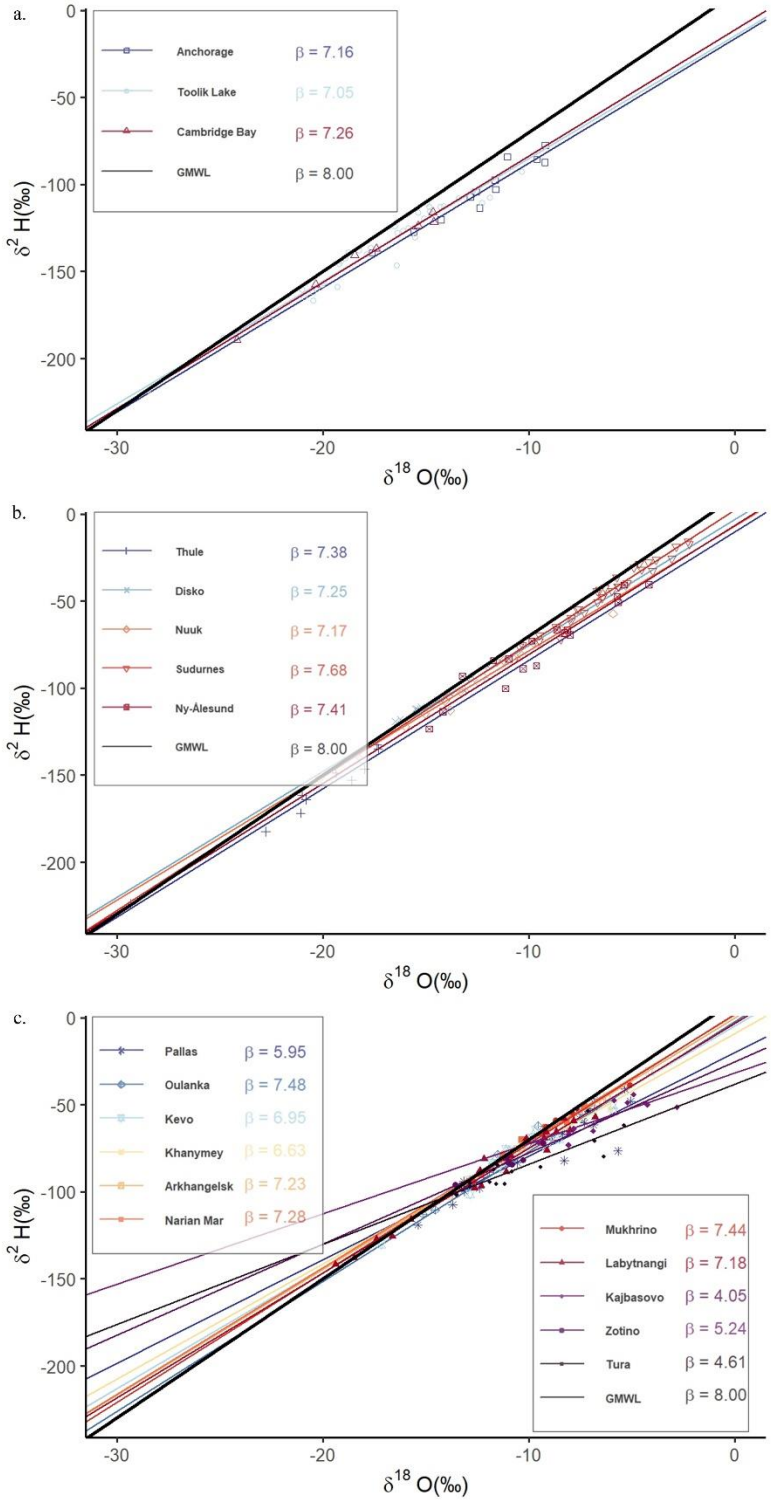
