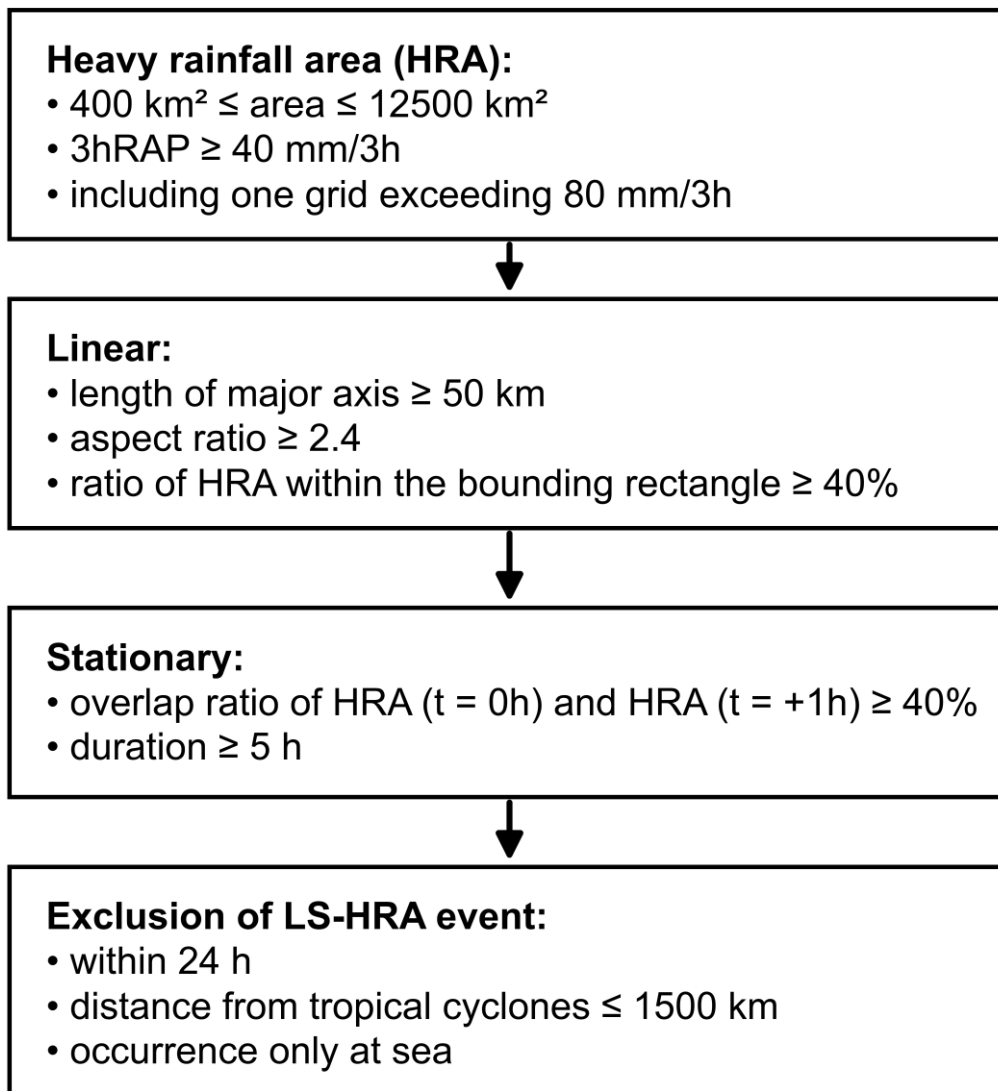


1 Supplementary material for

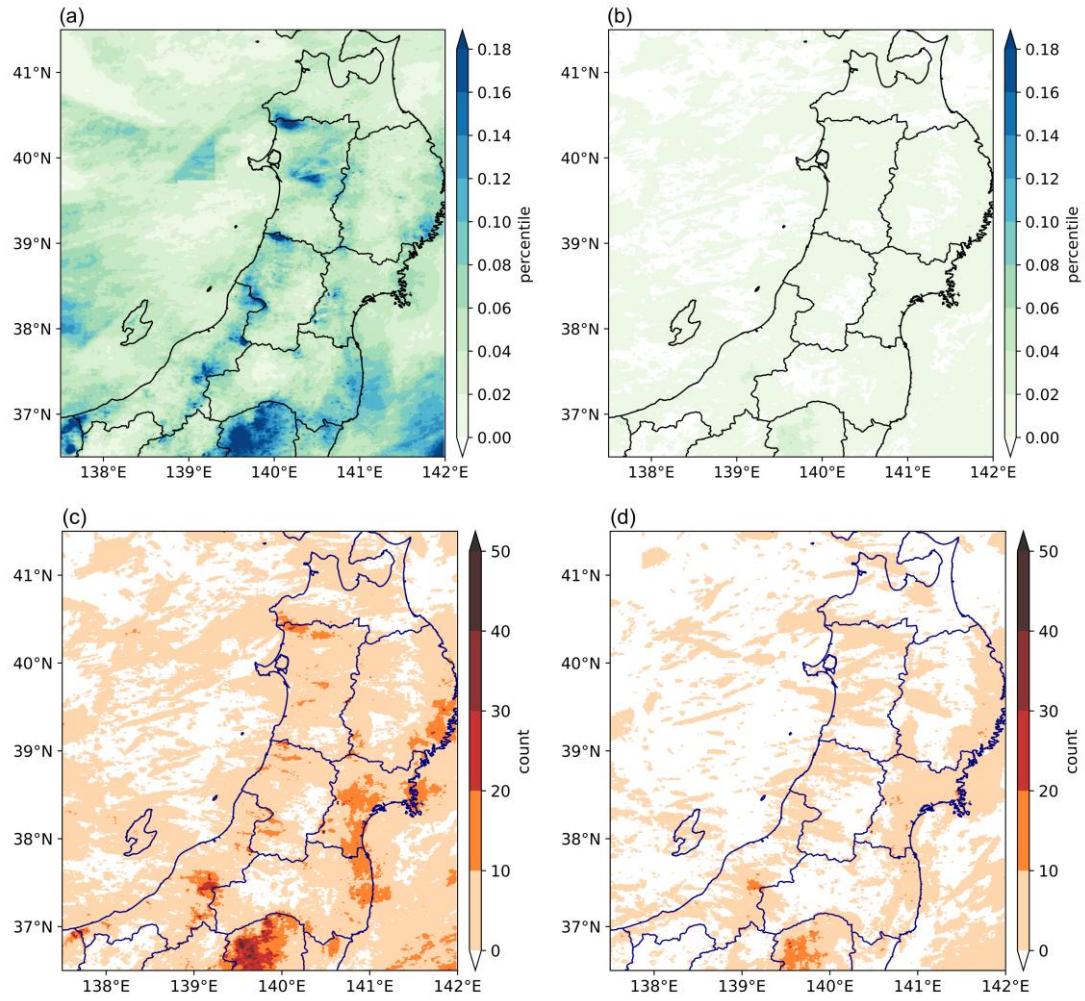
2 **Diversity in the Orientation of Linear-Stationary type Heavy**
3 **Rainfall Events in the Tohoku Region, Japan and Associated**
4 **Synoptic-Scale Atmospheric Circulations**

5



6

1 Fig. S1. Flowchart for the identification of LS-HRAs in the Tohoku region.



2

3 Fig. S2. Frequency of the observation of rainfall with intensities from April to November
4 during the period 2006–2022 of (a) $40 \text{ mm}(3\text{h})^{-1}$ and (b) $80 \text{ mm}(3\text{h})^{-1}$. (c) and (d)
5 Number of observations of $80 \text{ mm}(3\text{h})^{-1}$ and $100 \text{ mm}(3\text{h})^{-1}$ precipitation,
6 respectively.

