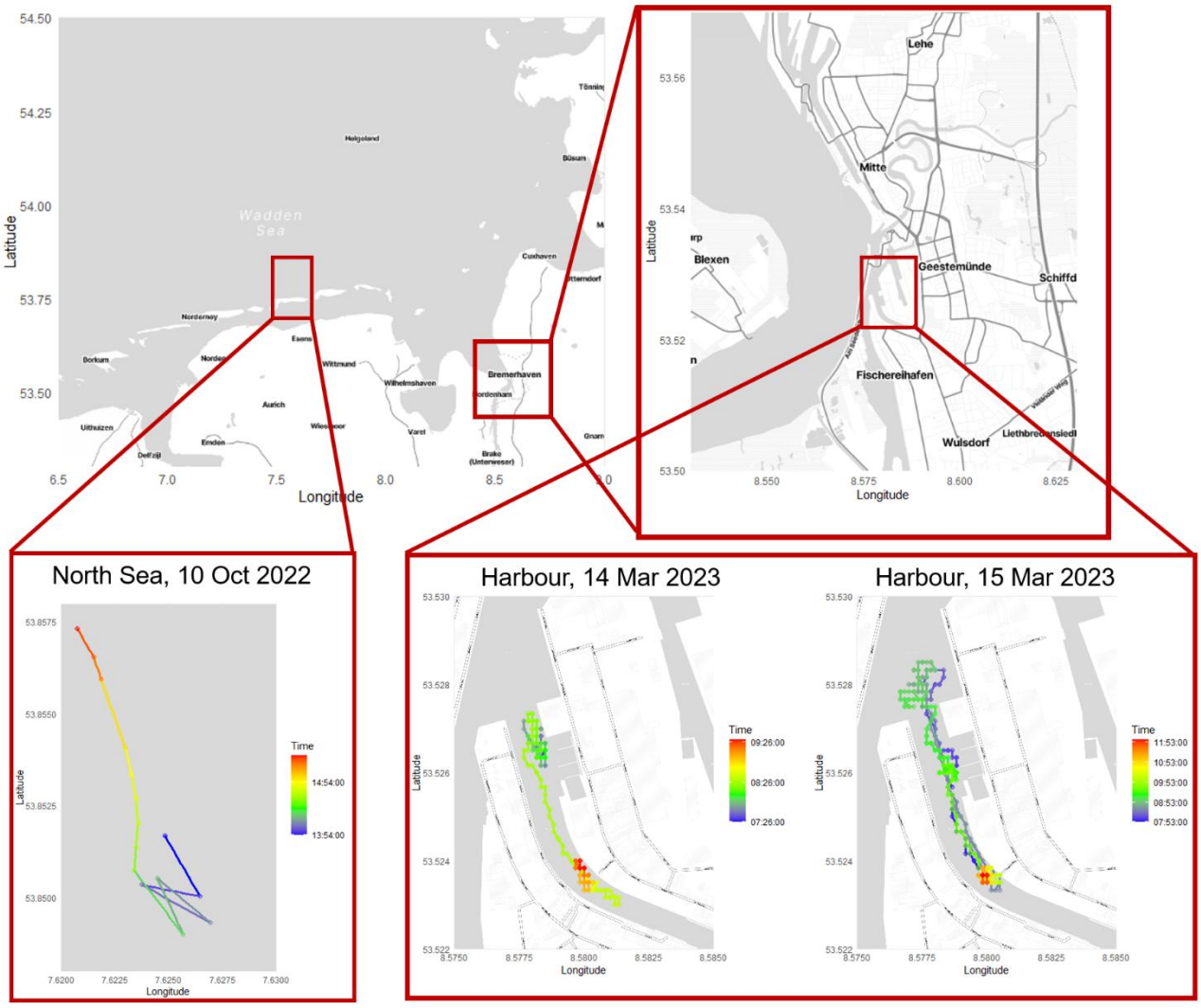

Figure S1: Map displaying the locations of observations in the harbor and the North Sea. The inset maps provide a detailed view of the ASV tracks, with a color scale indicating the ASV's position at specific time points (UTC). The map visualization was created using Stadia Maps based on OpenStreetMap data.