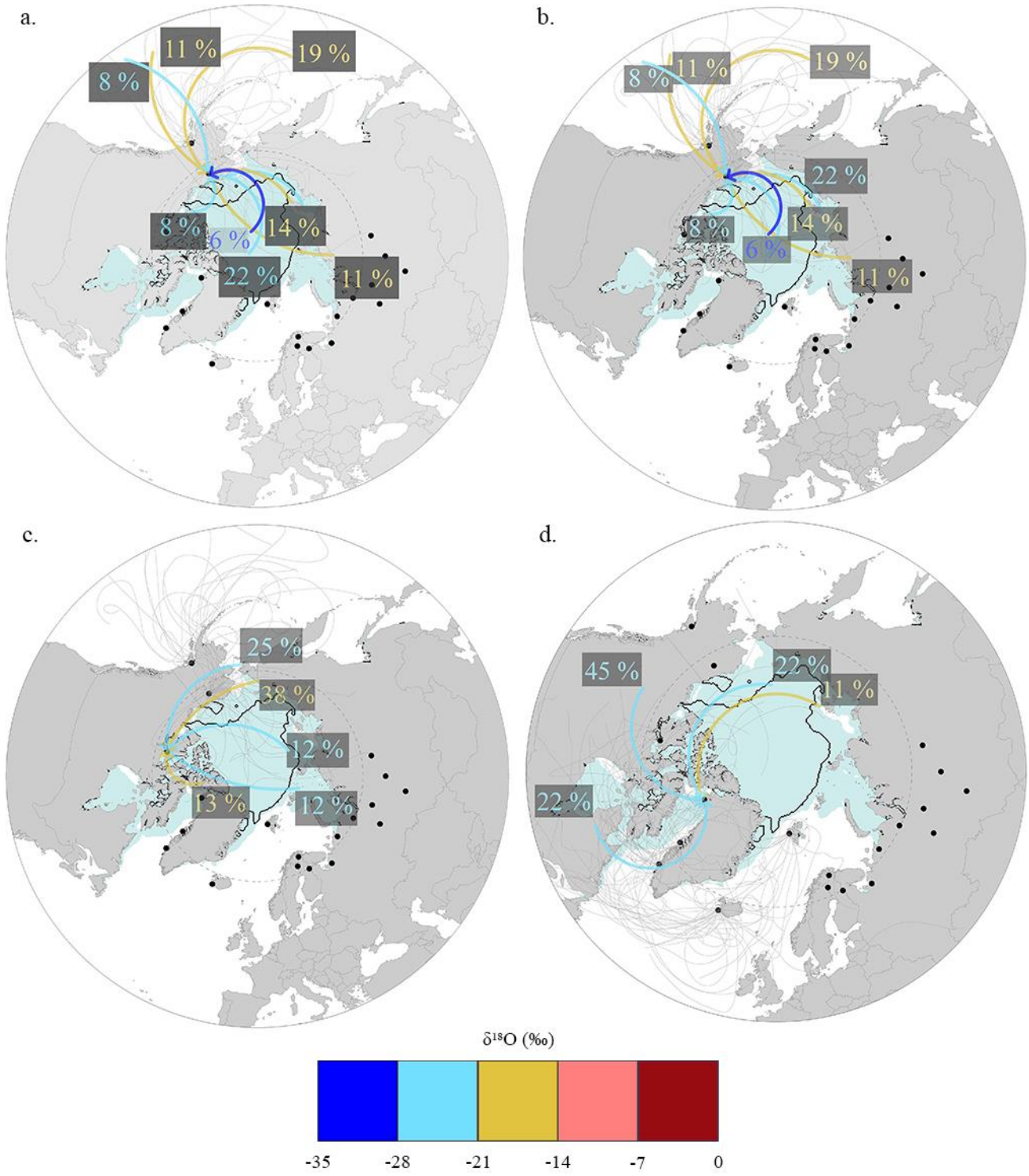
Supplementary Material

