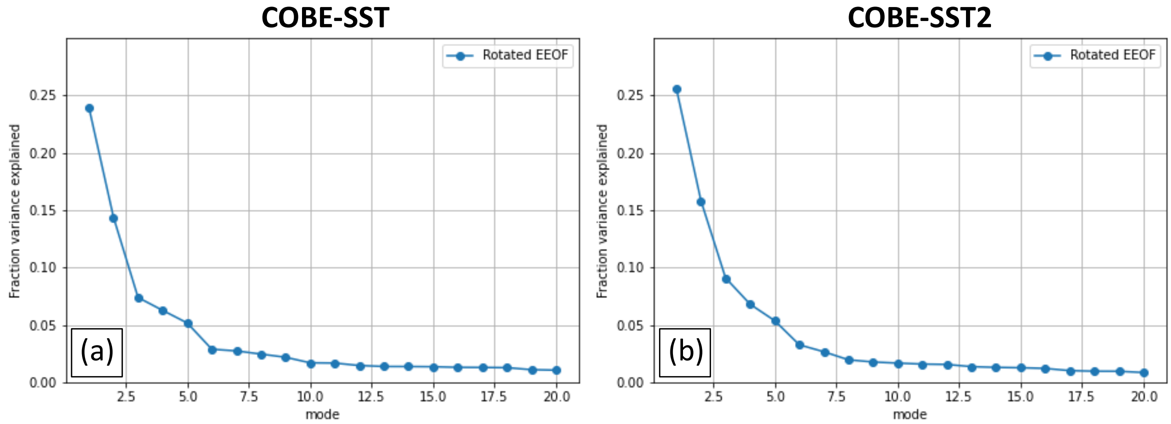
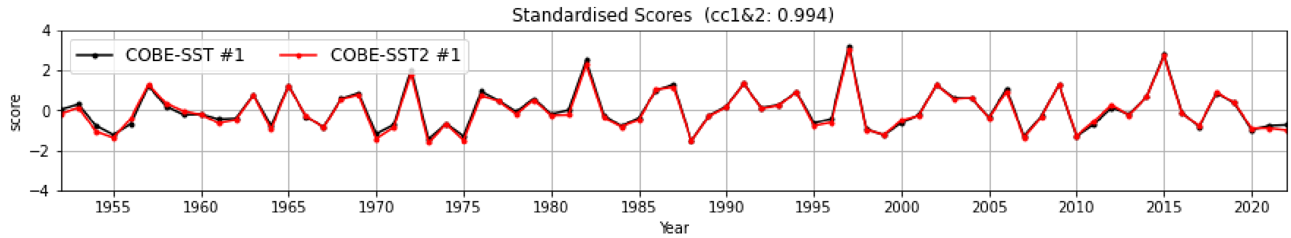
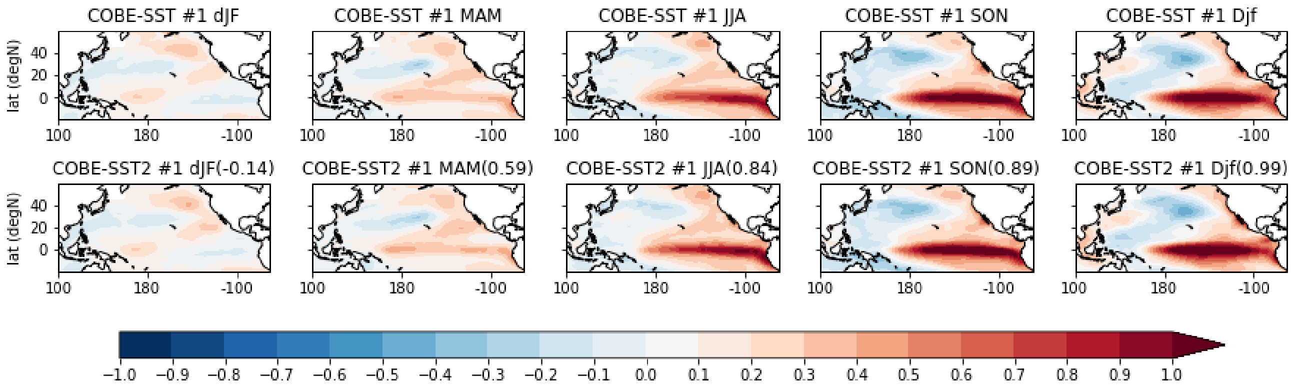
Supplementary Material Section 1



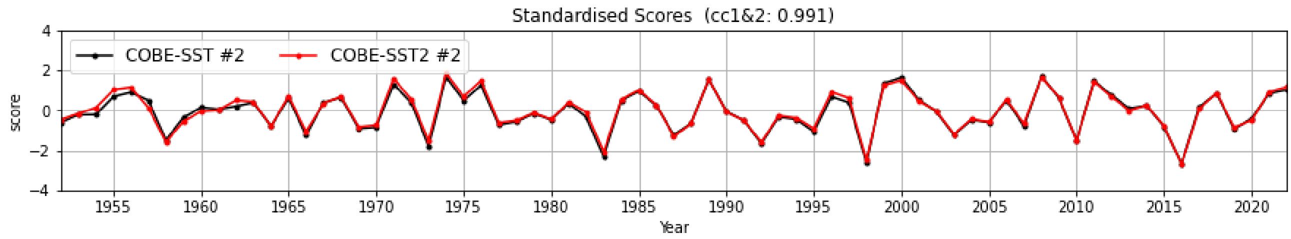
Supplementary Figure S2-0. Comparison of the fractional explained variance by the rotated modes of (a) COBE-SST and (b) COBE-SST2, for the period of 1952–2022.



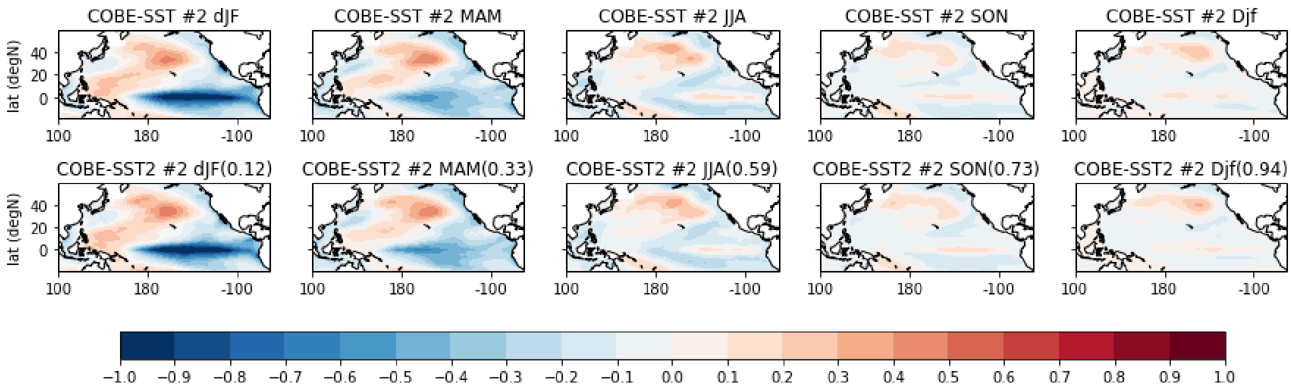
Supplementary Figure S2-1a. Comparison of standardised scores from the **1st** rotated PCA mode of (black line) COBE-SST and (red line) COBE-SST2, for the period of 1952–2022.



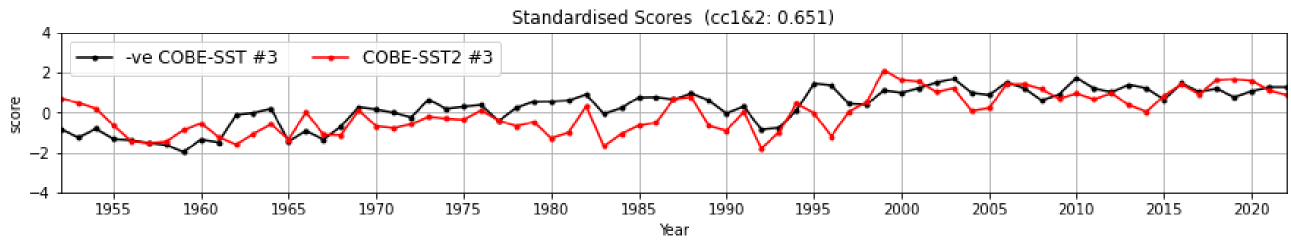
Supplementary Figure S2-1b. Comparison of loadings from the **1st** rotated PCA mode of (top row) COBE-SST and (bottom row) COBE-SST2, for the period of 1952–2022.



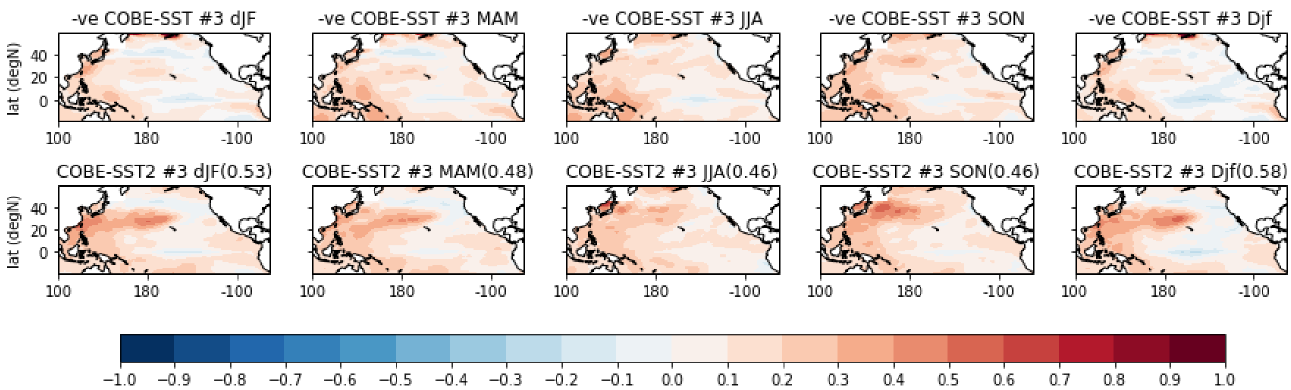
Supplementary Figure S2-2a. Comparison of standardised scores from the **2nd** rotated PCA mode of (black line) COBE-SST and (red line) COBE-SST2, for the period of 1952–2022.



