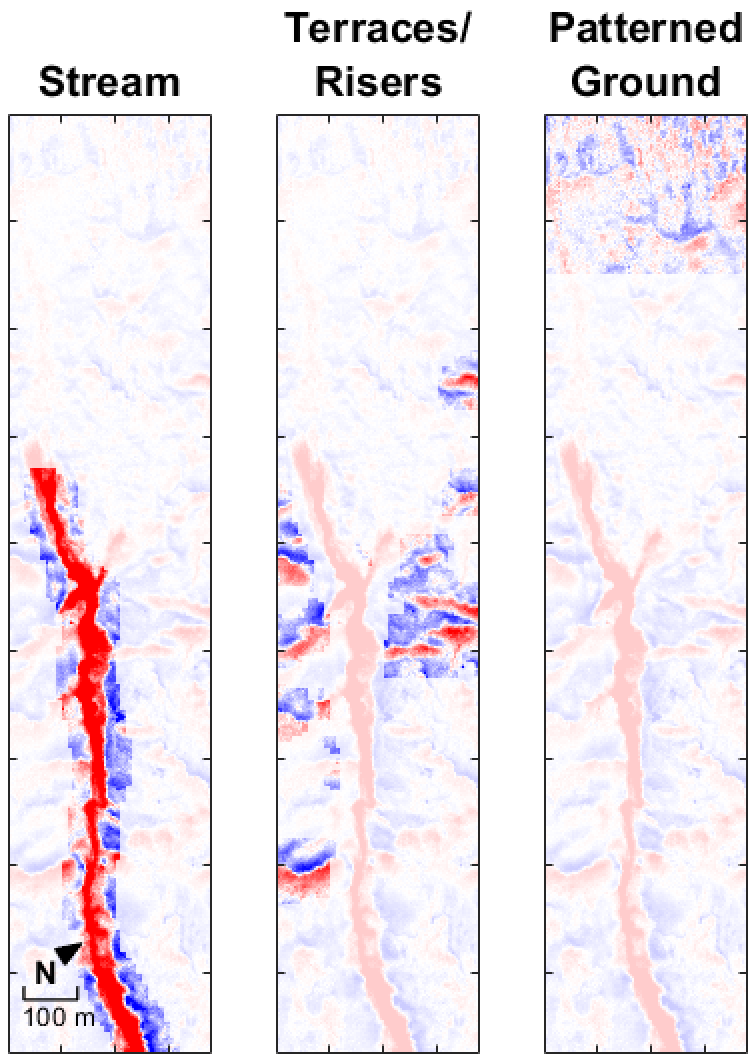

Figure S2. Regions characterized by each topographic feature. TM_SV is shown across the watershed with topographic features highlighted. The stream feature is shown on the left, the terraces and risers are shown in the middle, and the patterned ground is shown on the right. Extraction of these features is described in section 2.4 of the Methods.

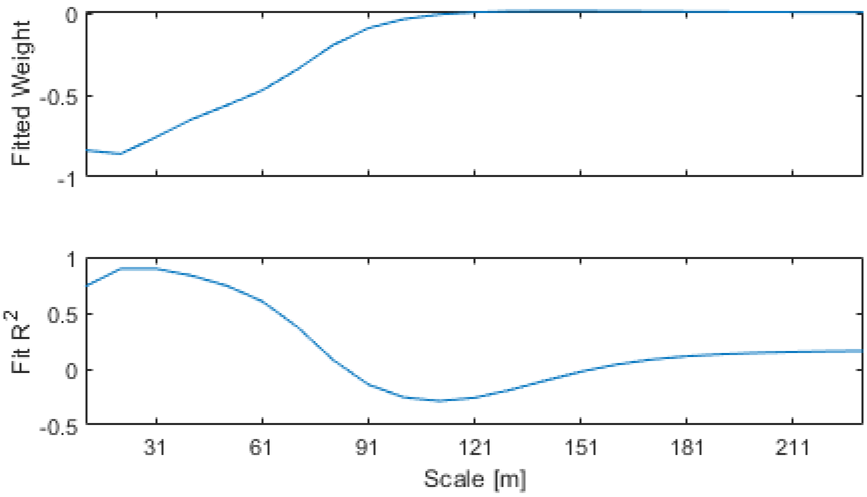

Figure S3. Fitted weights used in the TM_SV. Weights used for each layer of filtered topography in the TM_SV are determined via a linear fit to each layer of filtered snow depth (top). The R^2 for each fit is shown in the bottom panel.