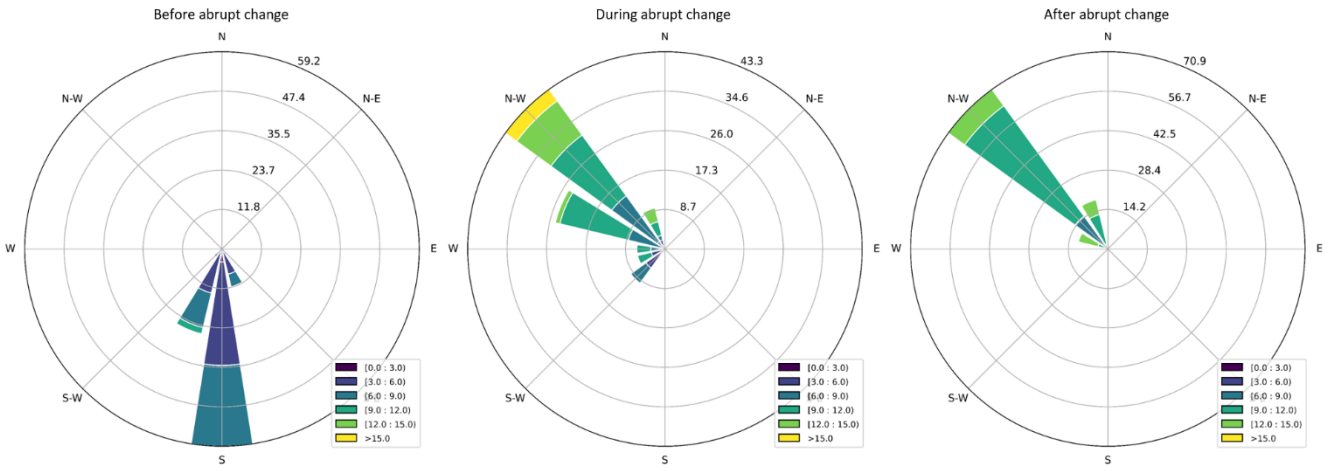

Figure S2: Wind rose plots illustrating wind direction, speed and frequency over three distinct periods. The radial spokes indicate the direction from which the wind originated, while color-coded segments represent wind speed categories (m s^{-1}), ranging from light (dark purple) to very strong winds (bright yellow). Concentric circles denote the frequency of wind occurrence from each direction, with larger bars indicating higher prevalence. The three time periods analyzed are: before (08:00–08:17 UTC), during (08:18–08:34 UTC) and after the abrupt change (08:36–08:45 UTC) on 14 March 2023.

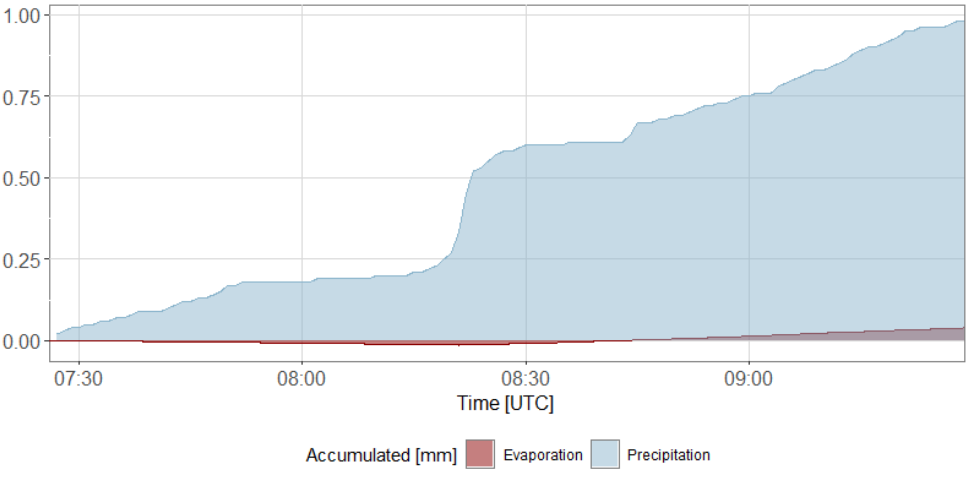

Figure S3: Time series of the accumulated evaporation and precipitation on 14 March 2023.