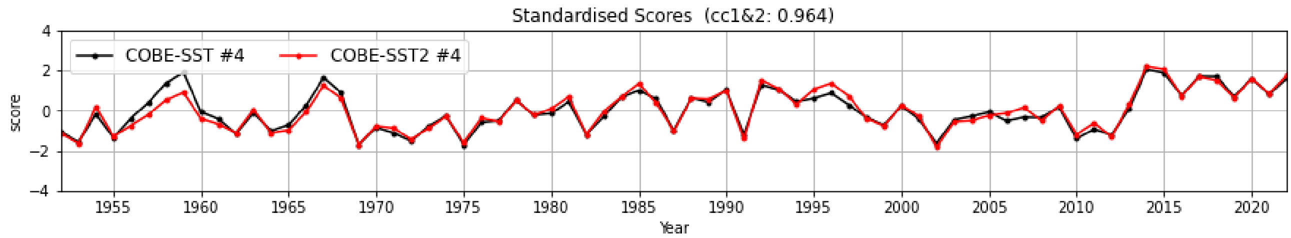
Supplementary Figure S2-2b. Comparison of loadings from the **2nd** rotated PCA mode of (top row) COBE-SST and (bottom row) COBE-SST2, for the period of 1952–2022.



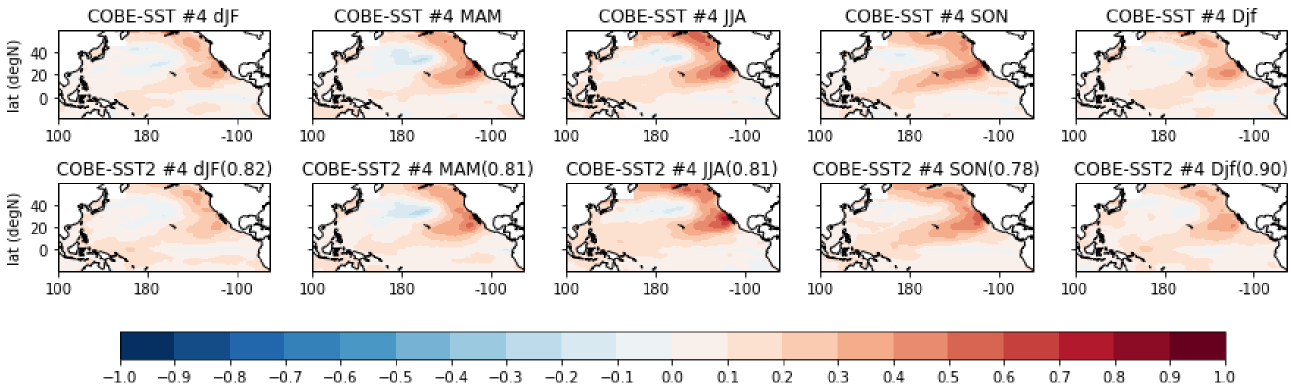
Supplementary Figure S2-3a. Comparison of standardised scores from the **3rd** rotated PCA mode of (black line) COBE-SST and (red line) COBE-SST2, for the period of 1952–2022.



Supplementary Figure S2-3b. Comparison of loadings from the **3rd** rotated PCA mode of (top row) COBE-SST and (bottom row) COBE-SST2, for the period of 1952–2022.



Supplementary Figure S2-4a. Comparison of standardised scores from the **4th** rotated PCA mode of (black line) COBE-SST and (red line) COBE-SST2, for the period of 1952–2022.



Supplementary Figure S2-4b. Comparison of loadings from the **4th** rotated PCA mode of (top row) COBE-SST and (bottom row) COBE-SST2, for the period of 1952–2022.

Supplementary Material Section 2

Supplementary Table S2-1.
Meteorological stations used, in three columns, with names in English and Japanese. Years listed with the shaded station are those with insufficient data and not considered.

Aburatsu	Kure	Sasebo
Akune	Kyoto	Shimizu
Cape Muroto	Maizuru	Shimonoseki
Fukuoka 1953, 1954, 1955	Makurazaki	Shionomisaki 1955, 1956, 1957, 1958
Fukuyama	Matsue	Sukumo
Hagi	Matsuyama	Sumoto
Hamada	Miyakonojo	Tadotsu
Hikone	Miyazaki	Takamatsu
Himeji	Mount Unzen	Tokushima
Hirado	Mt. Aso	Tottori
Hiroshima	Nagasaki	Toyooka
Hita	Nara 1952	Tsu
Hitoyoshi	Oita	Tsuyama
Iizuka	Okayama	Ueno
Kagoshima	Osaka	Ushibuka
Kobe	Owase	Uwajima
Kochi	Sakai	Wakayama
Kumamoto	Saga	Yonago

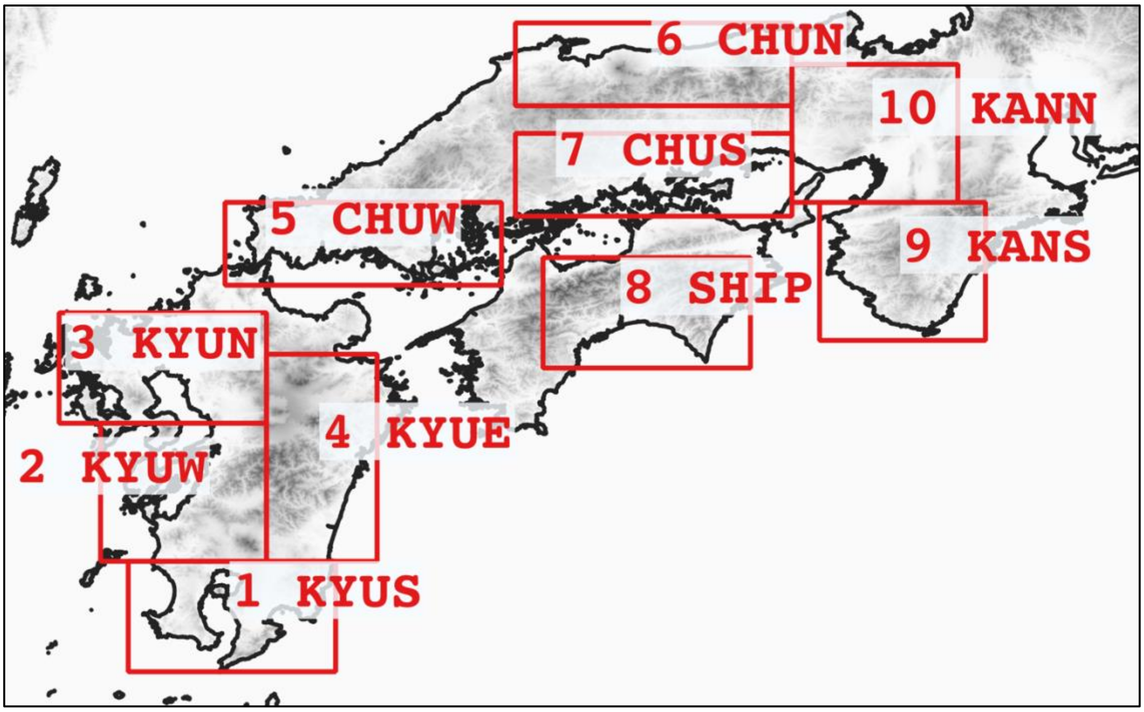
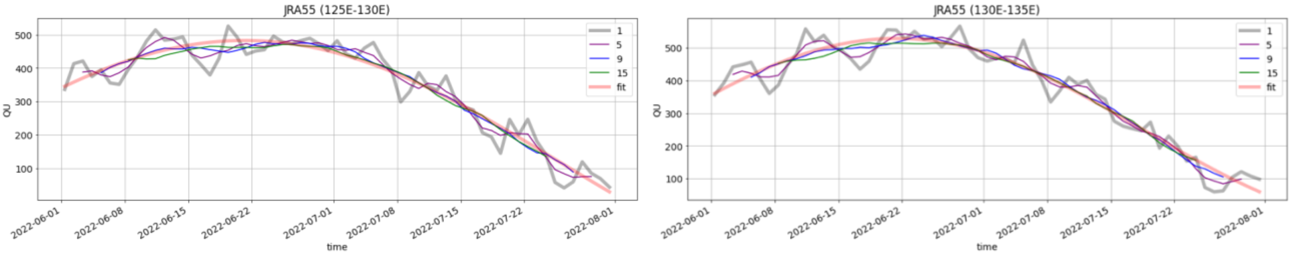
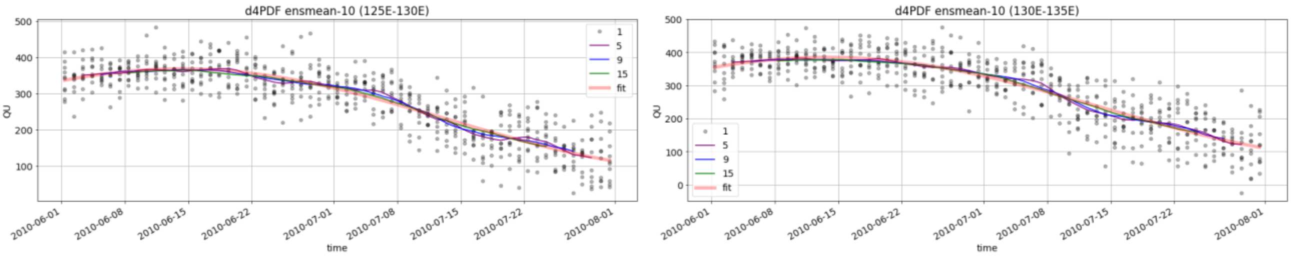


Figure S2-2. The 10 analysis regions defined in Table 1.

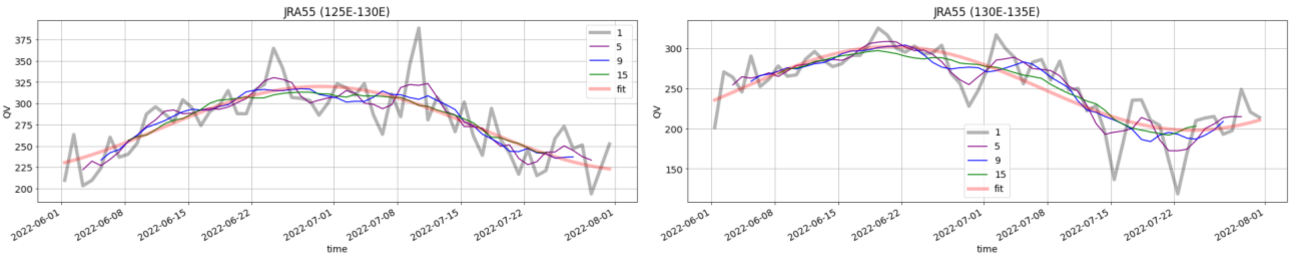
Supplementary Material Section 3



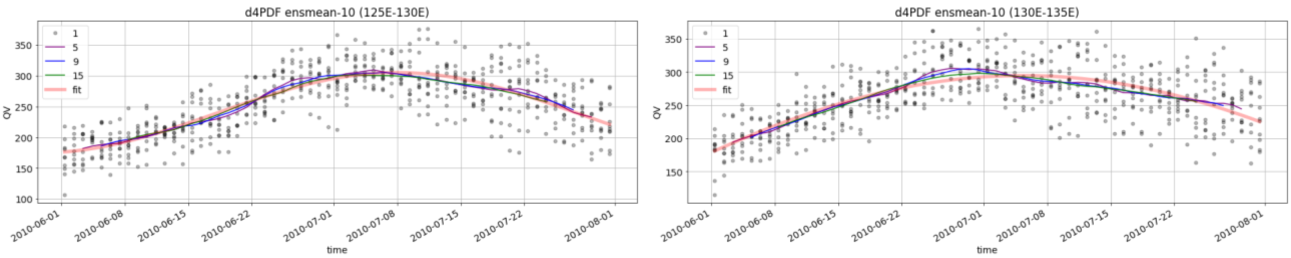
Supplementary Figure S.3.1a. Climatological seasonal cycle of the **zonal water vapour flux of the monsoon jet** in **JRA55** $(QU)_0$ over (left) 125–130 °E and (right) 130–135 °E. Thick grey line shows the daily time series. Purple, blue and green lines show the results after 5-point, 9-point, and 15-point centered running means. Thick red line shows the fit to the logistic equation.



