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New insights into the environmental factors controlling the ground thermal regime across the Northern Hemisphere: a comparison between permafrost and non-permafrost areas

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Table S1: Sources of mean annual ground temperature (MAGT) observations.

Data source	Data title	Link to the data	MAGT observations
GTN-P Database	**GTN-P:** Global Terrestrial Network for Permafrost Database: Permafrost Temperature Data (TSP - Thermal State of Permafrost). Akureyri, Iceland, ISSN 2410-2385 (accessed multiple times in early 2016), 2016.	http://gtnpdatabase.org/boreholes	453
Roshydromet	**Sherstiukov, A. B.:** Dataset of daily soil temperature up to 320 cm depth based on meteorological stations of Russian Federation RIHMI-WDC (5th February 2016), 2012.	http://meteo.ru/data/164-soil-temperature	89
Geological Survey of Canada	**Smith, S. L. et al.:** A Map and Summary Database of Permafrost Temperatures in Nunavut, Canada, Geological Survey of Canada, Open File 7393, 2013.	doi:10.4095/292615	50
	Crow et al.: Borehole geophysical logs in unconsolidated sediments across Canada, Geological Survey of Canada, Open File 7591, 2015.	doi:10.4095/295753	46
	Smith, S. L. & Ednie, M.: Ground thermal data collection along the Alaska Highway easement (KP 1559-1895) Yukon, summer 2014, Geological Survey of Canada, Open File 7762, 2015.	doi:10.4095/295974	7
	Ednie, M. et al.: Report on 2012 field activities and collection of ground thermal and active layer data in the Mackenzie Corridor completed under Northwest Territories Science Licence #15053, Geological Survey of Canada, Open File 7416, 2013.	doi: 10.4095/292864	1
	Wolfe, S. A. et al.: Geotechnical Database and Descriptions of Permafrost Monitoring Sites Established 2006-10 in the Northern Mackenzie Corridor, Northwest Territories, Geological Survey of Canada, Open File 6677, 2010.	doi: 10.4095/287167	1
NGDS (National Geothermal Data System, U.S. Department of Energy)	**Blackett, R.:** Utah Temperature-Depth Log Compilation, Utah Geological Survey, 2013.	http://search.geothermaldata.org/dataset/utah-temperature-depth-log-compilation	20
	Maine Geological Survey: Maine Well Headers, 2014.	http://search.geothermaldata.org/dataset/maine-well-headers	19
	Kelley, S.: New Mexico Temperature-Depth Logs and Graphic Profiles New Mexico Bureau of Geology & Mineral Resources, 2011.	http://search.geothermaldata.org/dataset/new-mexico-temperature-depth-logs-and-graphic-profiles	14
	Virginia Division of Geology and Mineral Resources: Georgia Well Logs, 2012.	http://search.geothermaldata.org/dataset/georgia-well-logs	11
	Curran, J. et al.: New Jersey Well Logs, 2013.	http://search.geothermaldata.org/dataset/new-jersey-well-logs	10
	Czajkowski, J.: Well Logs. Washington Division of Geology and Earth Resources, Department of Natural Resources, 2012.	http://search.geothermaldata.org/dataset/washington-well-logs	8
	Virginia Division of Geology and Mineral Resources: Virginia Well Logs, 2012.	http://search.geothermaldata.org/dataset/virginia-well-logs	6
	University of North Dakota: Temperature at Depth Database, 2014.	http://geothermal.smu.edu/static/DownloadFilesButtonPage.htm	4
	Virginia Division of Geology and Mineral Resources: Georgia Borehole Temperatures, 2011.	http://search.geothermaldata.org/dataset/georgia-borehole-temperatures	1

