Title of the manuscript: The diel vertical migration of microbes within snowpacks driven by solar radiation and nutrients

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Supplementary Figure S1: Photograph of a snow core collected on May 7th, 2021.
Supplementary Figure S2: The vertical distribution of microbes every three hours. %: Percentage of cell concentration or population density of each layer in the total five layers.
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Supplementary Figure S4: The chemical composition in each layer every three hours.
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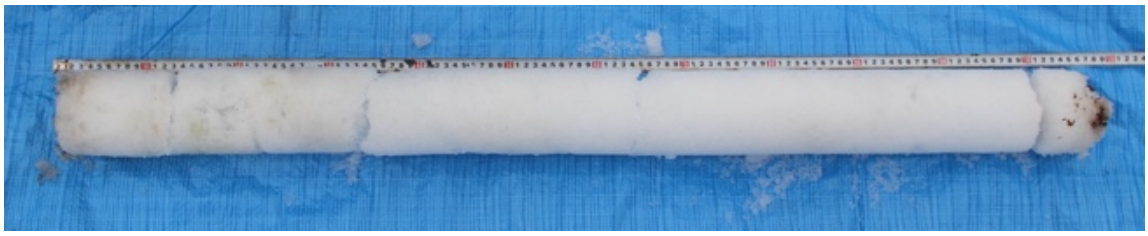
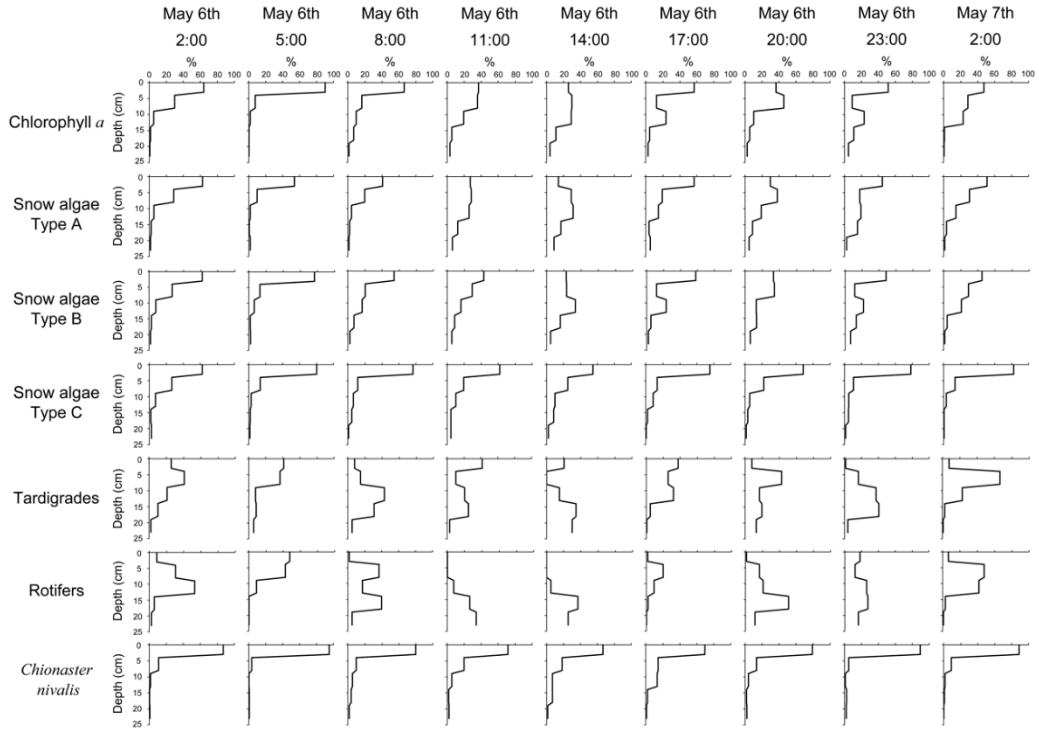
Supplementary Figure S6: The vertical distribution of chemical solutes every three hours.