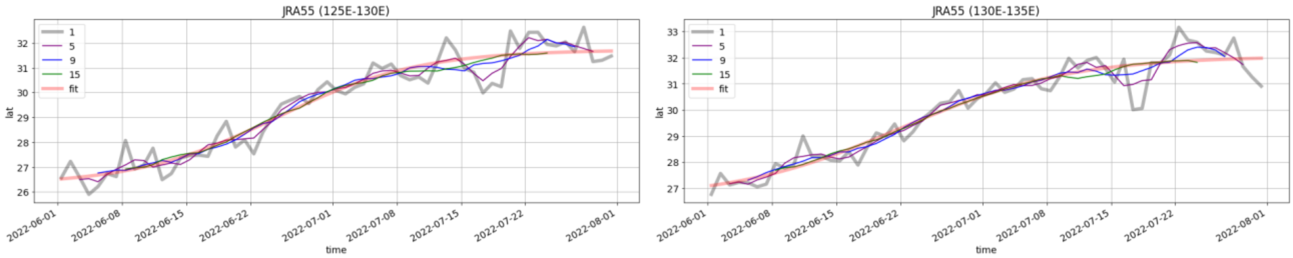
Supplementary Figure S.3.1a. Climatological seasonal cycle of the **zonal water vapour flux of the monsoon jet** in **d4PDF** $(QU)_0$ over (left) 125–130 °E and (right) 130–135 °E. Thick grey line shows the daily time series. Purple, blue and green lines show the results after 5-point, 9-point, and 15-point centered running means. Thick red line shows the fit to the logistic equation.



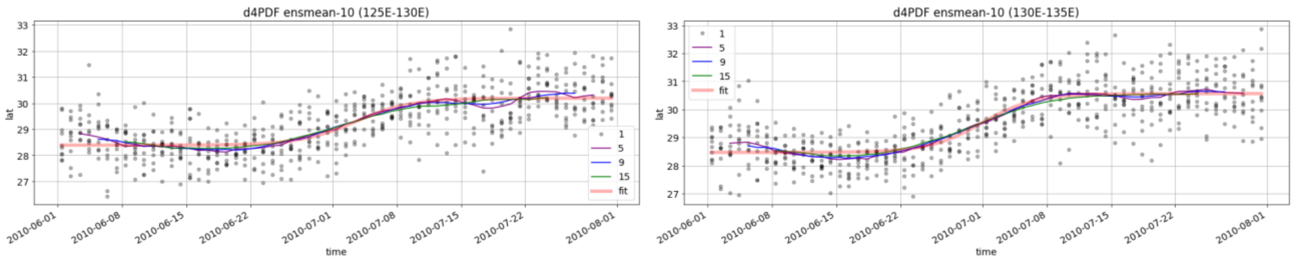
Supplementary Figure S.3.2a. Climatological seasonal cycle of the **meridional water vapour flux of the monsoon jet** in **JRA55** $(QV)_0$ over (left) 125–130 °E and (right) 130–135 °E. Thick grey line shows the daily time series. Purple, blue and green lines show the results after 5-point, 9-point, and 15-point centered running means. Thick red line shows the fit to the logistic equation.



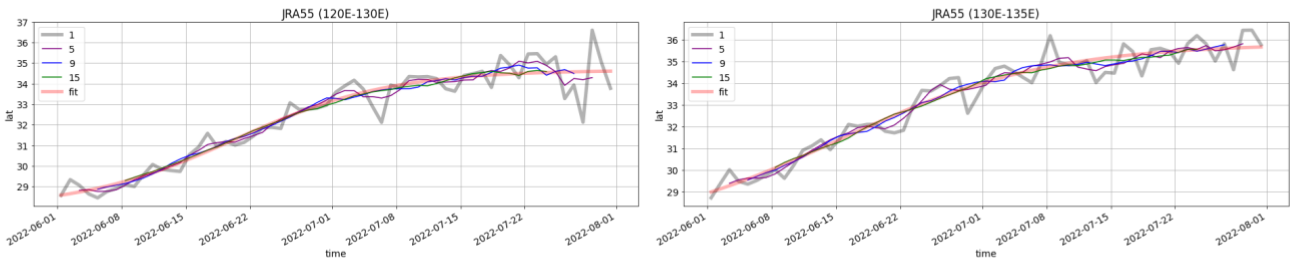
Supplementary Figure S.3.2b. Climatological seasonal cycle of the **meridional water vapour flux of the monsoon jet** in **d4PDF** $(QV)_0$ over (left) 125–130 °E and (right) 130–135 °E. Thick grey line shows the daily time series. Purple, blue and green lines show the results after 5-point, 9-point, and 15-point centered running means. Thick red line shows the fit to the logistic equation.



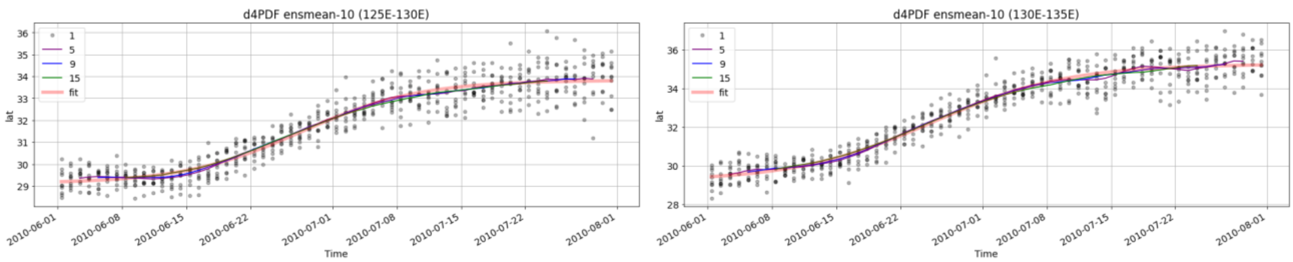
Supplementary Figure S.3.3a. Climatological seasonal cycle of the **latitude of the monsoon jet** in **JRA55** $(JLat)_0$ over (left) 125–130 °E and (right) 130–135 °E. Thick grey line shows the daily time series. Purple, blue and green lines show the results after 5-point, 9-point, and 15-point centered running means. Thick red line shows the fit to the logistic equation.



Supplementary Figure S.3.3b. Climatological seasonal cycle of the **latitude of the monsoon jet** in **d4PDF** $(JLat)_0$ over (left) 125–130 °E and (right) 130–135 °E. Thick grey line shows the daily time series. Purple, blue and green lines show the results after 5-point, 9-point, and 15-point centered running means. Thick red line shows the fit to the logistic equation.

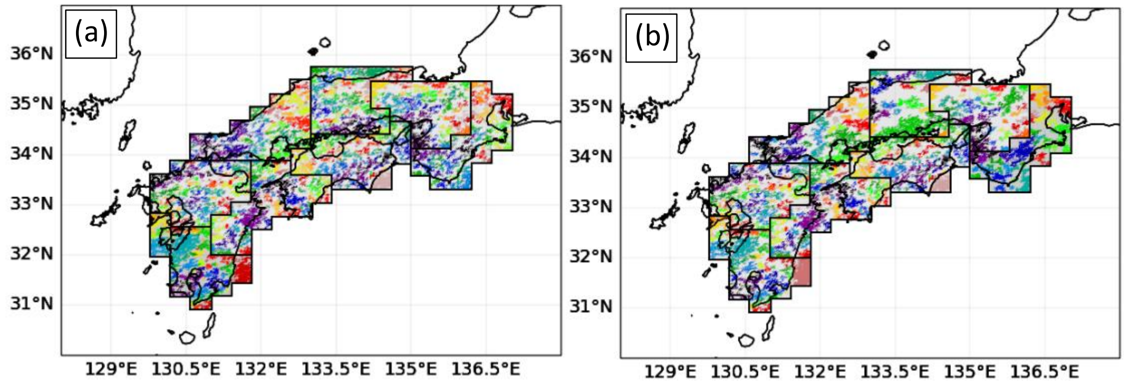


Supplementary Figure S.3.4a. Climatological seasonal cycle of the **latitude of the monsoon front** in **JRA55** $(FLat)_0$ over (left) 125–130 °E and (right) 130–135 °E. Thick grey line shows the daily time series. Purple, blue and green lines show the results after 5-point, 9-point, and 15-point centered running means. Thick red line shows the fit to the logistic equation.

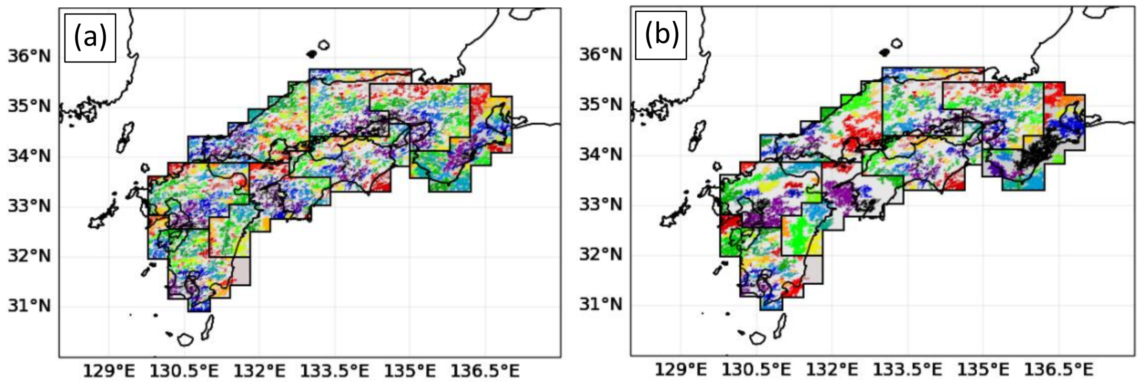


Supplementary Figure S.3.4b. Climatological seasonal cycle of the **latitude of the monsoon front** in **d4PDF** $(FLat)_0$ over (left) 125–130 °E and (right) 130–135 °E. Thick grey line shows the daily time series. Purple, blue and green lines show the results after 5-point, 9-point, and 15-point centered running means. Thick red line shows the fit to the logistic equation.