Table S1 continued

	Gosnold, W.: Nebraska Temperature-Depth Data and Profiles, University of North Dakota, 2013.	http://search.geothermaldata.org/dataset/nebraska-temperature-depth-data-and-profiles	1
	Niewendorp, C. A.: Oregon Well Logs, Oregon Department of Geology and Mineral Industries, 2012.	http://search.geothermaldata.org/dataset/oregon-well-logs	1
	Harrison III, W. B.: Michigan Well Log Observation Data. Western Michigan University - Geosciences Department, 2012.	http://search.geothermaldata.org/dataset/michigan-well-log-observation-data	1
	Nevada Bureau of Mines and Geology: Nevada Borehole Temperatures, 2014.	http://search.geothermaldata.org/dataset/nevada-borehole-temperatures	1
NOAA (National Oceanic and Atmospheric Administration, U.S. Department of Commerce)	**Huang, S. et al.:** Temperature trends over the past five centuries reconstructed from borehole temperatures, Nature, 403, 756–758 (accessed 10th February 2016), 2000.	doi:10.1038/35001556	13
FMI (Finnish Meteorological Institute)	**Finnish meteorological institute,** 2016.		9
NSF Arctic Data Center (formerly ACADIS)	**NSF Arctic Data Center:** Network of Permafrost Observatories in Western Alaska. Arctic Data Center (accessed 5th October 2015), 2014.	doi:10.18739/A2D934	3
Nordicana D, Centre for Northern Studies	**Allard, M. et al.:** Borehole and near-surface ground temperatures in northeastern Canada, v. 1.3 (1988-2014),Nordicana D8, data set (accessed 22nd January 2016), 2015.	doi:10.5885/45291SL-34F28A9491014AFD	3
Permafrost Laboratory (University of Alaska, Fairbanks)	**The Geophysical Institute Permafrost Laboratory:** Site Information and Historical Data Access (accessed 26th January 2016), 2010.	http://permafrost.gi.alaska.edu/sites_list?order=field_site_latitude_value&sort=asc&title_op=contains&title=	2
NSIDC (National Snow & Ice Data Center, Boulder, Colorado, USA)	**Paetzhold, R. F. ed:** Monthly Summaries of Soil Temperature and Soil Moisture at Sites in China, Digital Media (accessed 23rd December 2015), 2003.	http://nsidc.org/data/docs/fgdc/ggd625_soiltemp_china/	2
Publications	**Ødegård, R. S. et al.:** MAGST in Mountain Permafrost, Dovrefjell, Southern Norway, 2001–2006, Ninth International Conference on Permafrost, At University of Alaska Fairbanks, USA, in: Proceedings Volume 2, Kane D.L. & Hinkel, K.M. (eds.), Institute of Northern Engineering, University of Alaska Fairbanks, ISBN 978-0-9800179-3-9, 1311–1315, 2008.		2
	Streletskiy, D. A. et al.: Permafrost hydrology in changing climatic conditions: seasonal variability of stable isotope composition in rivers in discontinuous permafrost, Environ. Res. Lett. 10, 095003, 2015.		2
	Peter, M.: Modeling of permafrost temperatures in the Lena River Delta, Siberia, based on remote sensing products, Master thesis, University of Leipzig, 2015.	hdl:10013/epic.45589	2
	Günther, F. et al.: Russian-German Cooperation SYSTEM LAPTEV SEA. The Expeditions Laptev Sea - Mamontov Klyk 2011 & Buor Khaya 2012, Berichte zur Polar- und Meeresforschung 664, 2013.		1
Geological Survey of Norway (NGU)	**The Norwegian Permafrost Database:** Geological Survey of Norway (NGU), Trondheim, Norway, Accessed 4th February 2016, 2016.	http://geo.ngu.no/kart/permafrost_svalbard/?lang	1
TOTAL			**784**

Table S2: Sources of active-layer thickness (ALT) observations.