1 Supplementary Figures

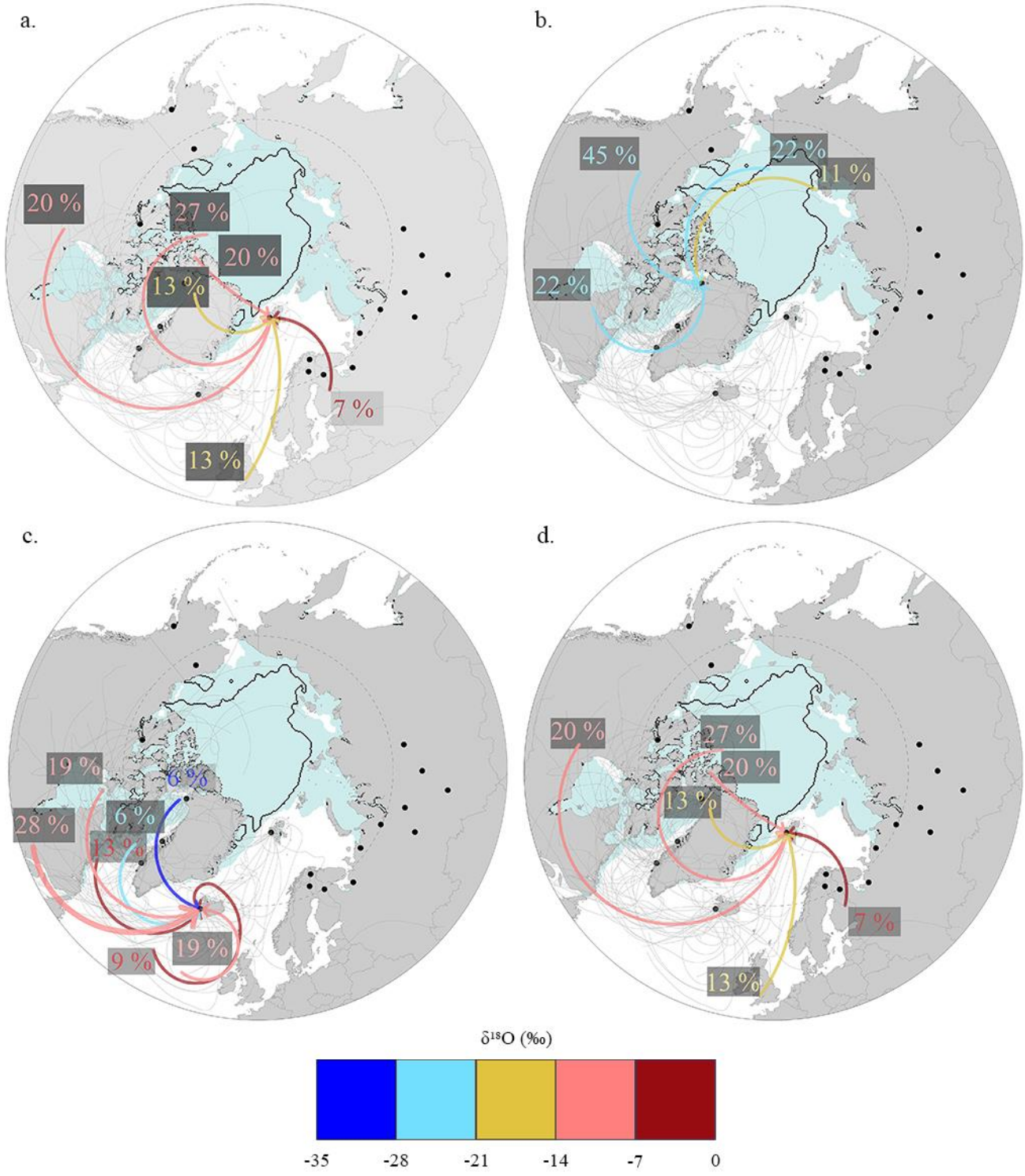


Supplementary Figure 1. Summer 2018 combined LMWLs for a) North American, b) Atlantic, c) Eurasian sectors. GMWL is presented as a reference.