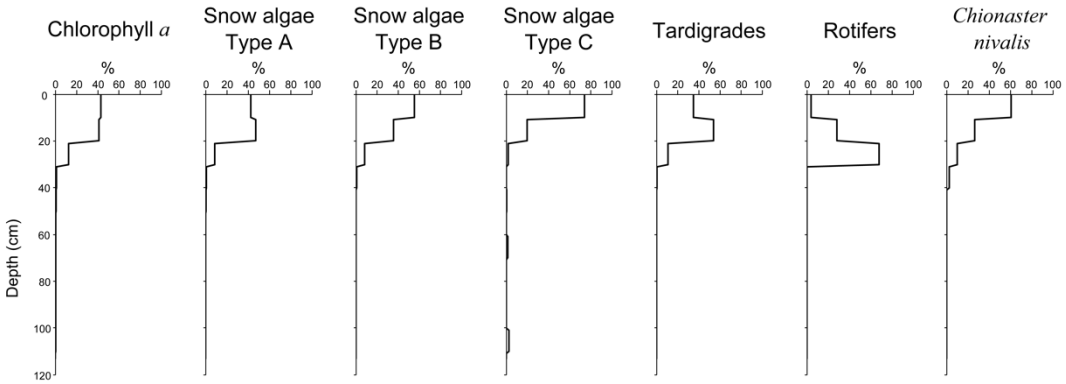
Supplementary Table S1: Chlorophyll *a* concentration, cell concentration, and population density of microbes every three hours. Their maximum, minimum in each layer is shown in each column. ND: Low abundance (under 1.7×10^3 cells L^{-1}).
Supplementary Table S2: Results of Chi-square test for vertical distribution of microbes between nighttime and daytime. Significant differences ($p < 0.05$) are shown in bold.



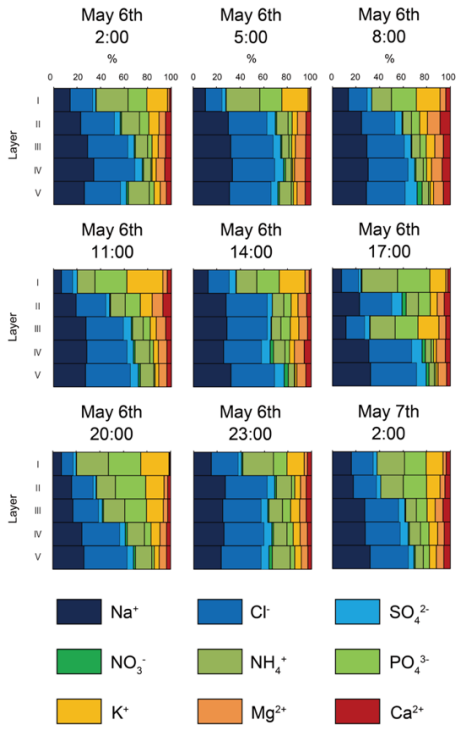
Supplementary Figure S1: Photograph of a snow core collected on May 7th, 2021.



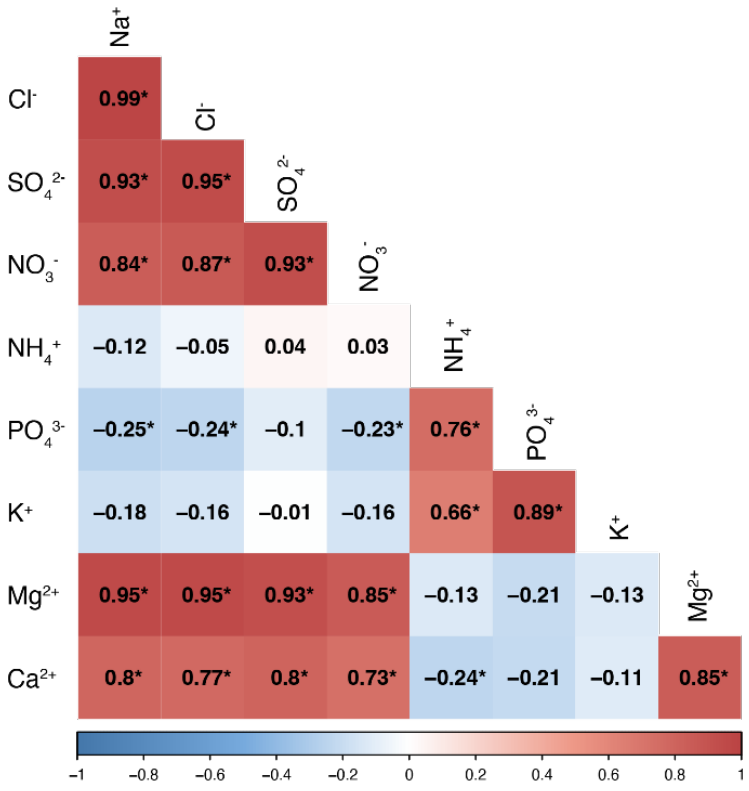
Supplementary Figure S2: The vertical distribution of microbes every three hours. %: Percentage of cell concentration or population density of each layer in the total of five layers.