Data source	Data title	Link to the data	ALT observations
GTN-P database	**GTN-P:** Global Terrestrial Network for Permafrost Database: Permafrost Temperature Data (TSP - Thermal State of Permafrost). Akureyri, Iceland, ISSN 2410-2385 (accessed multiple times in early 2016), 2016.	gtnpdatabase.org/activelayers https://www2.gwu.edu/~calm/	200
Publications	**Wu, Q. et al.:** Thermal state of the active layer and permafrost along the Qinghai-Xizang (Tibet) Railway from 2006 to 2010, The Cryosphere 6, 607–612, 2012.		23
Geological Survey of Canada	**Smith, S. L. et al:** Report on 2014 field activities and collection of ground thermal and active layer data in the Mackenzie Corridor, Northwest Territories, Geological Survey of Canada, Open File 7935, 2015.	doi:10.4095/296958	
	Chartrand, J. et al.: Report on 2013 field activities and collection of ground thermal and active layer data in the Mackenzie Corridor, Geological Survey of Canada, Open File 7659, 2014.	doi:10.4095/295596	
	Ednie, M. et al.: Report on 2012 field activities and collection of ground thermal and active layer data in the Mackenzie Corridor completed under Northwest Territories Science Licence #15053, Geological Survey of Canada, Open File 7416, 2013.	doi: 10.4095/292864	
	Ednie, M. et al.: Report on 2011 Field Activities and Collection of Ground Thermal and Active Layer Data in the Mackenzie Corridor Completed Under Northwest Territories Science Licence #14918, Geological Survey of Canada, Open File 7231, 2012.	doi:10.4095/291982	20
	Ednie, M. et al.: Report on 2010 Field Activities and Collection of Ground Thermal and Active Layer Data in the Mackenzie Corridor Completed Under N.W.T. Science Licence #14686, Geological Survey of Canada, Open File 6932, 2011.	doi:10.4095/288924	
	Smith, S. L. et al.: Report on 2009 field activities and ground thermal data collection in the Mackenzie Corridor completed under N.W.T. science licence #14582, Geological Survey of Canada, Open File 6695, 2010.	doi:10.4095/287166	
	Smith, S.L. et al.: Data for Geological Survey of Canada active layer monitoring sites in the Mackenzie Valley, N.W.T., Geological Survey of Canada, Open File 6287, 2009.	doi:10.4095/248197	16
	Wolfe, S. A. et al.: Report on 2010-11 permafrost investigations in the Yellowknife area, Northwest Territories, Geological Survey of Canada, Open File 6983, 2011.	doi:10.4095/289596	5
	LeBlanc, A.-M. et al.: Assessing permafrost conditions and landscape hazards in support of climate change adaptation in Pangnirtung, Nunavut, Geological Survey of Canada, Open File 6868, 2011.	doi:10.4095/289548	4
LTER (Long Term Ecological Research, University of Alaska, Fairbanks)	**Ruess, R. W. et al.:** Active Layer Depth or Permafrost Presence for the Regional Site Network. Bonanza Creek LTER - University of Alaska Fairbanks, BNZ:605 (accessed 14th March 2016), 2015.	http://www.lter.uaf.edu/data/data-detail/id/605	20

Table S2 continued

PERMOS (The Swiss Permafrost Monitoring Network)	**PERMOS:** PERMOS Database. Swiss Permafrost Monitoring Network, Fribourg, Switzerland (accessed 12th March 2016), 2016.	http://dx.doi.org/10.13093/permos-2016-01	9
NSIDC (National Snow & Ice Data Center, Boulder, Colorado, USA)	**Rönkkö, M.:** Active-Layer Depth of a Finnish Palsa Bog, Digital Media (accessed 15th March 2016), 2003.	http://nsidc.org/data/docs/fgdc/ggd622_palsabog_finland/index.html	1
TOTAL			**298**