7

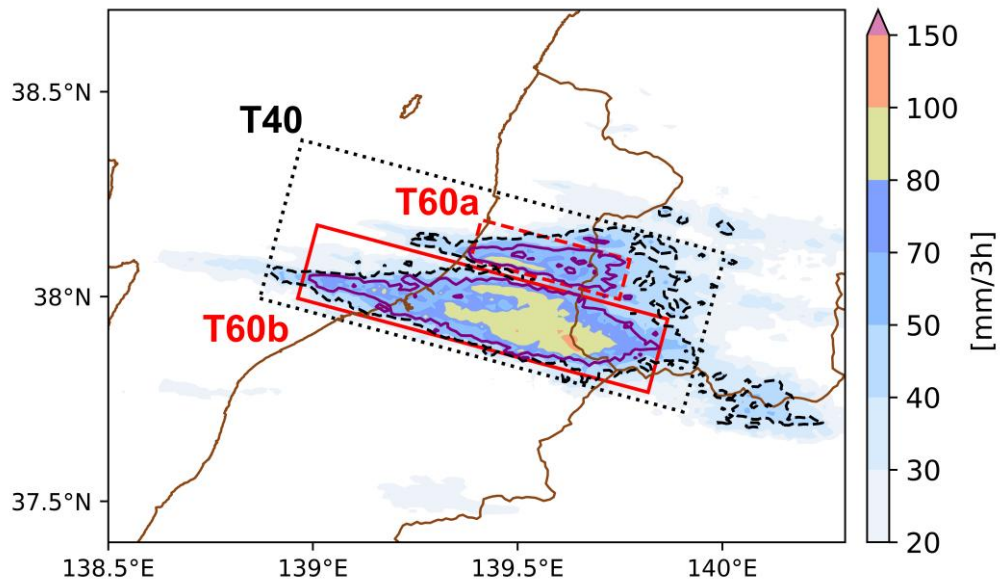


Fig. S3. 3-hour accumulated precipitation between 0400 UTC and 0700 UTC on 27 June 2022. HRAs extracted using threshold values of $40 \text{ mm}(3\text{h})^{-1}$ (T40) and $60 \text{ mm}(3\text{h})^{-1}$ (T60a, T60b). The HRA enclosed by a solid rectangle (T60b) was successfully identified as an LS-HRA, whereas those enclosed by dashed rectangles (T40, T60a) were not identified as LS-HRAs.

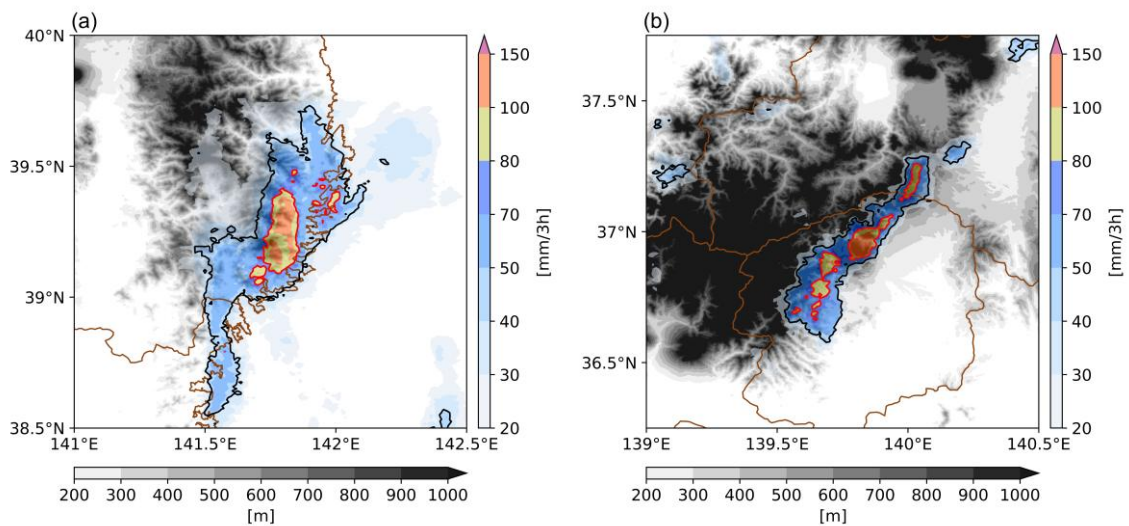


Fig. S4. (a) 3-hour accumulated precipitation between 1500 UTC and 1800 UTC on 27 August 2019 and (b) between 0800 UTC and 1100 UTC on 11 September 2020.