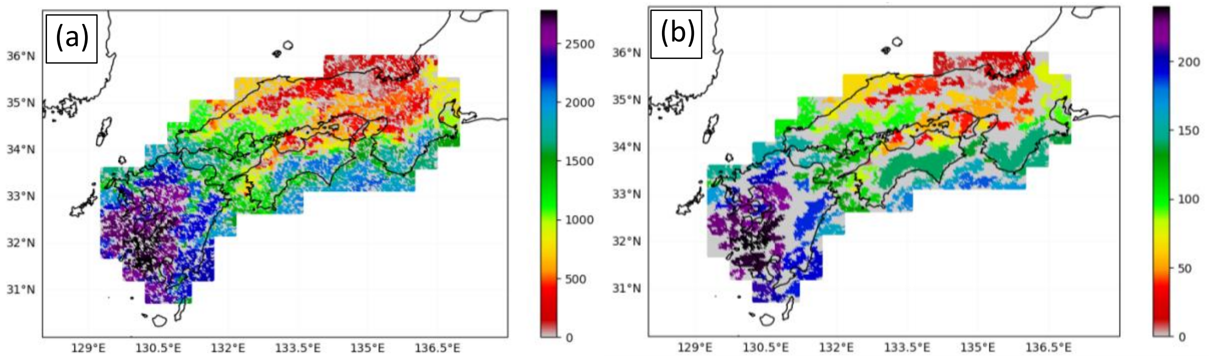
Supplementary Material Section 4



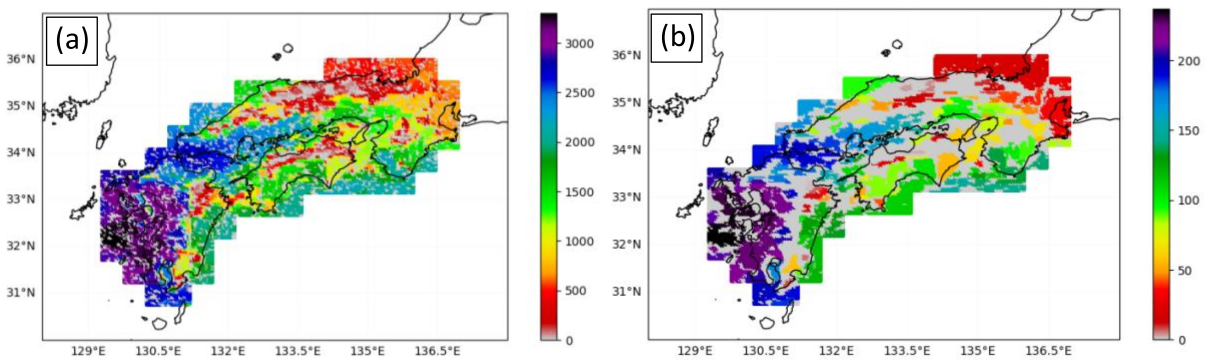
Supplementary Figure S4-1. Labels of clusters based on the time series of annual 99th percentile hourly rainfall from radar-AMeDAS. Colours only reflect the cluster numbering and do not reflect any units or magnitudes. Clustering was done separately on 8 pieces. (a) Using a minimum cluster size of 20. (b) Using different minimum cluster size values for each piece to maximise the clusters. Colorbars are not shown as the total number of clusters differed for each piece.



Supplementary Figure S4-2. Labels of clusters based on the time series of annual 90th percentile daily rainfall from radar-AMeDAS. Colours only reflect the cluster numbering and do not reflect any units or magnitudes. Clustering was done separately on 8 pieces. (a) Using a minimum cluster size of 20. (b) Using different minimum cluster size values for each piece to maximise the clusters. Colorbars are not shown as the total number of clusters differed for each piece.



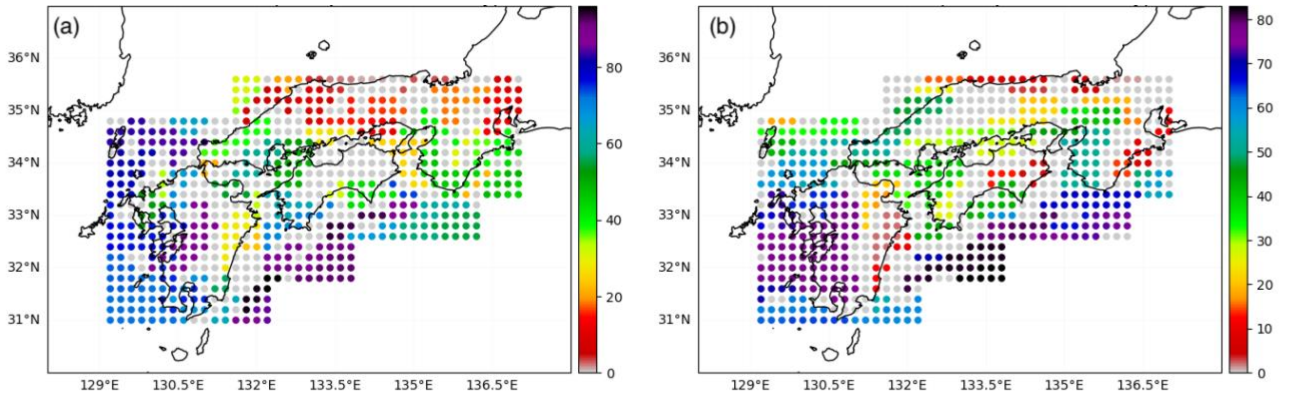
Supplementary Figure S4-3. Labels of clusters based on the time series of annual 99th percentile hourly rainfall from d4PDF. Colours only reflect the cluster numbering and do not reflect any units or magnitudes. Using a minimum cluster size of (a) 3, and (b) 18.



Supplementary Figure S4-4. Labels of clusters based on the time series of annual 90th percentile daily rainfall from d4PDF. Colours only reflect the cluster numbering and do not reflect any units or magnitudes. Using a minimum cluster size of (a) 3, and (b) 18.

Table S3-1. The value of c_{min} used in this study, and the number of clusters in square brackets.

<table>
<tr><th rowspan="3">Piece</th><th colspan="4">c_{min} used for</th></tr>
<tr><th colspan="2">radar-AMeDAS</th><th colspan="2">d4PDF</th></tr>
<tr><th>Ph_{99}</th><th>Pd_{90}</th><th>Ph_{99}</th><th>Pd_{90}</th></tr>
<tr><td>1</td><td>52 [74]</td><td>221 [16]</td><td rowspan="8">18 [240]</td><td rowspan="8">18 [238]
(following Ph_{99})</td></tr>
<tr><td>2</td><td>44 [72]</td><td>37 [118]</td></tr>
<tr><td>3</td><td>116 [25]</td><td>34 [112]</td></tr>
<tr><td>4</td><td>89 [46]</td><td>87 [36]</td></tr>
<tr><td>5</td><td>23 [175]</td><td>31 [128]</td></tr>
<tr><td>6</td><td>24 [179]</td><td>424 [10]</td></tr>
<tr><td>7</td><td>20 [216]</td><td>172 [19]</td></tr>
<tr><td>8</td><td>23 [148]</td><td>37 [94]</td></tr>
</table>

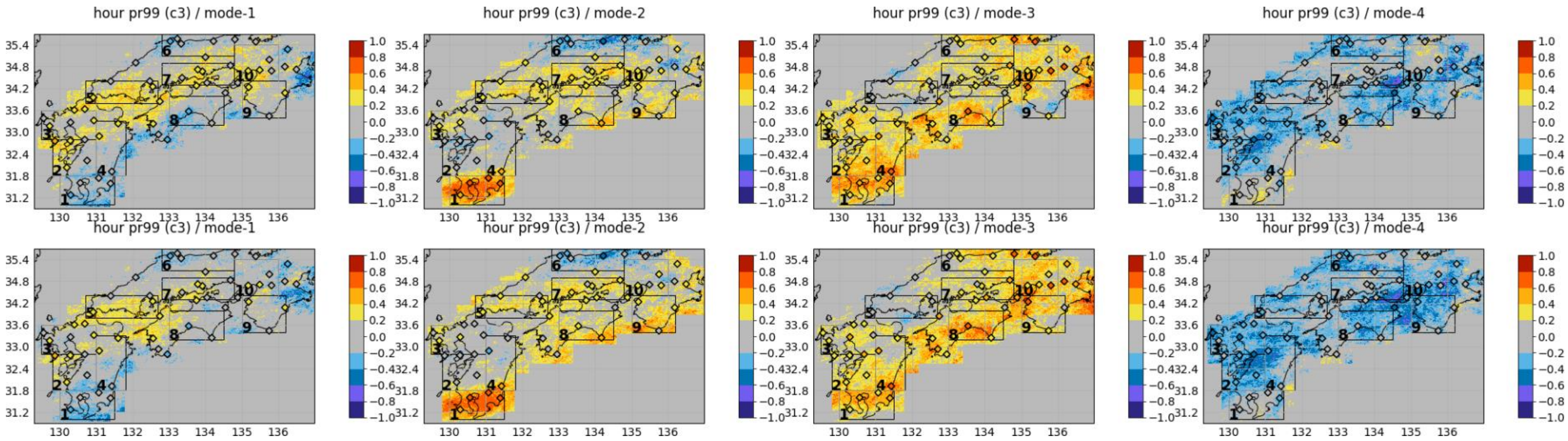


Supplementary Figure S4-5. Labels of clusters using a minimum cluster size of 3, from the 20 km version of d4PDF, based on the 50-member ensemble mean of (a) annual 99th percentile hourly rainfall, (b) annual 90th percentile daily rainfall. Colours only reflect the cluster numbering and do not reflect any units or magnitudes.