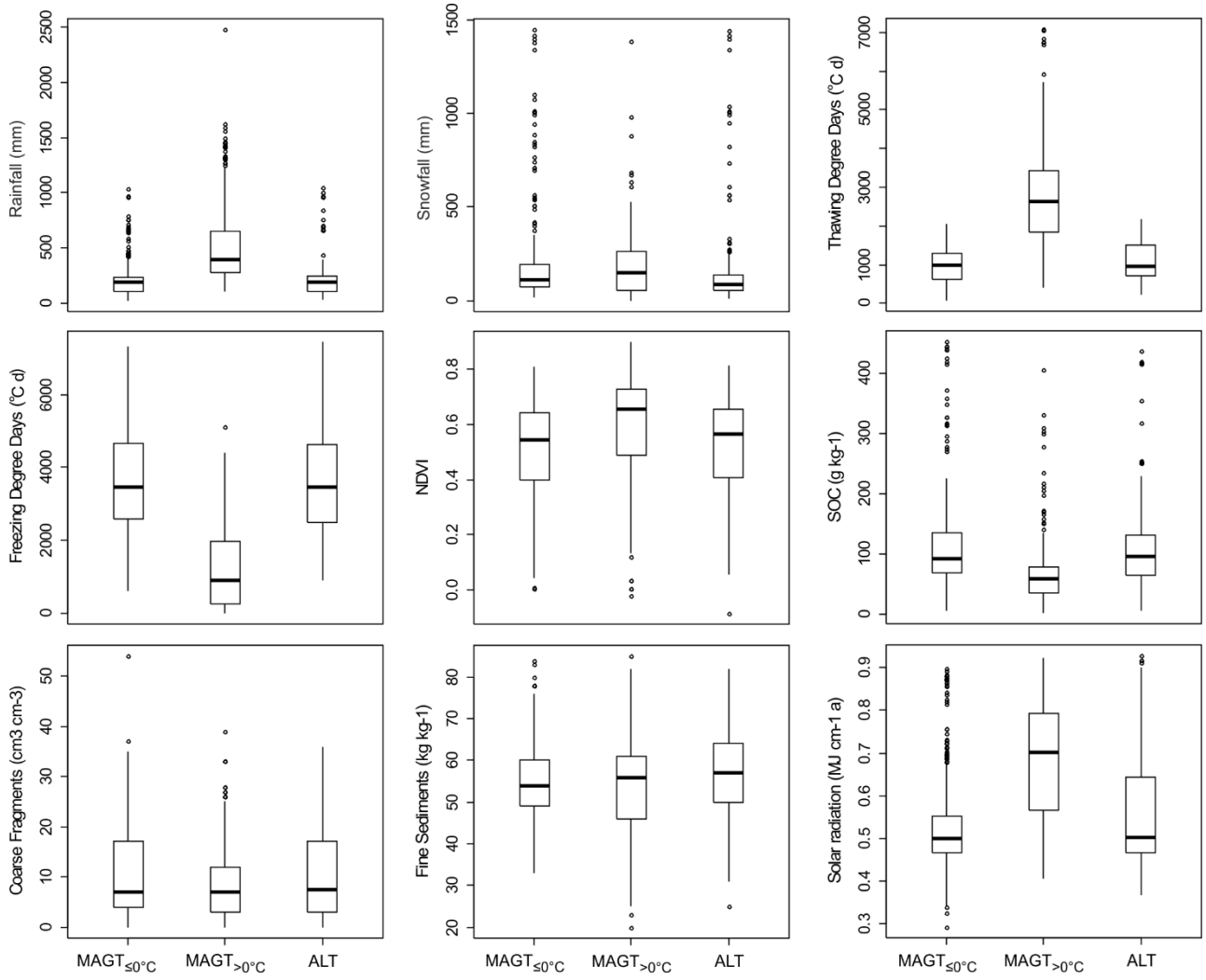

Figure S1: The ranges of values recorded by the environmental variables in $MAGT_{\leq 0\,°C}$ (mean annual ground temperature at or less than 0 °C), $MAGT_{>0\,°C}$ and (mean annual ground temperature greater than 0 °C) and ALT (active-layer thickness) datasets. The bottoms and tops of the boxes depict the first and third quartiles with thick black line at median. Values more than 1.5 times the inter-quartile range away from the first or third quartile are shown as outliers (open circles). The abbreviated variables are NDVI (normalized difference vegetation index) and SOC (soil organic carbon, g kg^{-1}).