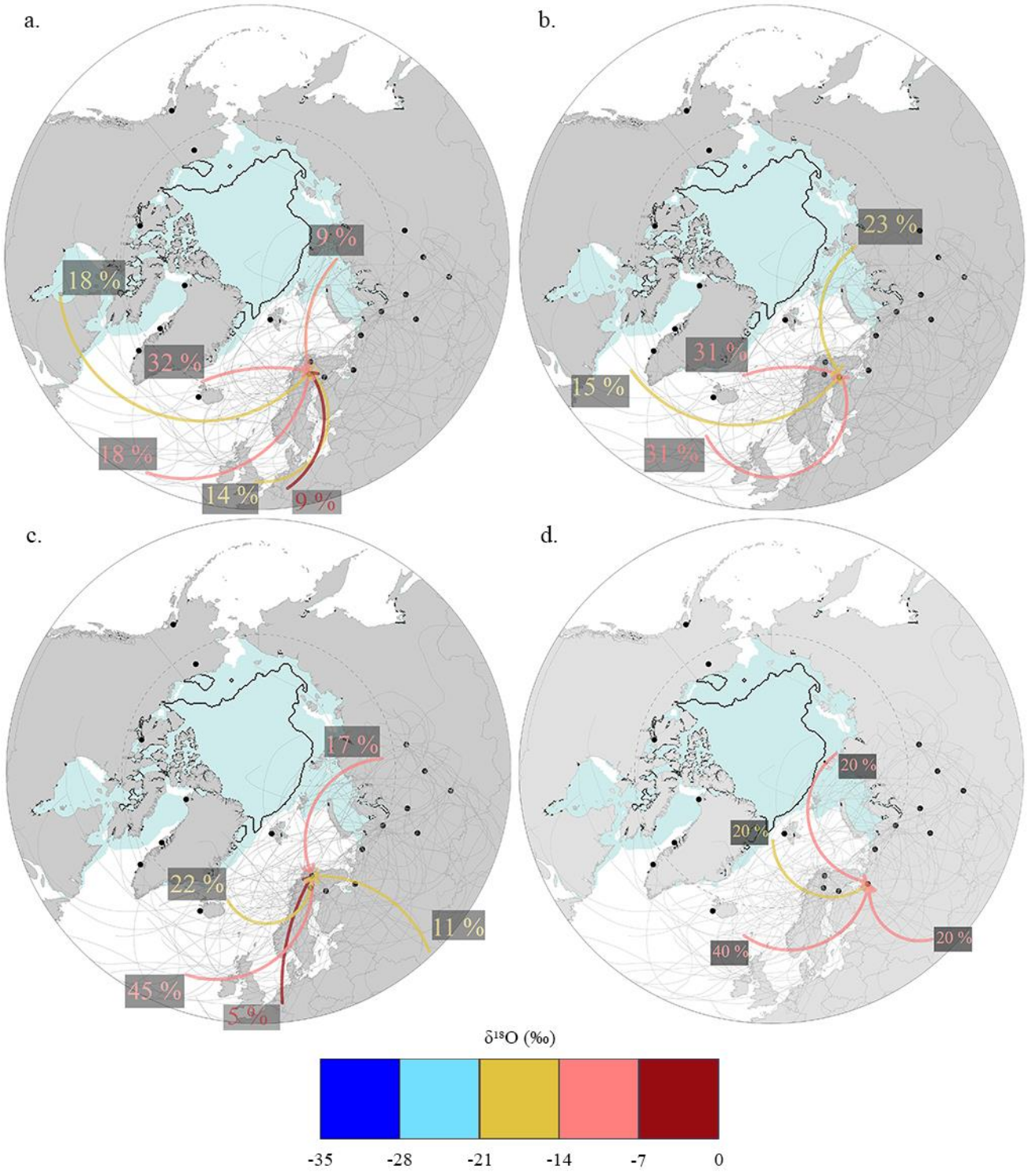
Supplementary Figure 2. Backward trajectories analysis (120 hours) for all the precipitation events during summer 2018 in PAPIN stations: (a) Anchorage, (b) Toolik Lake, (c) Cambridge Bay, (d) Thule. The arrows representing each cluster of trajectories are color-coded based on their corresponding $\delta^{18}O$. Blue shading represents the summer 2018 mean maximum sea ice extent (June),

while the thick black line indicates the mean minimum sea ice extent (August). Sea ice extent data obtained from the National Snow and Ice Data Center (NSIDC 2019).