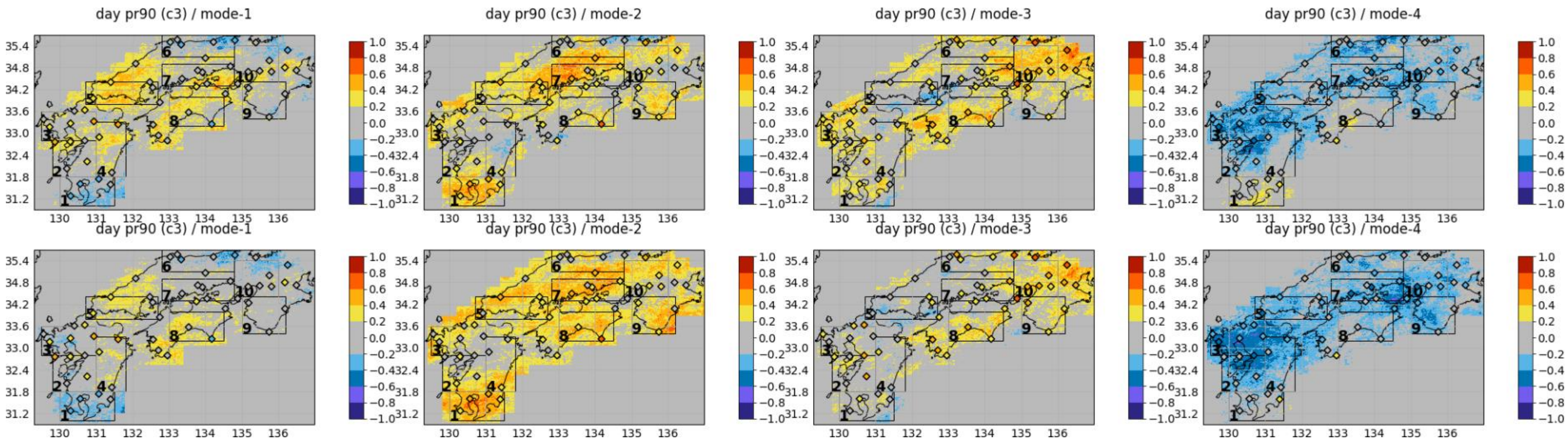
Supplementary Material Section 5

The International Best Track Archive for Climate Stewardship (IBTrACS) is a tropical cyclone (TC) dataset that merges TC information from different meteorological agencies, available from the United States of America National Oceanic and Atmospheric Administration (https://www.ncei.noaa.gov/products/international-best-track-archive). The merged tracks from the Western Pacific subset of IBTrACS Version 4 was used, with 3-hourly resolution.

A day was defined as influenced by tropical cyclones (TC-day) if at any time of the day, the center of a TC was less than 1000 km from the centroid of the smallest circle covering the two regions. This classification attempted to exclude not just direct impacts such as from landfalling TCs, but also indirect impacts such as changes to the regional circulation. Sub-daily classification was not made, so that the same time periods were removed when processing both hourly and daily rainfall. The TC-days were removed, and the remaining days June–July for was 2006–2022 were 58, 58, 57, 59, 60, 53, 50, 52, 50, 49, 59, 59, 44, 49, 61, 51, and 52. Correlations were calculated with and without TC-days.



Supplementary Figure S5-1. Shading shows correlation coefficients (CCs) between the annual 99th percentile hourly rainfall of clusters from radar-AMeDAS, and (columns) the scores of the 5 Pacific SST modes. The minimum cluster size was 3. All grid-points belonging to the same cluster are colored with the same CC. The top row shows CCs using all days. The bottom row shows CCs with TC-days removed. Numbered boxes show the 10 analysis regions defined in Table 1.



Supplementary Figure S5-2. Shading shows correlation coefficients (CCs) between the annual 90th percentile daily rainfall of clusters from radar-AMeDAS, and (columns) the scores of the 5 Pacific SST modes. The minimum cluster size was 3. All grid-points belonging to the same cluster are colored with the same CC. The top row shows CCs using all days. The bottom row shows CCs with TC-days removed. Numbered boxes show the 10 analysis regions defined in Table 1.

Supplementary Material Section 6

Supplementary Table S6-1a. Spearman CCs using the **"sets" method**, between the time series of annual 99th percentile **hourly rainfall** and scores of the Pacific SST modes for the 10 regions defined in Table 1. The CCs are shown using the same colors as Figs 4 and 5. Percentile values were calculated using the "sets" method, where every set of grid-points and timestep is one sample. Under each mode, the 1st sub-column "gauge short" shows CCs calculated from individual gauges for the 2006–2022 period. The 2nd sub-column "radar" shows CCs calculated from radar-AMeDAS for the 2006–2022 short period. The 3rd sub-column "model" shows CCs calculated from d4PDF for the 1952–2010 long period, using the 10-member ensemble mean of extreme values. The 4th sub-column "gauge long" shows CCs calculated from individual gauges for the 1952–2010 period. The values in square brackets at the 2nd column are the CCs using the 99.9th percentile hourly rainfall, used as a robustness check for the value above it. Cells are shaded according to the criteria of Section 2.2.4. Cells are shaded light dots if criteria S1, S2, or L2 are failed. Cells are shaded with heavy dots if criterion L1 in Section 2.2.4 is fulfilled. Cells are shaded with downward hatches (\\\) if criteria S3, S4 or S5 are failed. Cells are shaded with upward hatches (///) if criteria L3, L4 or L5 are failed. Cells are shaded with cross hatches (××) if both downward and upward hatches exist.

99th percentile hourly			mode																			
Sets			ENSO+				ENSO-				Trend+				PDV				ENSO-NC			
region	station		gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long
1 KYUS	Aburatsu	油津	-0.06	-0.16 [-0.26]	0.04	-0.25	**0.61**	**0.72 [0.68]**	**0.47**	0.02	0.44	**0.58 [0.59]**	0.21	0.24	-0.23	0.08 [0.02]	0.11	0.02	0.19	0.16 [0.28]	-0.16	-0.13
	Miyakonojo	都城	-0.12			-0.09	**0.67**			-0.09	0.38			0.22	0.14			-0.13	0.10			-0.15
	Makurazaki	枕崎	-0.23			-0.18	0.43			0.04	0.21			0.19	0.01			-0.08	-0.12			-0.13
	Kagoshima	鹿児島	-0.16			-0.14	**0.71**			-0.01	**0.50**			0.20	0.04			-0.05	0.11			-0.18
2 KYUW	Nagasaki	長崎	0.45	0.11 [-0.12]	0.09	**0.29**	-0.15	0.12 [0.02]	**0.35**	-0.25	0.33	0.41 [0.43]	0.24	0.03	-0.16	-0.41 [-0.31]	0.10	-0.12	-0.10	-0.11 [-0.11]	-0.20	**-0.30**
	Mount Unzen	雲仙岳	0.24			0.19	0.03			-0.16	0.32			0.13	-0.22			-0.09	-0.01			**-0.27**
	Hitoyoshi	人吉	-0.02			0.05	-0.06			-0.14	0.30			0.18	-0.26			-0.07	-0.04			-0.18
	Kumamoto	熊本	0.13			0.22	0.08			-0.17	0.42			0.10	-0.44			-0.16	-0.05			-0.18
	Akune	阿久根	0.22			0.03	0.10			-0.13	0.34			0.04	-0.22			-0.02	0.05			**-0.26**
3 KYUN	Saga	佐賀	-0.03	0.19 [0.05]	0.03	0.19	0.25	0.16 [-0.01]	**0.35**	-0.02	0.41	0.36 [0.32]	0.17	0.15	-0.42	-0.31 [-0.32]	0.08	-0.17	0.01	-0.03 [0.02]	**-0.26**	-0.10
	Sasebo	佐世保	0.21			0.23	0.22			-0.05	0.29			0.16	-0.18			-0.04	0.17			-0.10
	Hirado	平戸	0.13			0.25	0.16			-0.06	0.34			0.14	**-0.51**			0.01	-0.03			-0.06
	Hita	日田	0.20			0.12	-0.13			-0.15	0.09			0.17	-0.30			-0.04	-0.15			-0.12
4 KYUE	Mount Aso	阿蘇山	0.27	-0.06 [0.19]	**0.26**	0.15	-0.29	0.12 [0.05]	0.19	-0.24	**0.58**	**0.52 [0.53]**	0.15	0.17	-0.38	-0.31 [-0.38]	0.08	-0.11	-0.11	0.01 [~]	-0.15	-0.06
	Oita	大分	0.30			0.12	0.12			-0.16	0.27			**0.29**	-0.30			-0.14	-0.13			-0.13
	Miyazaki	宮崎	-0.15			-0.05	0.43			-0.06	**0.60**			**0.34**	-0.11			-0.10	0.38			-0.04
5 CHUW	Kure	呉	0.33	0.29 [0.19]	0.15	0.16	0.37	0.21 [0.22]	**0.32**	-0.17	0.18	0.07 [-0.03]	0.05	0.03	-0.10	-0.20 [-0.28]	0.11	-0.08	**0.50**	0.31 [0.27]	**-0.26**	-0.04
	Hiroshima	広島	0.15			0.13	0.18			-0.10	0.15			~	0.04			-0.12	0.27			~
	Shimonoseki	下関	0.21			0.11	0.22			0.03	0.01			0.09	-0.23			-0.07	-0.01			0.03
	Hagi	萩	0.08			0.20	0.30			-0.15	0.02			-0.01	-0.13			-0.09	**0.53**			-0.14
6 CHUN	Sakai	境	-0.05	-0.04 [-0.08]	**0.35**	0.13	-0.21	-0.12 [-0.29]	**0.29**	-0.06	0.34	0.38 [0.07	0.04	-0.08	-0.30	-0.23 [-0.17]	-0.11	-0.01	0.24	0.39 [0.30]	-0.14	-0.03
	Yonago	米子	-0.02			0.13	-0.16			-0.19	0.22			-0.03	-0.35			-0.06	0.25			-0.08
	Tottori	鳥取	-0.06			0.12	**-0.50**			-0.03	0.31			-0.06	0.11			0.13	-0.03			-0.22
	Matsue	松江	-0.31			0.15	-0.34			-0.01	0.13			-0.09	-0.13			-0.03	0.22			-0.01
7 CHUS	Himeji	姫路	0.06	0.26 [0.23]	**0.47**	-0.09	0.29	0.34 [0.06]	0.21	-0.08	0.45	0.19 [0.24]	0.08	-0.04	-0.16	-0.14 [-0.24]	-0.04	-0.10	0.23	0.38 [-0.04]	-0.13	-0.05
	Okayama	岡山	0.35			0.12	0.37			-0.13	0.31			-0.10	0.12			-0.04	**0.64**			0.03
	Fukuyama	福山	0.15			0.10	0.31			-0.07	0.28			0.01	-0.11			-0.10	0.32			-0.04
	Takamatsu	高松	0.13			0.06	0.33			0.01	0.42			0.21	-0.19			-0.01	**0.48**			-0.01
	Ushibuka	牛深	0.34			0.21	0.03			**-0.32**	0.17			**0.26**	-0.07			-0.09	-0.20			**-0.36**
8 SHIP	Murotomisaki	室戸岬	-0.12	-0.06 [~]	0.22	-0.03	**0.52**	0.22 [~]	0.11	-0.08	0.34	0.40 [0.34]	0.19	0.08	0.05	-0.27 [-0.08]	-0.01	-0.23	0.17	0.12 [-0.15]	-0.23	0.07
	Kochi	高知	-0.29			-0.04	0.21			0.13	**0.62**			0.22	-0.19			-0.11	0.31			-0.03
9 KANS	Owase	尾鷲	0.29	0.20 [0.22]	0.09	~	0.20	0.33 [0.46]	**0.28**	-0.06	-0.03	0.10 [-0.04]	0.12	-0.04	0.13	-0.26 [-0.17]	0.16	-0.07	-0.27	-0.02 [-0.09]	-0.01	-0.01
	Wakayama	和歌山	0.26			-0.13	0.35			0.04	**0.64**			0.09	-0.23			-0.05	0.21			-0.04
	Shionomisaki	潮岬	0.05			0.05	0.13			-0.05	0.33			~	0.10			~	0.40			-0.08
10 KANN	Kyoto	京都	0.05	0.34 [0.06]	**0.35**	0.02	0.20	0.22 [-0.30]	**0.28**	-0.01	0.30	0.41 [0.36]	-0.06	-0.15	0.10	-0.12 [-0.15]	0.10	-0.11	0.17	0.17 [-0.10]	0.01	-0.07
	Osaka	大阪	0.35			-0.06	~			-0.03	0.30			0.04	-0.23			-0.05	0.11			-0.06
	Nara	奈良	0.14			-0.05	0.29			-0.14	**0.60**			-0.11	-0.18			0.06	**0.52**			-0.03
	Kobe	神戸	0.21			-0.18	0.22			0.06	0.27			-0.06	-0.15			0.09	0.21			0.04