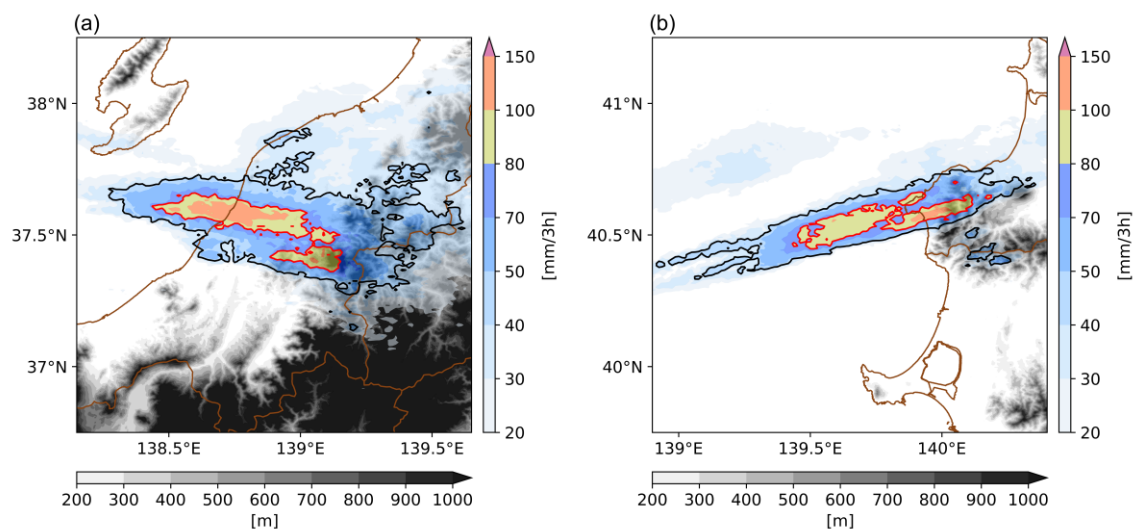
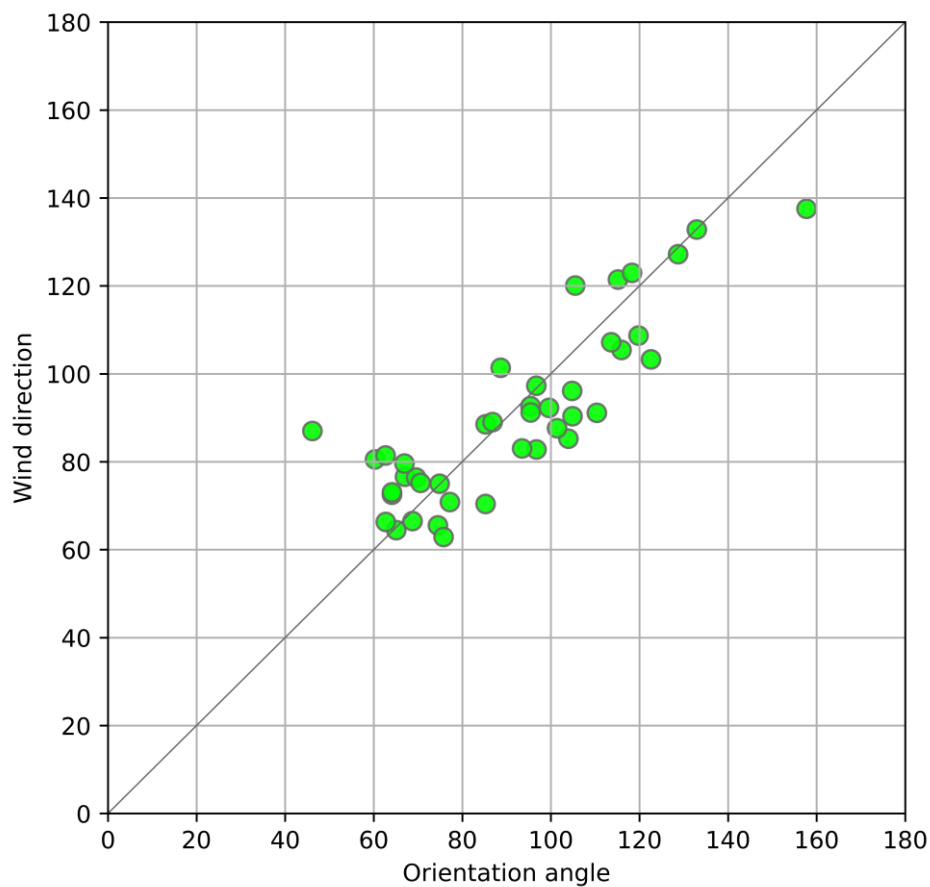


Fig. S5. (a) 3-hour accumulated precipitation between 1400 UTC and 1700 UTC on 31 July 2013 and (b) between 1900 UTC and 2200 UTC on 8 August 2022.



1 Fig. S6. Relationship between the orientation of LS-HRAs classified into SW–NE, W–
2 E, NW–SE types on the Sea of Japan side of the Tohoku region and the average wind
3 direction at 500 hPa in the approximately 300×300 km area surrounding each LS-
4 HRA.

5

6 Table S1. Precipitation threshold, area, and aspect ratio of the LS-HRA candidates shown
7 in Fig. S3. T40 was not extracted as its aspect ratio was below 2.4, and T60a was
8 excluded as it had an area of <400 km².

candidate of LS-HRA	threshold [mm/3h]	area [km ²]	aspect ratio
T40	40	2177	1.9
T60a	60	259	2.6
T60b	60	668	3.4

9