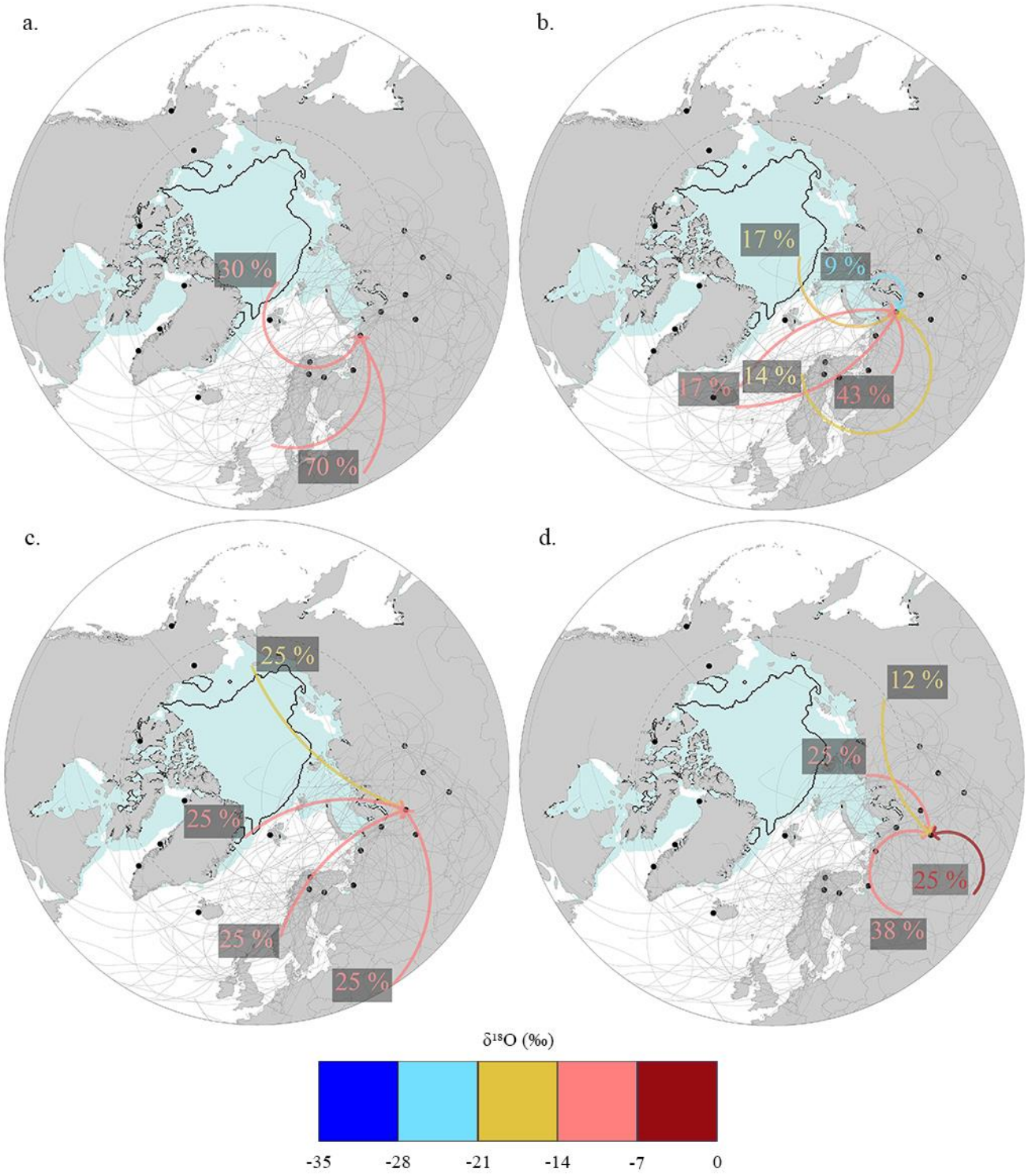


Supplementary Figure 3. Backward trajectories analysis (120 hours) for all the precipitation events during summer 2018 in PAPIN stations: (a) Disko, (b) Nuuk, (c) Sudurnes, (d) Ny-Ålesund. The