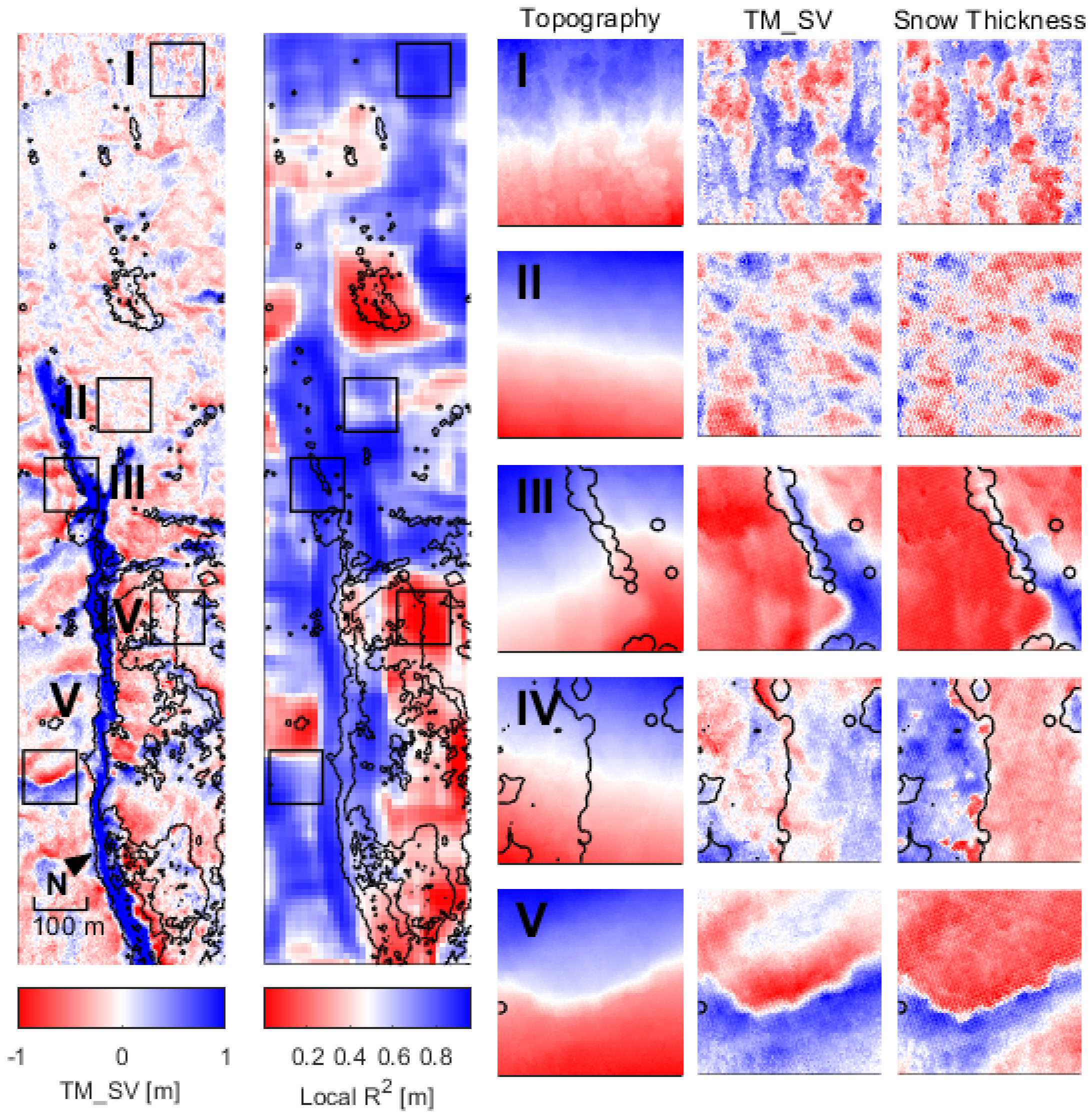

Figure S4. Topographic model of snow depth variation (TM_SV). The topographic model of snow depth variation (TM_SV) across the watershed is shown on the left. R^2 values for linear fits of 100m x 100m subsets of the TM_SV to 100m x 100m subsets of 2022 snow depth are shown in the middle. Maps of mean-centered topography, TM_SV, and 2022 snow depth are shown for five example 100m x 100m subsets on the right. Contour lines are drawn at a 3m distance from vegetation of 1m height or taller.