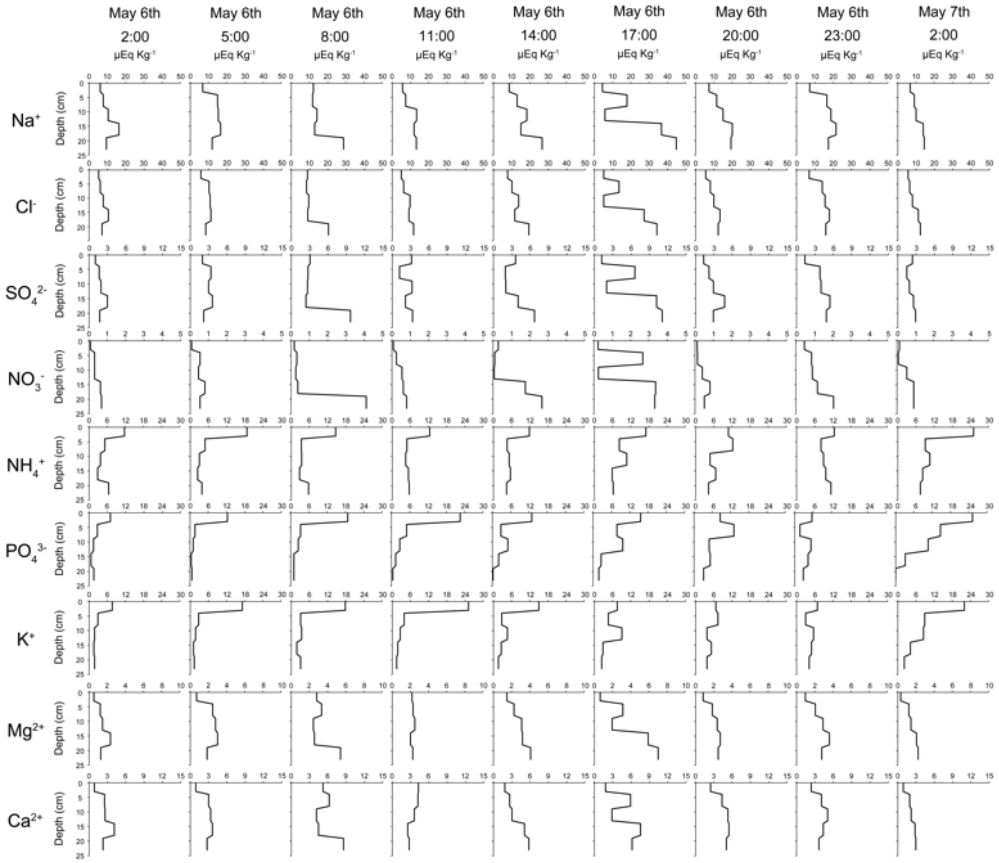
Supplementary Figure S3: The vertical distribution of microbes in the snow core. %: Percentage of chlorophyll *a* concentration, cell concentration, and population density of each layer in all layers.



Supplementary Figure S4: The chemical composition in each layer every three hours.



Supplementary Figure S5: Correlation between each chemical solute. Significant differences ($p < 0.01$) are shown in asterisk.



Supplementary Figure S6: The vertical distribution of chemical solutes every three hours.