Supplementary Table S6-1b. Spearman CCs using the **"box" method**, between the time series of annual 99th percentile **hourly rainfall** and scores of the Pacific SST modes for the 10 regions defined in Table 1. The CCs are shown using the same colors as Figs 4 and 5. Percentile values were calculated using the "sets" method, where every set of grid-points and timestep is one sample. Under each mode, the 1st sub-column "gauge short" shows CCs calculated from individual gauges for the 2006–2022 period. The 2nd sub-column "radar" shows CCs calculated from radar-AMeDAS for the 2006–2022 short period. The 3rd sub-column "model" shows CCs calculated from d4PDF for the 1952–2010 long period, using the 10-member ensemble mean of extreme values. The 4th sub-column "gauge long" shows CCs calculated from individual gauges for the 1952–2010 period. Cells are shaded according to the criteria of Section 2.2.4. Cells are shaded light dots if criteria S1, S2, or L2 are failed. Cells are shaded with heavy dots if criterion L1 in Section 2.2.4 is fulfilled. Cells are shaded with downward hatches (\\\) if criteria S3, S4 or S5 are failed. Cells are shaded with upward hatches (///) if criteria L3, L4 or L5 are failed. Cells are shaded with cross hatches (××) if both downward and upward hatches exist.

99th percentile hourly			mode																			
Box			ENSO+				ENSO-				Trend+				PDV				ENSO-NC			
region	station		gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long
1 KYUS	Aburatsu	油津	-0.06	-0.44	-0.08	-0.25	**0.61**	**0.51**	**0.46**	0.02	0.44	**0.57**	0.08	0.24	-0.23	-0.17	0.20	0.02	0.19	0.19	-0.03	-0.13
	Miyakonojo	都城	-0.12			-0.09	**0.67**			-0.09	0.38			0.22	0.14			-0.13	0.10			-0.15
	Makurazaki	枕崎	-0.23			-0.18	0.43			0.04	0.21			0.19	0.01			-0.08	-0.12			-0.13
	Kagoshima	鹿児島	-0.16			-0.14	**0.71**			-0.01	**0.50**			0.20	0.04			-0.05	0.11			-0.18
2 KYUW	Nagasaki	長崎	0.45	-0.16	-0.18	**0.29**	-0.15	-0.01	**0.29**	-0.25	0.33	0.38	0.16	0.03	-0.16	-0.20	0.11	-0.12	-0.10	-0.07	-0.11	**-0.30**
	Mount Unzen	雲仙岳	0.24			0.19	0.03			-0.16	0.32			0.13	-0.22			-0.09	-0.01			**-0.27**
	Hitoyoshi	人吉	-0.02			0.05	-0.06			-0.14	0.30			0.18	-0.26			-0.07	-0.04			-0.18
	Kumamoto	熊本	0.13			0.22	0.08			-0.17	0.42			0.10	-0.44			-0.16	-0.05			-0.18
	Akune	阿久根	0.22			0.03	0.10			-0.13	0.34			0.04	-0.22			-0.02	0.05			**-0.26**
3 KYUN	Saga	佐賀	-0.03	~	**-0.26**	0.19	0.25	-0.06	0.23	-0.02	0.41	0.37	0.11	0.15	-0.42	-0.43	0.08	-0.17	0.01	-0.04	**-0.27**	-0.10
	Sasebo	佐世保	0.21			0.23	0.22			-0.05	0.29			0.16	-0.18			-0.04	0.17			-0.10
	Hirado	平戸	0.13			0.25	0.16			-0.06	0.34			0.14	**-0.51**			0.01	-0.03			-0.06
	Hita	日田	0.20			0.12	-0.13			-0.15	0.09			0.17	-0.30			-0.04	-0.15			-0.12
4 KYUE	Mount Aso	阿蘇山	0.27	-0.29	-0.15	0.15	-0.29	-0.14	0.06	-0.24	**0.58**	0.48	0.15	0.17	-0.38	-0.39	**0.25**	-0.11	-0.11	-0.12	-0.13	-0.06
	Oita	大分	0.30			0.12	0.12			-0.16	0.27			**0.29**	-0.30			-0.14	-0.13			-0.13
	Miyazaki	宮崎	-0.15			-0.05	0.43			-0.06	**0.60**			**0.34**	-0.11			-0.10	0.38			-0.04
5 CHUW	Kure	呉	0.33	0.15	0.01	0.16	0.37	0.03	0.20	-0.17	0.18	0.04	0.19	0.03	-0.10	-0.43	0.10	-0.08	**0.50**	0.19	-0.16	-0.04
	Hiroshima	広島	0.15			0.13	0.18			-0.10	0.15			~	0.04			-0.12	0.27			~
	Shimonoseki	下関	0.21			0.11	0.22			0.03	0.01			0.09	-0.23			-0.07	-0.01			0.03
	Hagi	萩	0.08			0.20	0.30			-0.15	0.02			-0.01	-0.13			-0.09	**0.53**			-0.14
6 CHUN	Sakai	境	-0.05	-0.20	-0.02	0.13	-0.21	-0.31	0.23	-0.06	0.34	-0.16	-0.02	-0.08	-0.30	-0.14	-0.05	-0.01	0.24	~	-0.10	-0.03
	Yonago	米子	-0.02			0.13	-0.16			-0.19	0.22			-0.03	-0.35			-0.06	0.25			-0.08
	Tottori	鳥取	-0.06			0.12	**-0.50**			-0.03	0.31			-0.06	0.11			0.13	-0.03			-0.22
	Matsue	松江	-0.31			0.15	-0.34			-0.01	0.13			-0.09	-0.13			-0.03	0.22			-0.01
7 CHUS	Himeji	姫路	0.06	0.13	0.19	-0.09	0.29	-0.09	0.08	-0.08	0.45	0.10	-0.11	-0.04	-0.16	-0.29	0.06	-0.10	0.23	-0.26	~	-0.05
	Okayama	岡山	0.35			0.12	0.37			-0.13	0.31			-0.10	0.12			-0.04	**0.64**			0.03
	Fukuyama	福山	0.15			0.10	0.31			-0.07	0.28			0.01	-0.11			-0.10	0.32			-0.04
	Takamatsu	高松	0.13			0.06	0.33			0.01	0.42			0.21	-0.19			-0.01	**0.48**			-0.01
	Ushibuka	牛深	0.34			0.21	0.03			**-0.32**	0.17			**0.26**	-0.07			-0.09	-0.20			**-0.36**
8 SHIP	Murotomisaki	室戸岬	-0.12	0.03	-0.06	-0.03	**0.52**	~	-0.08	-0.08	0.34	**0.71**	**0.25**	0.08	0.05	0.02	-0.01	-0.23	0.17	0.13	~	0.07
	Kochi	高知	-0.29			-0.04	0.21			0.13	**0.62**			0.22	-0.19			-0.11	0.31			-0.03
9 KANS	Owase	尾鷲	0.29	-0.09	-0.02	~	0.20	-0.05	0.06	-0.06	-0.03	0.45	0.15	-0.04	0.13	-0.25	0.07	-0.07	-0.27	0.02	0.02	-0.01
	Wakayama	和歌山	0.26			-0.13	0.35			0.04	**0.64**			0.09	-0.23			-0.05	0.21			-0.04
	Shionomisaki	潮岬	0.05			0.05	0.13			-0.05	0.33			~	0.10			~	0.40			-0.08
10 KANN	Kyoto	京都	0.05	-0.19	0.20	0.02	0.20	**-0.65**	0.11	-0.01	0.30	0.15	-0.07	-0.15	0.10	-0.29	0.10	-0.11	0.17	-0.14	-0.07	-0.07
	Osaka	大阪	0.35			-0.06	~			-0.03	0.30			0.04	-0.23			-0.05	0.11			-0.06
	Nara	奈良	0.14			-0.05	0.29			-0.14	**0.60**			-0.11	-0.18			0.06	**0.52**			-0.03
	Kobe	神戸	0.21			-0.18	0.22			0.06	0.27			-0.06	-0.15			0.09	0.21			0.04

Supplementary Table S6-2a. Spearman CCs using the **"sets" method**, between the time series of annual 90th percentile **daily rainfall** and scores of the Pacific SST modes for the 10 regions defined in Table 1. The CCs are shown using the same colors as Figs 4 and 5. Percentile values were calculated using the "sets" method, where every set of grid-points and timestep is one sample. Under each mode, the 1st sub-column "gauge short" shows CCs calculated from individual gauges for the 2006–2022 period. The 2nd sub-column "radar" shows CCs calculated from radar-AMeDAS for the 2006–2022 short period. The 3rd sub-column "model" shows CCs calculated from d4PDF for the 1952–2010 long period, using the 10-member ensemble mean of extreme values. The 4th sub-column "gauge long" shows CCs calculated from individual gauges for the 1952–2010 period. The values in square brackets at the 2nd column are the CCs using the 99.9th percentile hourly rainfall, used as a robustness check for the value above it. Cells are shaded according to the criteria of Section 2.2.4. Cells are shaded light dots if criteria S1, S2, or L2 are failed. Cells are shaded with heavy dots if criterion L1 in Section 2.2.4 is fulfilled. Cells are shaded with downward hatches (\\\) if criteria S3, S4 or S5 are failed. Cells are shaded with upward hatches (///) if criteria L3, L4 or L5 are failed. Cells are shaded with cross hatches (××) if both downward and upward hatches exist.