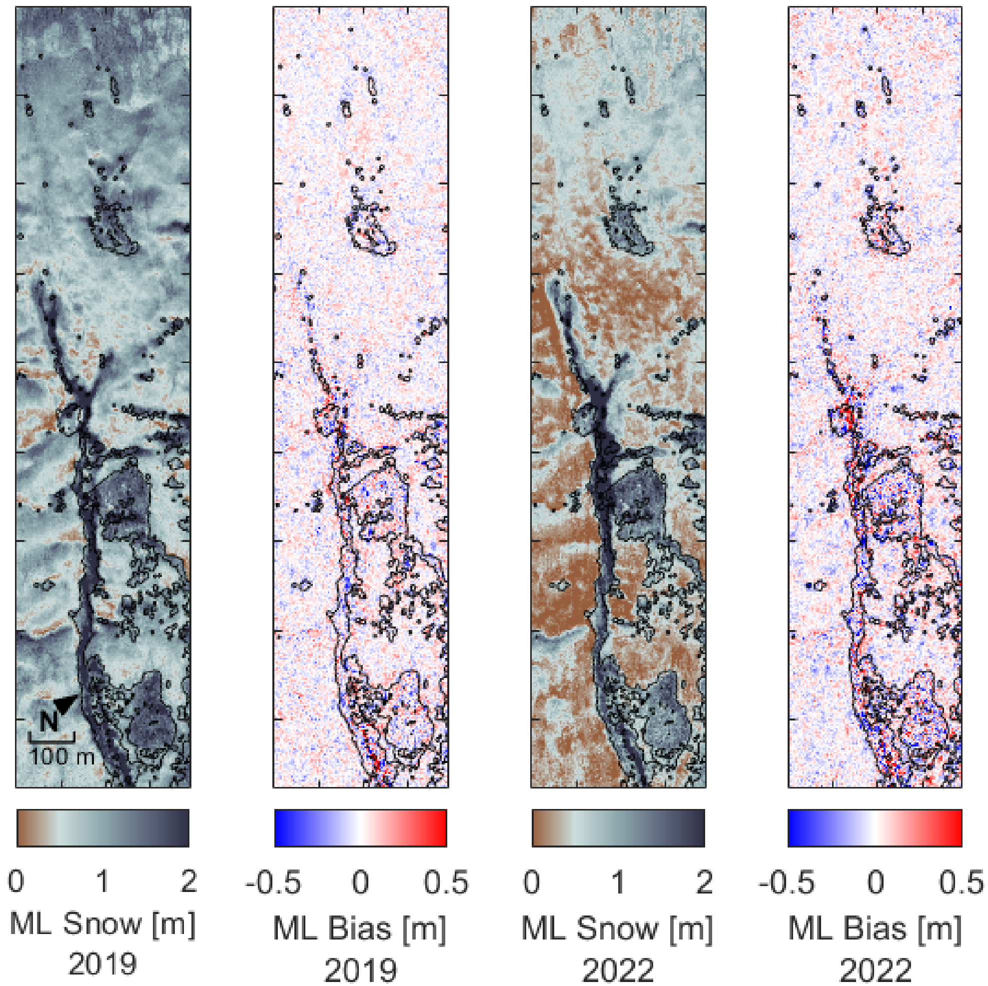

Figure S5. Machine learning predictions of snow depth. Predictions of snow depth generated by the machine learning models are shown across the watershed for years 2019 and 2022. Also shown is the bias of the machine learning models for years 2019 and 2022. Contour lines are drawn at a 3 m distance from vegetation of 1 m height or taller.

2019		2022	
Predictor Variable	**Relative Influence**	**Predictor Variable**	**Relative Influence**
TM_SV	41.7	TM_SV	43.7
Shrub canopy snow trapping field, ϕ_2	9.7	Shrub canopy snow trapping field, ϕ_2	17.7
Elevation	7.5	Elevation	6.4
Shrub canopy snow trapping field, ϕ_1	6.2	Shrub canopy snow trapping field, ϕ_1	2.6
Filtered topographic map, 31 m scale, down-slope	3.8	Filtered aspect, 21 m scale	2.3

Table S1. Top five predictor variables for 2019 and 2022 machine learning models. The top five most important predictors for the machine learning models of snow depth are shown for 2019 (left) and 2022 (right).

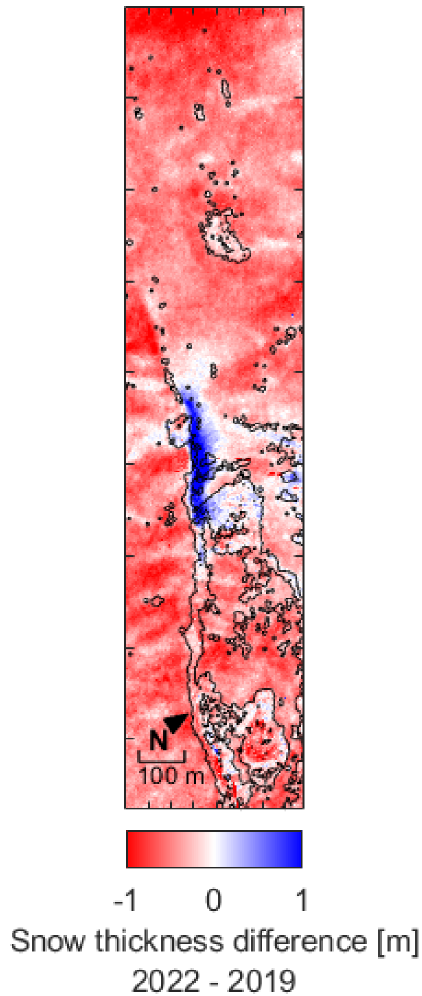

Figure S6. Interannual variation in snow depth. Difference between 2022 snow depth and 2019 snow depth shown across the watershed. Contour lines are drawn at a 3 m distance from vegetation of 1 m height or taller.