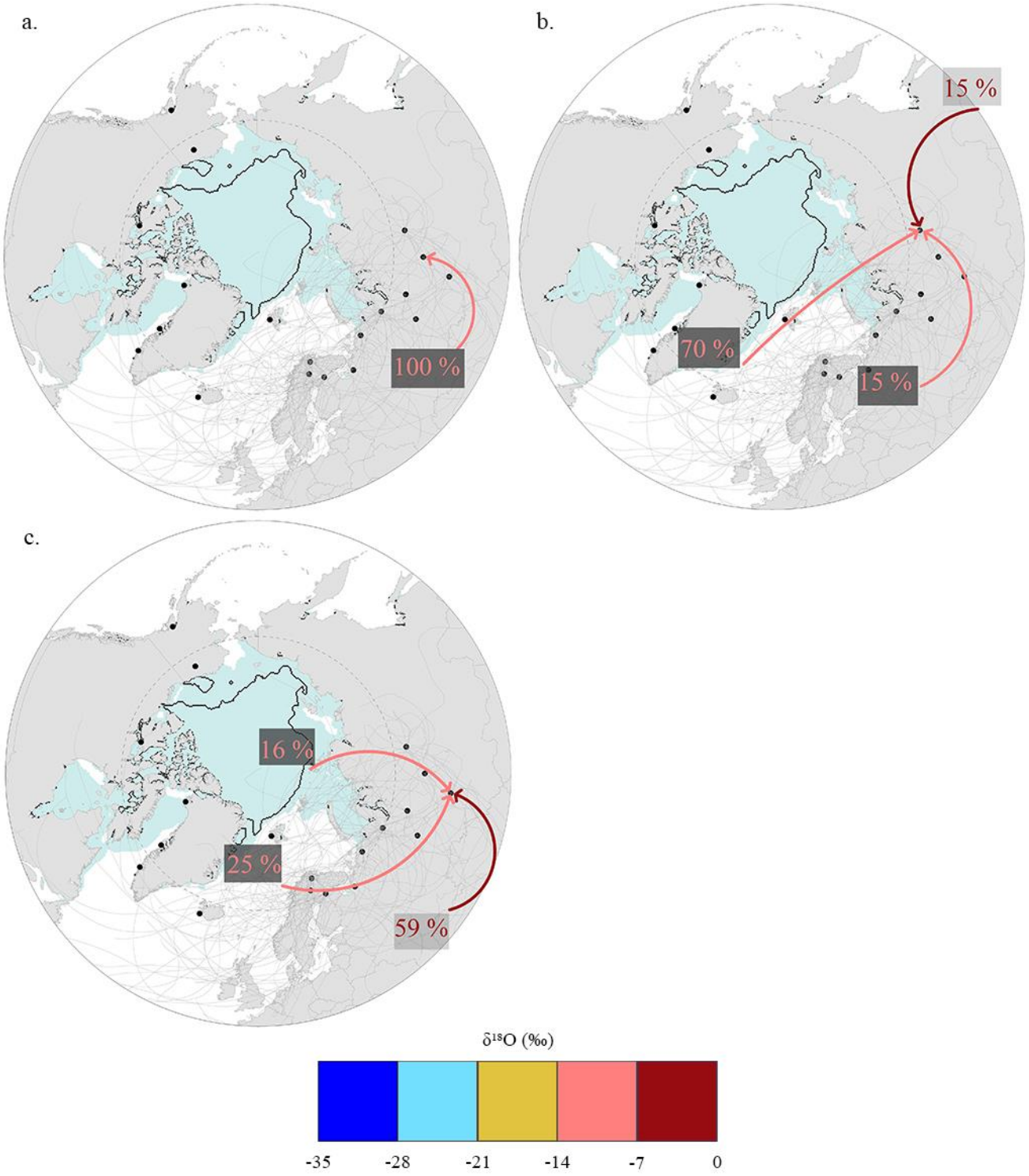
arrows representing each cluster of trajectories are color-coded based on their corresponding $\delta^{18}O$. Blue shading represents the summer 2018 mean maximum sea ice extent (June), while the thick black line indicates the mean minimum sea ice extent (August). Sea ice extent data obtained from the National Snow and Ice Data Center (NSIDC 2019).



Supplementary Figure 4. Backward trajectories analysis (120 hours) for all the precipitation events during summer 2018 in PAPIN stations: (a) Pallas, (b) Oulanka, (c) Kevo, (d) Arkhangelsk. The arrows representing each cluster of trajectories are color-coded based on their corresponding $\delta^{18}O$. Blue shading represents the summer 2018 mean maximum sea ice extent (June), while the thick black line indicates the mean minimum sea ice extent (August). Sea ice extent data obtained from the National Snow and Ice Data Center (NSIDC 2019).