90th percentile daily			mode																			
Sets			ENSO+				ENSO-				Trend+				PDV				ENSO-NC			
region	station		gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long
1 KYUS	Aburatsu	油津	0.03	-0.09 [-0.16]	-0.01	-0.29	0.39	0.5 [0.74]	0.49	0.06	0.08	0.19 [0.49]	0.12	0.02	0.33	0.15 [0.21]	0.19	-0.11	0.08	-0.08 [0.24]	-0.05	-0.02
	Miyakonojo	都城	-0.25			-0.11	0.45			0.01	-0.01			0.12	0.07			-0.25	-0.11			-0.02
	Makurazaki	枕崎	-0.36			-0.02	0.38			0.10	0.16			0.18	0.07			-0.22	-0.30			-0.11
	Kagoshima	鹿児島	-0.28			-0.10	0.52			0.14	0.23			0.13	0.02			-0.24	-0.04			-0.07
2 KYUW	Nagasaki	長崎	0.49	0.09 [0.22]	0.02	0.26	0.18	0.14 [-0.16]	0.41	-0.20	0.23	0.10 [0.39]	0.18	0.11	0.04	-0.28 [-0.22]	0.03	-0.20	-0.04	-0.27 [-0.08]	-0.26	-0.33
	Mount Unzen	雲仙岳	0.33			0.20	0.22			-0.19	0.06			0.15	-0.12			-0.12	-0.24			-0.31
	Hitoyoshi	人吉	0.21			~	0.11			-0.17	0.47			0.10	-0.12			-0.15	0.14			-0.15
	Kumamoto	熊本	0.01			0.11	0.03			-0.13	0.44			0.29	-0.54			-0.16	-0.10			-0.22
	Akune	阿久根	0.17			-0.01	0.25			-0.09	0.18			0.14	-0.07			-0.13	-0.03			-0.17
3 KYUN	Saga	佐賀	0.31	0.15 [0.11]	0.01	0.24	-0.07	0.14 [-0.05]	0.33	-0.22	0.09	0.23 [0.17]	0.10	0.08	-0.40	-0.51 [-0.23]	0.02	-0.17	-0.27	-0.13 [0.04]	-0.30	-0.23
	Sasebo	佐世保	0.22			0.27	0.16			-0.08	0.15			0.07	-0.43			-0.05	-0.11			-0.22
	Hirado	平戸	0.17			0.27	0.13			-0.19	0.23			0.03	-0.38			-0.06	-0.19			-0.15
	Hita	日田	0.41			0.26	0.09			-0.11	0.07			0.03	-0.24			-0.08	-0.23			-0.07
4 KYUE	Mount Aso	阿蘇山	0.34	0.21 [0.10]	0.07	0.21	0.08	0.11 [-0.05]	0.17	-0.16	0.31	0.08 [0.58]	0.13	0.22	-0.18	-0.12 [-0.21]	0.21	-0.16	-0.02	-0.26 [0.08]	-0.13	-0.20
	Oita	大分	0.46			0.16	0.05			-0.07	0.15			0.18	-0.24			-0.21	-0.14			-0.08
	Miyazaki	宮崎	-0.04			-0.04	0.23			0.06	0.12			0.23	0.06			-0.19	0.37			0.01
5 CHUW	Kure	呉	0.10	0.38 [0.22]	0.05	0.13	0.30	0.23 [0.22]	0.34	-0.19	0.23	0.04 [0.19]	-0.03	0.10	-0.36	-0.25 [-0.11]	0.11	-0.09	0.43	0.01 [0.43]	-0.25	-0.19
	Hiroshima	広島	0.14			0.12	0.35			-0.04	0.24			0.03	-0.20			-0.10	0.24			-0.10
	Shimonoseki	下関	0.22			0.17	0.09			-0.03	-0.05			0.06	-0.46			-0.07	0.15			-0.04
	Hagi	萩	0.31			0.19	0.40			-0.16	0.08			0.01	-0.39			-0.07	0.34			-0.16
6 CHUN	Sakai	境	-0.20	0.01 [0.09]	0.14	0.17	0.19	0.21 [-0.27]	0.31	0.01	0.44	0.21 [0.31]	-0.01	-0.10	-0.10	-0.29 [-0.16]	-0.03	-0.02	0.23	0.30 [0.42]	-0.03	-0.10
	Yonago	米子	-0.27			0.14	-0.01			-0.04	0.36			-0.08	-0.22			-0.05	0.23			-0.15
	Tottori	鳥取	-0.04			0.01	0.19			-0.12	0.38			~	-0.01			-0.03	0.10			-0.18
	Matsue	松江	-0.16			0.08	-0.04			0.02	0.06			-0.10	-0.03			~	0.31			-0.04
7 CHUS	Himeji	姫路	0.01	0.29 [0.17]	0.19	-0.18	0.30	0.47 [0.08]	0.26	-0.03	0.59	0.29 [0.15]	-0.03	-0.07	-0.26	-0.26 [0.07]	0.04	-0.10	0.34	0.19 [0.32]	-0.12	0.06
	Okayama	岡山	0.03			0.08	0.33			-0.03	0.33			0.14	-0.44			-0.15	0.21			~
	Fukuyama	福山	-0.15			0.07	0.50			-0.10	0.23			0.09	-0.49			-0.18	0.23			-0.10
	Takamatsu	高松	0.11			0.07	0.22			-0.14	0.32			0.06	-0.19			-0.05	0.01			0.07
	Ushibuka	牛深	0.19			0.11	0.07			-0.19	0.07			0.16	-0.04			-0.13	-0.19			-0.23
8 SHIP	Murotomisaki	室戸岬	-0.35	0.22 [-0.27]	0.12	-0.10	0.63	0.18 [0.07]	0.09	-0.09	0.28	0.36 [0.14]	0.15	0.15	-0.03	0.02 [-0.11]	0.16	-0.24	0.16	0.14 [0.04]	-0.06	-0.14
	Kochi	高知	0.15			0.04	0.25			0.03	0.50			0.10	0.12			-0.24	0.18			-0.14
9 KANS	Owase	尾鷲	0.05	0.12 [0.02]	0.11	-0.12	0.19	0.33 [0.26]	0.33	-0.03	0.28	0.20 [-0.02]	-0.01	0.03	0.07	-0.30 [-0.17]	0.21	-0.06	-0.16	0.02 [0.09]	-0.02	0.03
	Wakayama	和歌山	0.06			-0.14	0.22			-0.08	0.49			0.08	-0.40			-0.15	-0.08			0.03
	Shionomisaki	潮岬	-0.09			0.05	0.26			0.01	0.24			0.25	-0.10			~	0.29			0.01
10 KANN	Kyoto	京都	0.10	0.09 [0.24]	0.21	0.01	0.29	0.16 [-0.17]	0.35	-0.04	0.42	0.40 [0.11]	-0.11	-0.15	-0.07	-0.24 [-0.13]	0.16	-0.08	0.12	0.14 [0.14]	0.10	-0.10
	Osaka	大阪	0.03			-0.13	0.30			-0.21	0.49			~	-0.17			-0.04	0.04			-0.07
	Nara	奈良	0.11			~	0.23			-0.18	0.36			-0.03	-0.27			-0.03	0.05			-0.16
	Kobe	神戸	0.05			-0.14	0.19			-0.08	0.49			-0.04	-0.43			-0.13	0.03			0.02

Supplementary Table S6-2b. Spearman CCs using the **“box” method**, between the time series of annual 99th percentile **daily rainfall** and scores of the Pacific SST modes for the 10 regions defined in Table 1. The CCs are shown using the same colors as Figs 4 and 5. Percentile values were calculated using the "sets" method, where every set of grid-points and timestep is one sample. Under each mode, the 1st sub-column “gauge short” shows CCs calculated from individual gauges for the 2006–2022 period. The 2nd sub-column “radar” shows CCs calculated from radar-AMeDAS for the 2006–2022 short period. The 3rd sub-column “model” shows CCs calculated from d4PDF for the 1952–2010 long period, using the 10-member ensemble mean of extreme values. The 4th sub-column “gauge long” shows CCs calculated from individual gauges for the 1952–2010 period. Cells are shaded according to the criteria of Section 2.2.4. Cells are shaded light dots if criteria S1, S2, or L2 are failed. Cells are shaded with heavy dots if criterion L1 in Section 2.2.4 is fulfilled. Cells are shaded with downward hatches (\\\) if criteria S3, S4 or S5 are failed. Cells are shaded with upward hatches (///) if criteria L3, L4 or L5 are failed. Cells are shaded with cross hatches (××) if both downward and upward hatches exist.