Microbes	Layer (depth)	Concentration or density								
		2:00 May 6th	5:00 May 6th	8:00 May 6th	11:00 6th May	14:00 6th May	17:00 6th May	20:00 6th May	23:00 6th May	2:00 7th May
Chlorophyll *a* (μg L^{-1})	Ⅰ (0–3 cm)	4.0×10^{2}–5.3×10^{2}	3.7×10^{2}–1.1×10^{3}	1.3×10^{2}–6.5×10^{2}	1.8×10^{2}–3.3×10^{2}	0.3×10^{2}–1.6×10^{2}	2.2×10^{2}–1.4×10^{3}	1.5×10^{2}–4.2×10^{2}	3.3×10^{2}–7.1×10^{2}	5.2×10^{2}–1.8×10^{3}
	Ⅱ (3–8 cm)	0.9×10^{2}–3.2×10^{2}	0.3×10^{2}–1.4×10^{2}	0.7×10^{2}–2.2×10^{2}	1.2×10^{2}–$\times2.210^{2}$	0.4×10^{2}–1.3×10^{2}	8.7–1.1×10^{3}	1.4×10^{2}–9.3×10^{2}	0.7×10^{2}–1.7×10^{2}	2.9×10^{2}–1.1×10^{3}
	Ⅲ (8–13 cm)	0.2×10^{2}–1.0×10^{2}	0.2×10^{2}–1.2×10^{2}	0.7×10^{2}–1.1×102	0.2×10^{2}–$\times2.510^{2}$	0.3×10^{2}–2.5×10^{2}	3.5–7.9×10^{2}	0.1×10^{2}–4.4×10^{2}	0.2×10^{2}–5.2×10^{2}	0.4×10^{2}–7.4×10^{2}
	Ⅳ (13–18 cm)	4.5–0.5×10^{2}	6.6–0.2×10^{2}	0.3×10^{2}–0.5×10^{2}	9.2–1.7×10^{2}	0.3×10^{2}–1.2×10^{2}	0.9–3.7×10^{2}	0.9×10^{2}–2.0×10^{2}	8.0 6.6$\times10^{2}$	0.1×10^{2}–2.5×10^{2}
	Ⅴ (18–23 cm)	6.1–0.2×10^{2}	0.1×10^{2}–0.2×10^{2}	6.0–0.4×10^{2}	9.5–0.4×10^{2}	3.3–0.3×10^{2}	1.2–2.3×10^{2}	0.2×10^{2}–1.5×10^{2}	0.7–3.8×10^{2}	2.4–0.9×10^{2}
Snow algae Type A (cells L^{-1})	Ⅰ (0–3 cm)	9.9×10^{6}–1.4×10^{7}	1.4×10^{7}–5.4×10^{7}	2.4×10^{6}–2.3×10^{7}	3.7×10^{6}–5.3×10^{6}	4.1×10^{5}–5.2×10^{6}	1.9×10^{6}–2.7×10^{7}	6.2×10^{6}–1.6×10^{7}	2.2×10^{7}–3.7×10^{7}	1.2×10^{7}–6.1×10^{7}
	Ⅱ (3–8 cm)	1.9×10^{6}–1.2×10^{7}	4.6×10^{5}–4.3×10^{6}	9.7×10^{5}–4.4×10^{6}	3.8×10^{6}–5.7×10^{6}	7.3×10^{5}–4.2×10^{6}	1.1×10^{6}–3.2×10^{7}	4.6×10^{6}–9.1×10^{7}	4.6×10^{6}–6.5×10^{6}	1.1×10^{7}–4.4×10^{7}
	Ⅲ (8–13 cm)	1.5×10^{5}–1.3×10^{6}	7.5×10^{4}–2.0×10^{6}	7.5×10^{5}–1.5×10^{6}	3.9×10^{5}–5.5×10^{6}	3.7×10^{5}–8.7×10^{6}	8.2×10^{5}–4.9×10^{7}	3.7×10^{5}–2.0×10^{7}	4.9×10^{5}–4.9×10^{7}	3.8×10^{5}–2.9×10^{7}
	Ⅳ (13–18 cm)	3.5×10^{4}–3.7×10^{5}	7.0×10^{4}–1.1×10^{5}	3.9×10^{5}–9.4×10^{5}	2.0×10^{5}–1.5×10^{6}	2.8×10^{5}–1.7×10^{6}	2.1×10^{5}–1.1×10^{7}	1.1×10^{6}–2.5×10^{6}	1.6×10^{5}–1.8×10^{7}	1.5×10^{5}–1.5×10^{6}