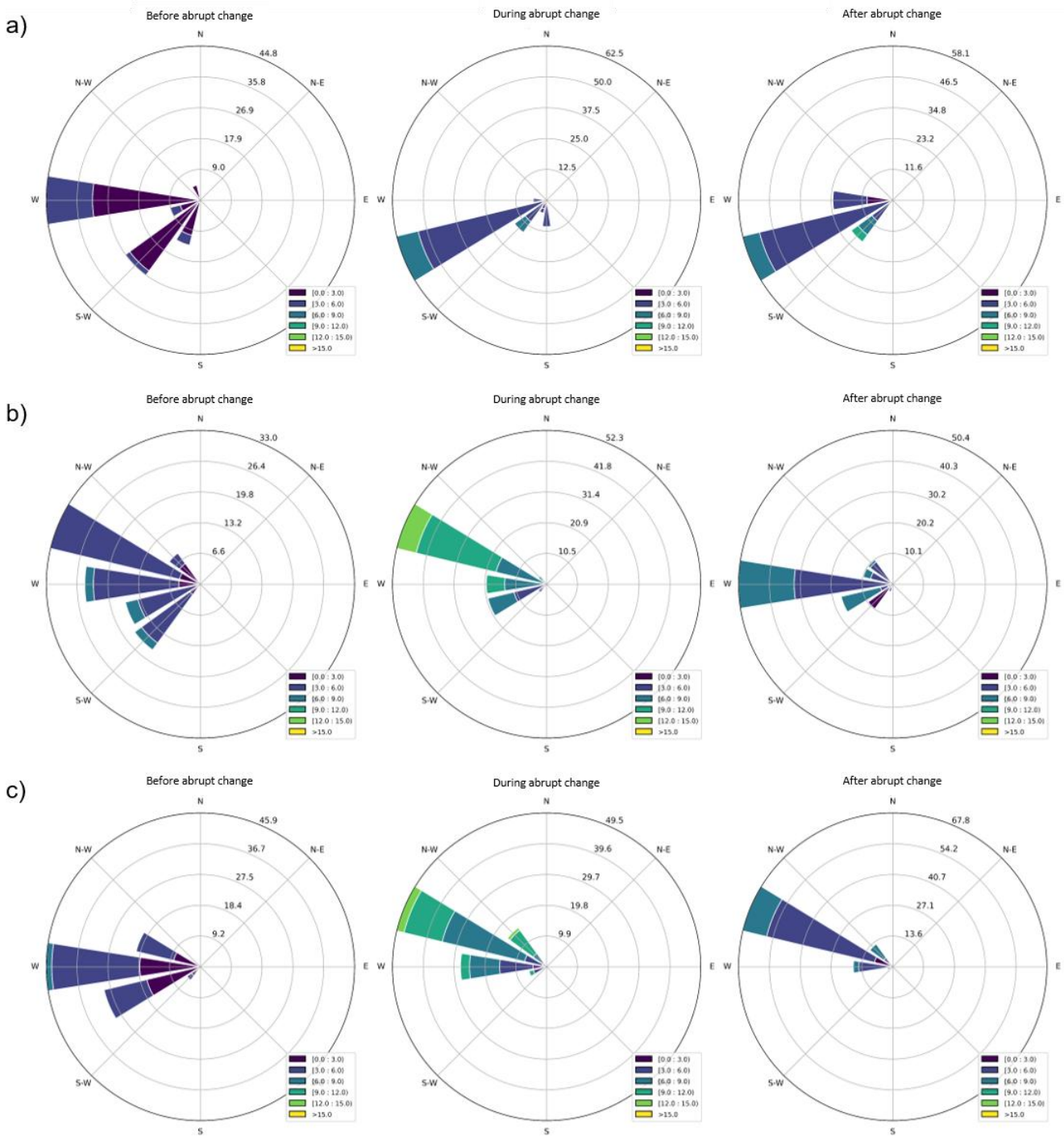

Figure S4: Wind rose plots illustrating wind direction, speed and frequency over three distinct periods. The radial spokes indicate the direction from which the wind originated, while color-coded segments represent wind speed categories (m s^{-1}), ranging from light (dark purple) to very strong winds (bright yellow). Concentric circles denote the frequency of wind occurrence from each direction, with larger bars indicating higher prevalence. a) first event on 15 March 2023 with the three time periods analyzed are:

before (07:30–08:04 UTC), during (08:06–08:15 UTC) and after the abrupt change (08:16–08:21 UTC). b) second event on 15 March 2023 with the three time periods analyzed are: before (08:27–08:45 UTC), during (08:46–09:15 UTC) and after the abrupt change (09:20–09:40 UTC). c) third event on 15 March 2023 with the three time periods analyzed are: before (10:30– 10:40 UTC), during (10:41–11:15 UTC) and after the rapid change (11:20– 11:40 UTC).

