



Supplement of

Linking biogenic high-temperature ice nucleating particles in Arctic soils and streams to their microbial producers

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Table S1 show the amount of soil used for DNA extraction for each sample and if the sample was excluded from the study due to DNA extraction inefficiency. Additionally, the amount of 16S rRNA copies per gram of soil together with the nitrogen and carbon content of the samples. Note that samples which had too little DNA after extraction were excluded from the DNA analysis.

Stream	Replicate	Soil (g)	16S copies · g ⁻¹	N (% w/w)	TC (% w/w)	Note
Kærelv C	1	0.22	$6.35 \cdot 10^9$	0.24	1.37	
Kærelv C	2	0.25	$5.24 \cdot 10^{9}$	0.24	1.37	
Kærelv A	1	0.28	$5.76 \cdot 10^{9}$	0.12	1.81	
Kærelv A	2	0.28	$6.51 \cdot 10^9$	0.12	1.81	
West 5	1	0.22	$5.85 \cdot 10^{9}$	0.95	21.01	
West 5	2	0.26	$5.67 \cdot 10^{9}$	0.95	21.01	
West 4	1	0.26	$2.07 \cdot 10^{8}$	2.31	0.57	
West 4	2	0.28	$2.48 \cdot 10^{9}$	2.31	0.57	
Aucella	1	0.16	-	0.01	0.14	Excluded
Aucella	2	0.15	-	0.01	0.14	Excluded
Tørvedammen	1	0.25	$7.83 \cdot 10^{9}$	0.82	10.85	
Tørvedammen	2	0.24	6.39 · 10 ⁹	0.82	10.85	
West 1	1	0.25	$1.74 \cdot 10^{9}$	0.03	0.44	
West 1	2	0.26	$6.08 \cdot 10^{9}$	0.03	0.44	
West 3	1	0.29	$3.17 \cdot 10^{8}$	0.01	0.10	
West 3	2	0.27	$1.28 \cdot 10^{9}$	0.01	0.10	
West 2	1	0.29	$2.24 \cdot 10^{9}$	1.20	1.21	
West 2	2	0.28	$4.58 \cdot 10^8$	1.20	1.21	
Grænseelv	1	0.25	$5.54 \cdot 10^{9}$	19.40	3.18	
Grænseelv	2	0.29	$1.23 \cdot 10^{9}$	19.40	3.18	
Zackenberg	1	0.15	$1.56 \cdot 10^{7}$	0.18	0.33	
River						
Zackenberg	2	0.04	-	0.18	0.33	Excluded
River						



Figure S1 Frozen fraction plots for soil samples collected from eleven different locations in Northeast Greenland and the corresponding Milliq negative controls. These samples were pre-sieved to <63 μm and subjected to various filtration
treatments. The "< 63 μm " category represents the untreated sample. The "Soluble > 1000 kDa" category includes samples that passed through a 0.2 μm filter but were retained on a 1000 kDa filter. The "1000-300 kDa" category comprises samples that passed through the 1000 kDa filter but were retained on the 300 kDa filter. The "300-100 kDa" category includes samples that passed through the 300 kDa filter but were retained on the 100 kDa filter. Finally, the "<100 kDa" category encompasses samples that passed through the 1000 kDa filter. The samples from Aucella, Zackenberg, and West 2, 3, and 4 were only passed through the 0.2 μm filter, as they lost most of their high activity after this initial treatment. Note that the

sample from Kaerelev A were not treated as the rest of the sample was lost during the first filtration step.



Figure S2 show soil particle size distribution for the 4 samples with a peak mode between 40 and 60 μ m. Clay particles are considered as < 2 μ m, Silt 2-63 μ m, while Sand > 63 μ m. Note the only 4 samples are depicted here, since too little sample was available for the rest of location to perform the analysis.



Figure S3 Shows the mean relative abundance of the top 11 highest abundant bacterial phyla present in the soil samples from the 10 different location. Additionally the samples has been clustered based on the euclidean distance matrix.



Figure S4 Shows the mean relative abundance of the top 10 highest abundant fungal phyla present in the soil samples fromthe 10 different location. Additionally the samples has been clustered based on the euclidean distance matrix.



Figure S5 shows the mean relative abundance of known fungal INA genera at all 10 locations.



Stream

- Graenseelv
- Kaerelv A
- Kaerelv C
- Toervedammen
- West 1
- West 2
 West 3
- West 4
- West 5
- Zackenberg River

Relative abundance

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35 Figure S6 provides an overview of the mean relative abundance of predicted fungal trophic modes and guilds across all 11 sampled locations. The predictions were generated using FUNguild, a tool commonly employed for assessing fungal functional roles in environmental samples. In this context, trophic modes refer to the nutritional strategies adopted by fungi, such as saprotrophy, pathotrophy, or symbiotrophy. Additionally, guilds categorize fungi based on shared ecological functions.

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Treatment

Bulk

Soluble > 1000 KDa

1000 - 300 KDa

300 - 100 KDa

Figure S7 Frozen fraction plots for stream samples collected from twelve different locations in Northeast Greenland and the corresponding Milliq negative controls. The "Bulk" category represents the untreated sample. The "Soluble > 1000 kDa" category includes samples that passed through a 0.2 µm filter but were retained on a 1000 kDa filter. The "1000-300 kDa"

45 category comprises samples that passed through the 1000 kDa filter but were retained on the 300 kDa filter. The "300-100 kDa" category includes samples that passed through the 300 kDa filter but were retained on the 100 kDa filter. Finally, the "<100 kDa" category encompasses samples that passed through the 100 kDa filter.



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Figure S8 Significant Spearman's rank correlations (p < 0.05) between INP concentrations in soil and stream water with various biogeochemical parameters. The size of the bubbles indicates the strength of the absolute correlation, while the color represents the direction of the correlation: positive (red) or negative (blue). Parameters include Carbon to Nitrogen ratio

55 (C/N), Dissolved Inorganic Nitrogen (DIN), Nitrate (NO₃), Total Dissolved Nitrogen (TDN), Calcium (Ca), Sulfur (S), Magnesium (Mg), Silicone (Si), Ammonia (NH₄), catchment area, and cumulative INP concentrations at -10 °C and -15 °C in both soil (INP10.s, INP15.s) and stream water (INP10.w, INP15.w).