	Ⅴ (18–23 cm)	5.0×10^{4}–9.3×10^{4}	5.3×10^{4}–1.6×10^{5}	4.7×10^{4}–5.0×10^{5}	1.4×10^{5}–6.5×10^{5}	9.0×10^{4}–3.7×10^{5}	5.3×10^{4}–5.0×10^{6}	1.9×10^{5}–9.0×10^{5}	1.5×10^{5}–8.4×10^{6}	3.0×10^{4}–7.7×10^{5}
Snow algae Type B (cells L^{-1})	Ⅰ (0–3 cm)	1.9×10^{7}–2.8×10^{7}	2.4×10^{7}–3.0×10^{7}	3.8×10^{6}–5.3×10^{7}	1.7×10^{6}–5.1×10^{6}	2.2×10^{5}–8.3×10^{5}	9.6×10^{6}–6.6×10^{7}	5.1×10^{6}–1.1×10^{7}	4.0×10^{6}–4.9×10^{7}	1.1×10^{7}–6.2×10^{7}
	Ⅱ (3–8 cm)	6.1×10^{6}–1.4×10^{7}	2.4×10^{6}–7.7×10^{6}	2.3×10^{6}–3.2×10^{7}	1.6×10^{6}–7.3×10^{6}	6.3×10^{5}–1.7×10^{6}	1.1×10^{6}–1.1×10^{8}	7.5×10^{6}–1.8×10^{7}	1.6×10^{6}–1.8×10^{7}	3.2×10^{6}–5.1×10^{7}
	Ⅲ (8–13 cm)	7.2×10^{5}–3.0×10^{6}	4.5×10^{5}–2.6×10^{6}	1.2×10^{6}–6.2×10^{6}	1.3×10^{5}–1.5×10^{7}	6.8×10^{5}–2.2×10^{6}	5.6×10^{6}–4.2×10^{7}	6.0×10^{5}–1.0×10^{7}	7.4×10^{5}–2.0×10^{7}	8.1×10^{5}–1.7×10^{7}
	Ⅳ (13–18 cm)	1.9×10^{5}–1.2×10^{6}	1.5×10^{5}–5.5×10^{5}	4.6×10^{5}–3.1×10^{6}	1.5×10^{5}–6.6×10^{6}	1.8×10^{5}–2.0×10^{6}	5.2×10^{4}–1.6×10^{7}	1.1×10^{6}–4.5×10^{6}	5.9×10^{5}–3.6×10^{7}	1.9×10^{5}–5.1×10^{6}
	Ⅴ (18–23 cm)	4.4×10^{5}–5.1×10^{5}	2.2×10^{5}–1.3×10^{6}	2.2×10^{4}–1.4×10^{6}	2.1×10^{5}–9.4×10^{5}	2.8×10^{4}–9.1×10^{5}	2.3×10^{4}–1.6×10^{7}	5.1×10^{5}–2.7×10^{6}	1.7×10^{4}–8.8×10^{6}	5.8×10^{4}–2.5×10^{6}
Snow algae Type C (cells L^{-1})	Ⅰ (0–3 cm)	8.0×10^{5}–1.4×10^{6}	4.0×10^{5}–9.0×10^{5}	7.6×10^{5}–2.1×10^{6}	1.6×10^{6}–6.2×10^{6}	4.2×10^{5}–1.2×10^{6}	2.2×10^{4}–2.1×10^{6}	7.7×10^{5}–2.8×10^{6}	3.3×10^{5}–2.1×10^{6}	1.5×10^{6}–2.7×10^{6}
	Ⅱ (3–8 cm)	1.0×10^{5}–1.7×10^{5}	1.0×104–4.4×10^{4}	1.1×10^{5}–2.3×10^{5}	4.2×10^{5}–1.0×10^{6}	1.3×10^{5}–3.3×10^{5}	ND–5.3×10^{5}	2.0×10^{5}–4.2×10^{5}	1.1×10^{4}–5.0×10^{4}	1.3×10^{5}–2.0×10^{5}
	Ⅲ (8–13 cm)	2.0×10^{3}–3.3×10^{4}	ND–3.3×10^{3}	4.7×10^{4}–9.3×10^{4}	6.3×10^{4} – 3.7×10^{5}	3.0×10^{4}–1.8×10^{5}	6.7×10^{4}–6.0×10^{5}	2.5×10^{4}–1.6×10^{5}	ND–3.3×10^{4}	ND–1.3×10^{5}