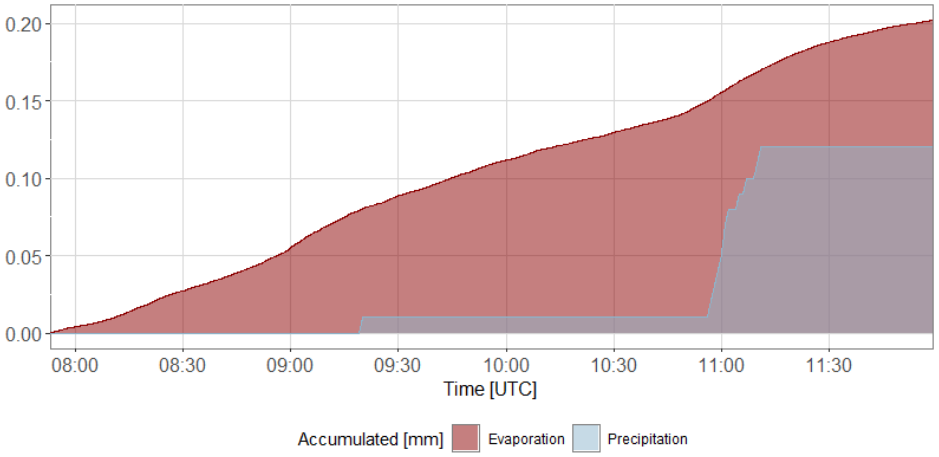

Figure S5: Time series of the accumulated evaporation and precipitation on 15 March 2023.

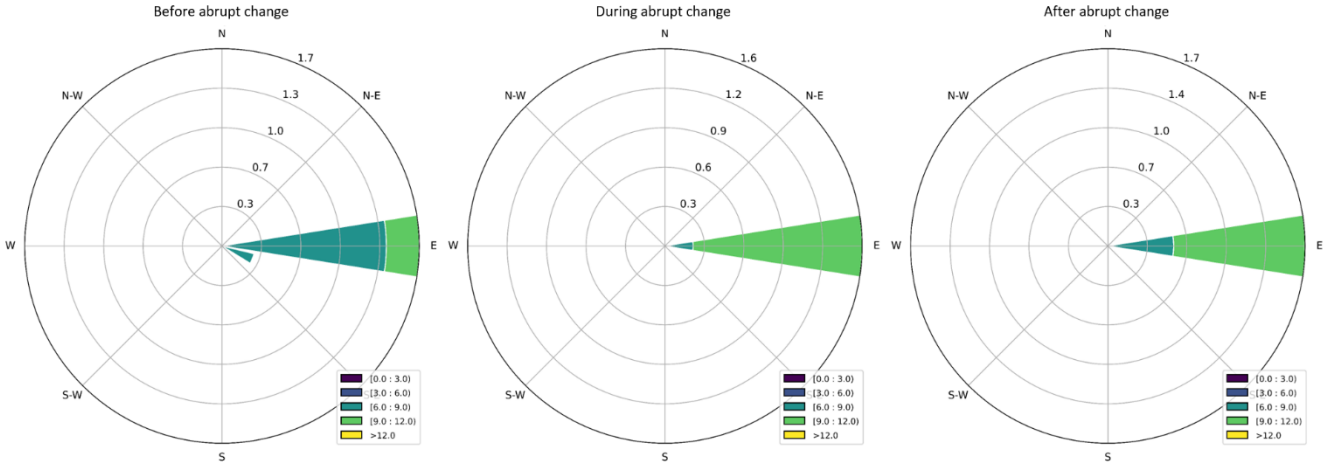

Figure S6: Wind rose plots illustrating wind direction, speed and frequency over three distinct periods. The radial spokes indicate the direction from which the wind originated, while color-coded segments represent wind speed categories (m s^{-1}), ranging from light (dark purple) to very strong winds (bright yellow). Concentric circles denote the frequency of wind occurrence from each direction, with larger bars indicating higher prevalence. The three time periods analyzed are: before (12:30–13:30 UTC), during (13:40–14:55 UTC) and after the abrupt change (14:55–15:30 UTC) on 10 October 2022.