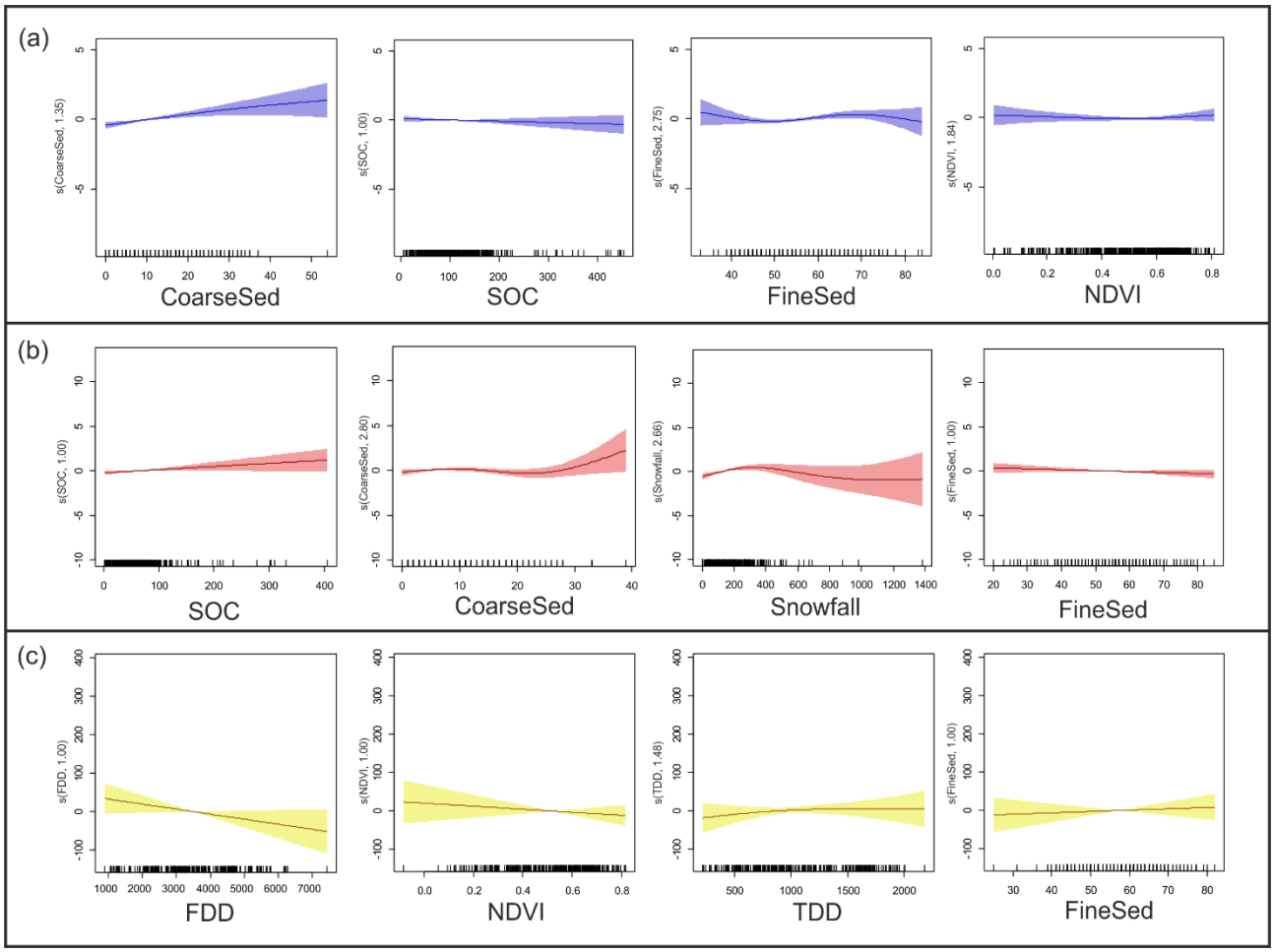

Figure S2: Response shapes of the four predictors with most contribution in $MAGT_{\leq 0\ °C}$ (mean annual ground temperature less than or equal to 0 °C, blue curves) (a), $MAGT_{>0\ °C}$ (mean annual ground temperature greater than 0 °C, red curves) (b), and ALT (active-layer thickness, yellow curves) (c) datasets obtained from generalized additive modelling (GAM).Variables are presented in the descending order of their effect size in respective datasets. X-axis units appear in the original scale of the explanatory variables. Y-axis displays partial residuals and labels the estimated degrees of freedom used in fitting the respective variables to a response. Three degrees of freedom at maximum were allowed. Shaded areas depict 95 % confidence limits. The variables shown are proportion of coarse sediments (CoarseSed, %), proportion of fine sediments (FineSed, %), soil organic carbon (SOC, g kg^{-1}), normalized difference vegetation index (NDVI), precipitation when monthly mean air temperature was below 0 °C (Snowfall, mm), freezing degree days (FDD, °C) and thawing degree days (TDD, °C).