	Ⅳ (13–18 cm)	ND–1.7×10^{4}	ND–8.3×10^{3}	1.6×10^{4}–8.7×10^{4}	1.3×10^{4}–1.5×10^{5}	1.3×10^{4}–1.3×10^{5}	3.3×10^{3}–1.3×10^{5}	1.7×10^{4}–7.3×10^{4}	5.0×10^{3}–1.3×10^{5}	ND–5.6×10^{4}
	Ⅴ (18–23 cm)	ND–1.7×10^{4}	2.0×10^{3}–5.0×10^{3}	1.8×10^{4}–3.8×10^{4}	2.8×10^{4}–1.7×10^{5}	3.3×10^{3}–3.0×10^{4}	5.0×10^{3}–6.7×10^{4}	3.3×10^{4}–7.1×10^{4}	1.7×10^{3}–1.0×10^{5}	ND–8.3×10^{3}
Tardigrades (ind L^{-1})	Ⅰ (0–3 cm)	7.6×10^{2}–3.0×103	1.0×10^{3}–3.5×10^{4}	0.9×10^{2}–3.1×10^{2}	0.7×10^{2}–1.1×10^{3}	0–4.7×10^{2}	0.5×10^{2}–1.7×10^{4}	5.6×10^{2}–2.1×10^{3}	0–6.4×10^{2}	3.1×10^{2}–2.3×10^{4}
	Ⅱ (3–8 cm)	2.3×10^{3}–3.2×10^{3}	1.2×10^{3}–2.0×10^{4}	0–1.5×10^{3}	0.1×10^{2}–0.7×10^{2}	0	0–1.1×10^{5}	0.9×10^{2}–3.7×10^{4}	1.7×10^{3}–9.8×10^{3}	3.9×10^{3}–9.0×10^{4}
	Ⅲ (8–13 cm)	1.9×10^{2}–4.5×10^{3}	2.6×10^{3}–3.7×10^{3}	1.5×10^{2}–3.4×10^{3}	0–1.7×10^{3}	0–3.4×10^{2}	0–1.8×10^{4}	5.9×10^{2}–1.8×10^{4}	2.0×10^{3}–2.1×10^{4}	1.0×10^{3}–3.3×10^{4}
	Ⅳ (13–18 cm)	0.9×10^{2}–2.5×10^{3}	1.1×102–1.2×10^{3}	1.7×10^{2}–1.6×10^{3}	0.4×10^{2}–2.4×10^{3}	0.8×10^{2}–1.4×10^{3}	0–4.0×10^{3}	9.1×10^{2}–7.9×10^{3}	4.0×10^{3}–1.5×10^{4}	0.8×10^{2}–5.3×10^{3}
	Ⅴ (18–23 cm)	0.8×10^{2}–3.4×10^{2}	1.5×10^{2}–7.4×10^{2}	0–1.0×10^{3}	0–0.3×10^{2}	0–4.5×10^{2}	0–2.5×10^{3}	8.6×10^{2}–1.1×10^{3}	0–5.8×10^{3}	0.3×10^{2}–1.5×10^{3}
Rotifers (ind L^{-1})	Ⅰ (0–3 cm)	0–1.2×10^{2}	0.3×10^{2}–5.7×102	0–0.4×10^{2}	0	0	0–1.0×10^{3}	0–1.5×10^{2}	0–7.5×10^{3}	0–4.1×10^{3}
	Ⅱ (3–8 cm)	0–3.5×10^{2}	0.2×10^{2}–1.2×10^{3}	0–3.2×10^{2}	0	0	0–1.1×10^{4}	0.6×10^{2}–1.1×10^{3}	0–4.9×10^{3}	5.4×10^{2}–1.1×10^{4}
	Ⅲ (8–13 cm)	0–2.3×10^{2}	0–7.0×10^{2}	0–2.8×10^{2}	0–9.9	0–0.3×10^{2}	0–4.9×10^{3}	0.9×10^{2}–3.5×10^{3}	0.4×10^{2}–8.7×10^{2}	2.1×10^{2}–7.9×10^{3}
	Ⅳ (13–18 cm)	0–0.7×10^{2}	0–0.2×10^{2}	0–1.9×10^{2}	0–0.3×10^{2}	0–9.1×10^{2}	0–1.2×10^{3}	1.7×10^{2}–4.1×10^{3}	1.5×10^{2}–3.7×10^{2}	0–2.5×10^{2}
	Ⅴ (18–23 cm)	0–0.3×10^{2}	0–0.1×10^{2}	0–1.4×10^{2}	0–0.1×10^{2}	0–1.2×10^{2}	0–1.9×10^{2}	1.1×10^{2}–4.2×10^{2}	0–1.8×10^{2}	0–0.7×10^{2}
