Figure. S1. Overview of meteorological parameters measured during the 2019 campaign including **(a)** wind direction (°) in black, **(b)** wind speed (m s^{-1}) in red, and **(c)** snow depth (m) in blue. The areas shaded in blue indicate Events 1 and 2, respectively.
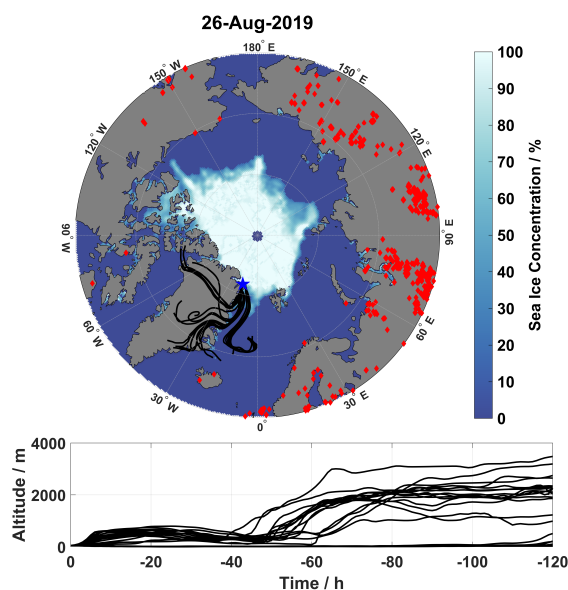
Figure. S2. Hourly air mass back-trajectories for August 26, 2019. The top panels show back-trajectories in black along with sea ice concentration (%), and active fires (including fires from five days before the start of each day up till the end of each day) in red. The bottom panels show the altitude (m) of each hourly back-trajectory.
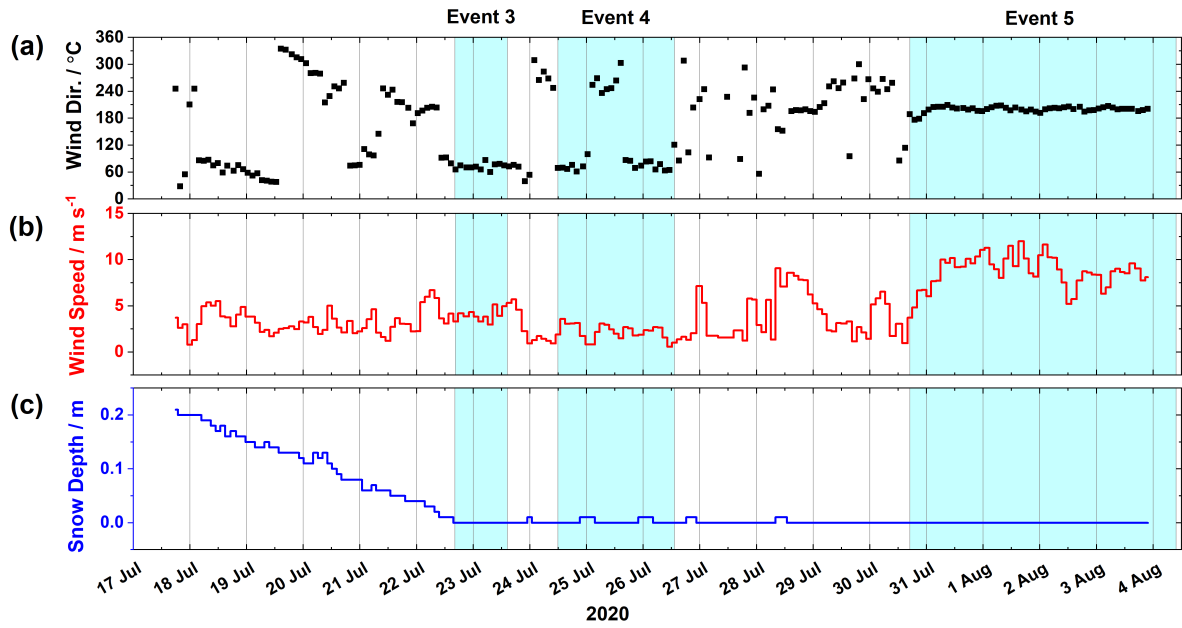
Figure. S3. Overview of meteorological parameters measured during the 2020 campaign including **(a)** wind direction (°) in black, **(b)** wind speed (m s^{-1}) in red, and **(c)** snow depth (m) in blue. The areas shaded in blue indicate Events 3, 4, and 5, respectively.