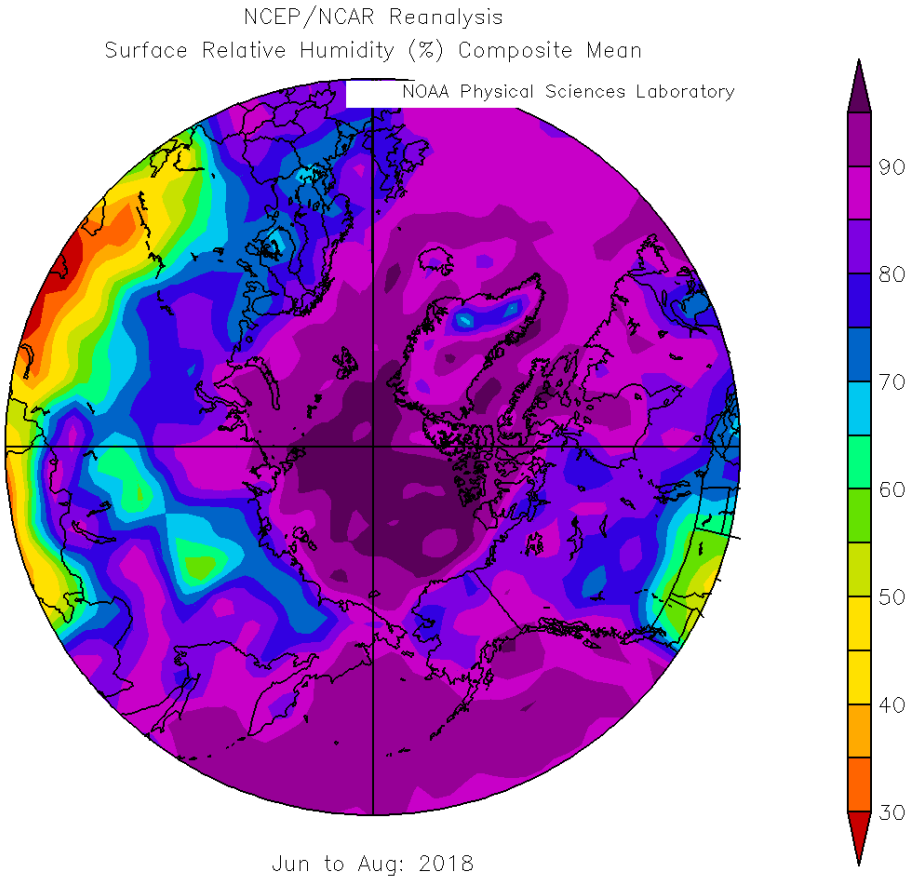


Supplementary Figure 5. Backward trajectories analysis (120 hours) for all the precipitation events during summer 2018 in PAPIN stations: (a) Narian Mar, (b) Labytnangi, (c) Khanymey, (d) Mukhrino. The arrows representing each cluster of trajectories are color-coded based on their corresponding $\delta^{18}O$. Blue shading represents the summer 2018 mean maximum sea ice extent (June), while the thick black line indicates the mean minimum sea ice extent (August). Sea ice extent data obtained from the National Snow and Ice Data Center (NSIDC 2019).



Supplementary Figure 6. Backward trajectories analysis (120 hours) for all the precipitation events during summer 2018 in PAPIN stations: (a) Zotino, (b) Tura, (c) Kajbasovo. The arrows representing each cluster of trajectories are color-coded based on their corresponding $\delta^{18}O$. Blue shading represents the summer 2018 mean maximum sea ice extent (June), while the thick black line

indicates the mean minimum sea ice extent (August). Sea ice extent data obtained from the National Snow and Ice Data Center (NSIDC 2019).



Supplementary Figure 7. Mean surface relative humidity (%) composite map for June, July, and August 2018 from NCEP/NCAR (Kalnay et al. 1996).

2 Supplementary Tables

Supplementary Table 1. The number of events sampled and analyzed from each PAPIN station during each month of summer 2018 and the source for obtaining the meteorological data (SAT, precipitation amount) used in this study.

	Stations	June	July	August	Total	Source of Meteorological Data
Finland	Pallas	16	2	4	22	Finnish Meteorological Institute (FMI)
	Oulanka	0	1	12	13	FMI
	Kevo	0	6	16	22	FMI
Norway	Ny-Ålesund	0	7	8	15	Ny-Ålesund Research Station-Sverdrup
Greenland	Thule	1	5	3	9	Thule Air Base
	Nuuk	0	6	10	16	Asiaq Greenland Survey
	Disko	0	7	9	16	Danish Meteorological Institute (DMI)
Iceland	Sudrunes	0	21	11	32	Sudurnes Science & Learning Centre
Russia	Khaneymey	0	2	2	4	worldweatheronline.com
	Arkhangelsk	0	1	4	5	Arkhangelsk Station
	Narian Mar	0	0	8	8	Narian Mar Station
	Mukhrino	1	3	4	8	Mukhrino Field Station
	Zotino	0	1	5	6	Zotino Station
	Tura	3	11	0	14	Tura Station
	Kajbasovo	4	4	4	12	worldweatheronline.com
	Labytnangi	10	5	8	23	worldweatheronline.com
Canada	Cambridge Bay	0	1	6	7	Canadian High Arctic Research Station
USA	Toolike Lake	6	16	14	36	Toolik Lake Station
	Anchorage	0	4	9	13	Alaska Climate Research Center
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