Chionaster nivalis (cells L^{-1})	Ⅰ (0–3 cm)	7.7×10^{5}–1.1×10^{6}	7.3×10^{5}–2.8×10^{6}	1.1×10^{5}–1.6×10^{6}	2.0×10^{5}–7.8×10^{5}	9.0×10^{4}–3.0×10^{5}	3.3×10^{4}–5.1×10^{6}	4.2×10^{5}–1.4×10^{6}	9.0×10^{5}–6.2×10^{6}	2.2×10^{6}–5.2×10^{6}
	Ⅱ (3–8 cm)	1.7×10^{5}–8.2×10^{5}	1.0×10^{5}–5.0×10^{5}	6.7×10^{3}–2.5×10^{5}	1.0×10^{5}–1.8×10^{5}	4.3×10^{4}–1.3×10^{5}	3.3×10^{3}–2.1×10^{6}	1.3×10^{5}–7.3×10^{5}	6.7×10^{3}–1.0×10^{6}	4.0×10^{5}–7.7×10^{5}
	Ⅲ (8–13 cm)	3.3×10^{4}–2.2×10^{5}	1.0×10^{4}–8.9×10^{4}	1.3×10^{4}–6.0×10^{4}	3.8×10^{4}–1.7×10^{5}	1.5×10^{4}–5.3×10^{4}	1.2×10^{5}–8.0×10^{5}	3.3×10^{4}–6.7×10^{4}	3.3×10^{4}–6.3×10^{5}	7.0×10^{4}–2.0×105
	Ⅳ (13–18 cm)	1.3×10^{4}–3.3×10^{4}	1.8×10^{4}–3.0×10^{4}	8.9×10^{3}–3.3×10^{4}	8.3×10^{3}–1.2×10^{5}	6.7×10^{3}–5.3×10^{4}	6.7×10^{3}–1.7×10^{5}	6.7×10^{3}–7.3×104	1.3×10^{4}–1.0×10^{6}	ND–3.3×10^{4}
	Ⅴ (18–23 cm)	1.0×10^{4}–7.7×10^{4}	1.2×10^{4}–5.3×10^{4}	ND–1.8×10^{4}	2.2×10^{4}–4.0×10^{4}	ND–1.2×10^{4}	ND–1.2×10^{5}	ND–2.5×10^{4}	ND–3.0×10^{5}	ND–3.3×10^{4}

Supplementary Table S1: Chlorophyll *a* concentration, cell concentration, and population density of microbes every three hours. Their maximum, minimum, in each layer are shown in each column. ND: Low abundance (under 1.7×10^3 cells L^{-1})

Pearson's chi-square test			
	χ^2	df	p < 0.05
Microbes			
Chlorophyll *a*	9.921	4	**0.042**
Snow algae Type A	15.722	4	**0.003**
Snow algae Type B	26.059	4	**0.000**
Snow algae Type C	6.585	4	0.160
Tardigrades	37.084	4	**0.000**
Rotifers	71.056	4	**0.000**
Chionaster nivalis	7.100	4	0.131
Components			
Na^+	1.455	4	0.835
Cl^-	1.359	4	0.851
SO_4^{2-}	1.198	4	0.878
NO_3^-	0.247	4	0.993
NH_4^+	0.282	4	0.991
PO_4^{3-}	2.347	4	0.672
K^+	2.639	4	0.620
Mg^{2+}	0.517	4	0.972
Ca^{2+}	0.193	4	0.996

Supplementary Table S2: Results of Chi-square test for vertical distribution of microbes between nighttime and daytime. Significant differences (p < 0.05) are shown in bold.