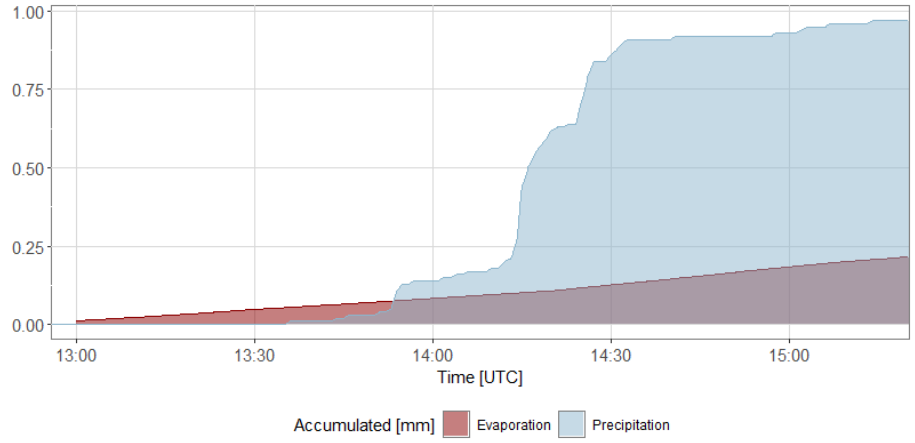

Figure S7: Time series of the accumulated evaporation and precipitation on 10 October 2022.

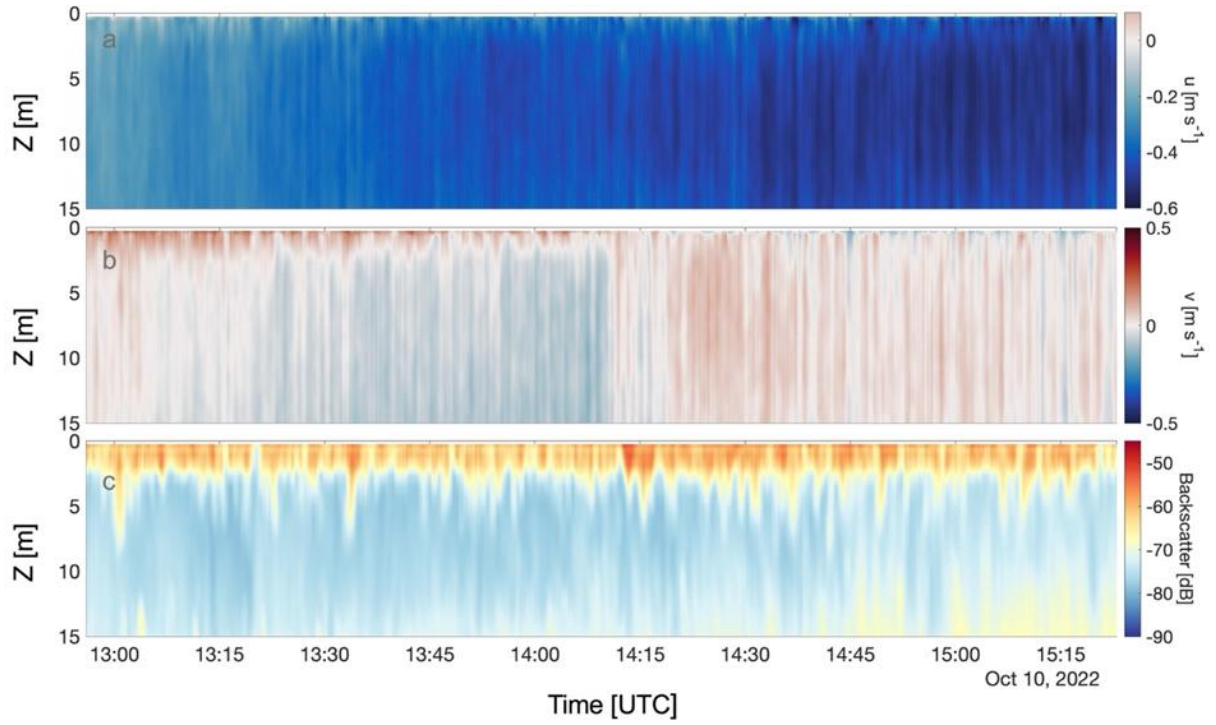

Figure S8: Current velocity data measured with an ADCP mounted on the centre of Halobates on 10 October 2022 to a depth of 15 metres. (a) Zonal current velocity, (b) meridional current velocity and (c) backscatter signals are shown in three panels, and the colour scale shows the velocity magnitude for each current velocity component.