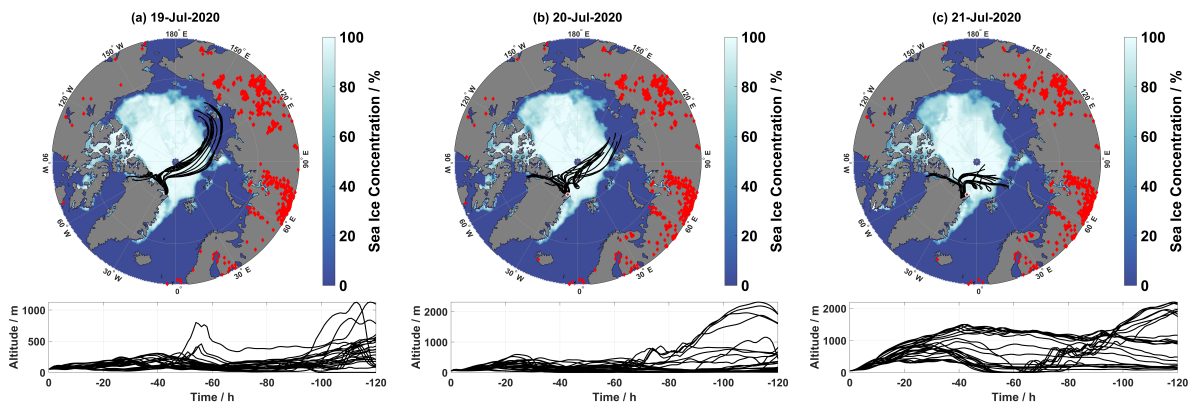
Figure. S4. Hourly air mass back-trajectories for July 19–21, 2020 (a–c). The top panels show back-trajectories in black along with sea ice concentration (%), and active fires (including fires from five days before the start of each day up till the end of each day) in red. The bottom panels show the altitude (m) of each hourly back-trajectory.
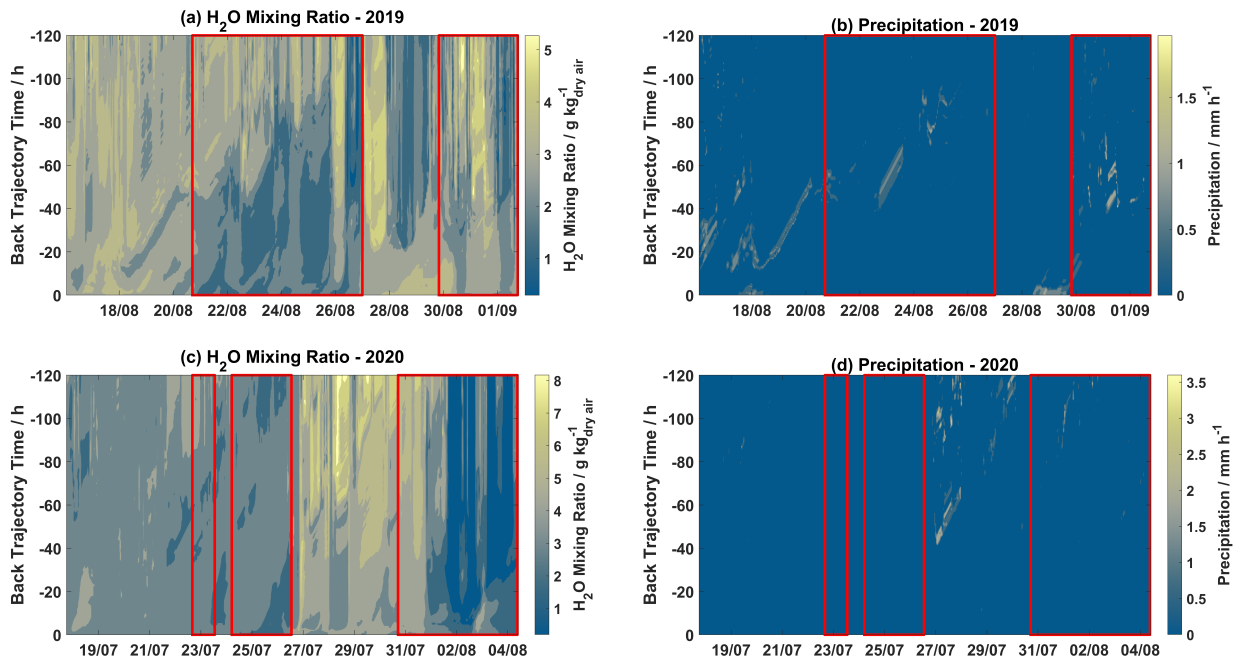
Figure. S5. Contour plots of trajectory derived meteorological parameters **(a)** H_2O mixing ratio and **(b)** precipitation for the 2019 campaign, as well as **(c)** H_2O mixing ratio and **(d)** precipitation for the 2020 campaign. Event periods are outlined in red. The x-axis displays arrival time at Villum, the y-axis displays hours backward in time for each trajectory, and the color bar represents the meteorological parameter.