90th percentile daily			mode																			
Sets			ENSO+				ENSO-				Trend+				PDV				ENSO-NC			
region	station		gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long	gauge short	radar	model	gauge long
1 KYUS	Aburatsu	油津	0.03	-0.19	-0.14	-0.29	0.39	0.31	**0.31**	0.06	0.08	0.33	0.08	0.02	0.33	-0.07	0.15	-0.11	0.08	0.01	-0.16	-0.02
	Miyakonojo	都城	-0.25			-0.11	0.45			0.01	-0.01			0.12	0.07			-0.25	-0.11			-0.02
	Makurazaki	枕崎	-0.36			-0.02	0.38			0.10	0.16			0.18	0.07			-0.22	-0.30			-0.11
	Kagoshima	鹿児島	-0.28			-0.10	**0.52**			0.14	0.23			0.13	0.02			-0.24	-0.04			-0.07
2 KYUW	Nagasaki	長崎	**0.49**	0.14	-0.11	0.26	0.18	0.21	**0.26**	-0.20	0.23	0.24	0.24	0.11	0.04	-0.16	0.08	-0.20	-0.04	0.08	-0.22	**-0.33**
	Mount Unzen	雲仙岳	0.33			0.20	0.22			-0.19	0.06			0.15	-0.12			-0.12	-0.24			**-0.31**
	Hitoyoshi	人吉	0.21			~	0.11			-0.17	0.47			0.10	-0.12			-0.15	0.14			-0.15
	Kumamoto	熊本	0.01			0.11	0.03			-0.13	0.44			**0.29**	**-0.54**			-0.16	-0.10			-0.22
	Akune	阿久根	0.17			-0.01	0.25			-0.09	0.18			0.14	-0.07			-0.13	-0.03			-0.17
3 KYUN	Saga	佐賀	0.31	0.02	-0.16	0.24	-0.07	0.11	**0.27**	-0.22	0.09	0.26	0.15	0.08	-0.40	**-0.54**	0.02	-0.17	-0.27	-0.11	**-0.33**	-0.23
	Sasebo	佐世保	0.22			**0.27**	0.16			-0.08	0.15			0.07	-0.43			-0.05	-0.11			-0.22
	Hirado	平戸	0.17			**0.27**	0.13			-0.19	0.23			0.03	-0.38			-0.06	-0.19			-0.15
	Hita	日田	0.41			**0.26**	0.09			-0.11	0.07			0.03	-0.24			-0.08	-0.23			-0.07
4 KYUE	Mount Aso	阿蘇山	0.34	0.09	-0.01	0.21	0.08	0.19	0.09	-0.16	0.31	0.38	0.09	0.22	-0.18	-0.21	0.21	-0.16	-0.02	0.14	-0.11	-0.20
	Oita	大分	0.46			0.16	0.05			-0.07	0.15			0.18	-0.24			-0.21	-0.14			-0.08
	Miyazaki	宮崎	-0.04			-0.04	0.23			0.06	0.12			0.23	0.06			-0.19	0.37			0.01
5 CHUW	Kure	呉	0.10	0.39	-0.07	0.13	0.30	0.29	**0.26**	-0.19	0.23	-0.04	~	0.10	-0.36	-0.08	0.07	-0.09	0.43	0.20	-0.23	-0.19
	Hiroshima	広島	0.14			0.12	0.35			-0.04	0.24			0.03	-0.20			-0.10	0.24			-0.10
	Shimonoseki	下関	0.22			0.17	0.09			-0.03	-0.05			0.06	-0.46			-0.07	0.15			-0.04
	Hagi	萩	0.31			0.19	0.40			-0.16	0.08			0.01	-0.39			-0.07	0.34			-0.16
6 CHUN	Sakai	境	-0.20	-0.14	0.18	0.17	0.19	-0.10	0.24	0.01	0.44	0.01	-0.12	-0.10	-0.10	-0.29	-0.07	-0.02	0.23	0.16	-0.09	-0.10
	Yonago	米子	-0.27			0.14	-0.01			-0.04	0.36			-0.08	-0.22			-0.05	0.23			-0.15
	Tottori	鳥取	-0.04			0.01	0.19			-0.12	0.38			~	-0.01			-0.03	0.10			-0.18
	Matsue	松江	-0.16			0.08	-0.04			0.02	0.06			-0.10	-0.03			~	0.31			-0.04
7 CHUS	Himeji	姫路	0.01	-0.05	0.16	-0.18	0.30	0.30	0.10	-0.03	**0.59**	0.28	-0.10	-0.07	-0.26	-0.12	0.19	-0.10	0.34	0.40	0.03	0.06
	Okayama	岡山	0.03			0.08	0.33			-0.03	0.33			0.14	-0.44			-0.15	0.21			~
	Fukuyama	福山	-0.15			0.07	**0.50**			-0.10	0.23			0.09	-0.49			-0.18	0.23			-0.10
	Takamatsu	高松	0.11			0.07	0.22			-0.14	0.32			0.06	-0.19			-0.05	0.01			0.07
	Ushibuka	牛深	0.19			0.11	0.07			-0.19	0.07			0.16	-0.04			-0.13	-0.19			-0.23
8 SHIP	Murotomisaki	室戸岬	-0.35	0.17	-0.09	-0.10	**0.63**	0.06	~	-0.09	0.28	**0.68**	0.08	0.15	-0.03	0.03	0.07	-0.24	0.16	0.19	0.06	-0.14
	Kochi	高知	0.15			0.04	0.25			0.03	**0.50**			0.10	0.12			-0.24	0.18			-0.14
9 KANS	Owase	尾鷲	0.05	0.21	0.04	-0.12	0.19	0.23	0.06	-0.03	0.28	**0.49**	0.04	0.03	0.07	-0.08	0.03	-0.06	-0.16	0.44	-0.01	0.03
	Wakayama	和歌山	0.06			-0.14	0.22			-0.08	**0.49**			0.08	-0.40			-0.15	-0.08			0.03
	Shionomisaki	潮岬	-0.09			0.05	0.26			0.01	0.24			0.25	-0.10			~	0.29			0.01
10 KANN	Kyoto	京都	0.10	-0.18	-0.02	0.01	0.29	-0.16	0.09	-0.04	0.42	0.38	**-0.26**	-0.15	-0.07	-0.33	0.08	-0.08	0.12	0.07	0.03	-0.10
	Osaka	大阪	0.03			-0.13	0.30			-0.21	**0.49**			~	-0.17			-0.04	0.04			-0.07
	Nara	奈良	0.11			~	0.23			-0.18	0.36			-0.03	-0.27			-0.03	0.05			-0.16
	Kobe	神戸	0.05			-0.14	0.19			-0.08	**0.49**			-0.04	-0.43			-0.13	0.03			0.02

Supplementary Material Section 7

Supplementary Table S7.1a. Strength of Spearman CCs between rainfall extremes in the 10 analysis regions (rows) and indices describing the monsoon front (columns). The CCs are shown using the same colors as Figs 4 and 5. The indices are for monsoon jet zonal water vapour flux anomaly μ_{JQU}, monsoon jet meridional water vapour flux anomaly μ_{JQV}, and monsoon jet water vapour flux variance $\sigma_{JQ(U,V)}$. For each index, sub-columns are for seasonal 99th percentile hourly rainfall and 90th percentile daily rainfall. For each time resolution, CCs are shown for both the short-period (SO) of 2006–2022 and the long-period (LO) of 2058–2010. Bold font indicates statistical significance at α=0.05.

			West (125-130 °E)											
			QU anomaly				QV anomaly				Q(U,V) variance			
			hour		day		hour		day		hour		day	
region	station		SO	LO	SO	LO	SO	LO	SO	LO	SO	LO	SO	LO
1 KYUS	Aburatsu	油津	**0.65**	**0.41**	0.40	**0.48**	0.31	-0.07	0.43	0.05	-0.35	**-0.37**	-0.19	**-0.41**
	Miyakonojo	都城		**0.43**		**0.45**		-0.06		0.03		-0.22		-0.24
	Makurazaki	枕崎		**0.53**		**0.51**		-0.04		0.13		**-0.37**		**-0.38**
	Kagoshima	鹿児島		**0.52**		**0.58**		-0.04		0.14		**-0.39**		**-0.30**
2 KYUW	Nagasaki	長崎	0.12	0.13	0.20	0.26	**0.67**	0.09	**0.70**	0.16	-0.02	-0.04	-0.04	-0.12
	Mount Unzen	雲仙岳		0.22		0.21		-0.05		0.08		-0.02		-0.03
	Hitoyoshi	人吉		**0.38**		**0.48**		0.08		0.10		-0.24		**-0.31**
	Kumamoto	熊本		0.24		**0.37**		0.16		0.08		-0.13		-0.21
	Akune	阿久根		**0.28**		**0.36**		0.03		0.05		-0.22		-0.24
3 KYUN	Saga	佐賀	0.24	0.21	0.13	0.15	**0.48**	0.19	**0.74**	0.20	-0.10	-0.12	-0.09	-0.06
	Sasebo	佐世保		0.03		0.20		0.23		**0.29**		0.00		-0.12
	Hirado	平戸		0.07		0.11		0.08		0.21		-0.01		-0.03
	Hita	日田		0.16		0.26		0.13		0.08		-0.10		-0.13
4 KYUE	Mount Aso	阿蘇山	0.15	0.21	0.05	**0.35**	0.33	0.06	**0.59**	0.11	-0.07	-0.02	0.15	-0.04
	Oita	大分		0.21		0.14		0.20		0.17		-0.15		-0.14
	Miyazaki	宮崎		**0.28**		**0.47**		-0.14		-0.06		-0.24		**-0.33**
5 CHUW	Kure	呉	0.08	0.08	0.01	0.23	0.45	**0.33**	**0.58**	0.21	~	0.04	0.12	0.00
	Hiroshima	広島		0.16		**0.32**		**0.43**		**0.35**		-0.09		-0.10
	Shimonoseki	下関		**0.33**		**0.31**		**0.37**		**0.32**		-0.10		-0.15
	Hagi	萩		0.13		0.13		**0.36**		**0.30**		-0.01		0.10
6 CHUN	Sakai	境	-0.13	-0.03	0.14	0.03	-0.02	0.15	0.31	0.14	0.10	0.21	0.08	0.20
	Yonago	米子		0.02		0.10		**0.27**		0.26		0.15		0.08
	Tottori	鳥取		0.08		0.14		0.08		0.21		0.10		0.06
	Matsue	松江		~		0.05		0.09		0.21		0.22		0.14
7 CHUS	Himeji	姫路	0.01	0.13	0.20	0.20	0.22	-0.04	**0.61**	-0.06	0.13	0.05	0.06	0.01
	Okayama	岡山		-0.01		0.15		0.17		0.17		0.16		0.03
	Fukuyama	福山		-0.06		0.16		**0.33**		0.19		0.14		0.07
	Takamatsu	高松		0.12		-0.06		0.05		0.07		0.08		0.25
	Ushibuka	牛深		**0.28**		**0.32**		0.11		0.08		-0.12		-0.14
8 SHIP	Murotomisaki	室戸岬	0.27	0.18	0.16	**0.42**	0.37	-0.22	**0.53**	-0.07	~	0.09	0.22	-0.18
	Kochi	高知		0.03		0.11		-0.06		0.05		-0.04		-0.08
9 KANS	Owase	尾鷲	0.38	0.14	0.37	0.15	**0.51**	**-0.32**	**0.51**	**-0.32**	0.02	-0.06	-0.03	-0.18
	Wakayama	和歌山		0.20		**0.32**		-0.09		-0.06		-0.10		-0.22
	Shionomisaki	潮岬		**0.33**		**0.39**		-0.17		-0.13		-0.12		-0.19
10 KANN	Kyoto	京都	0.03	0.15	0.10	0.17	0.30	0.09	**0.50**	-0.06	0.16	0.04	0.12	0.04
	Osaka	大阪		0.26		0.14		0.01		-0.05		-0.20		-0.11
	Nara	奈良		0.24		0.25		-0.09		-0.12		-0.04		-0.09
	Kobe	神戸		0.19		0.23		-0.06		0.05		-0.14		-0.13

Supplementary Table S7.1b. Strength of Spearman CCs between rainfall extremes in the 10 analysis regions (rows) and indices describing the monsoon front (columns). The CCs are shown using the same colors as Figs 4 and 5. The columns are monsoon jet latitude anomaly μ_{JLat}, monsoon jet latitude variance σ_{JLat}, monsoon front latitude anomaly μ_{FLat}, and monsoon front latitude variance σ_{FLat}. For each index, sub-columns are for seasonal 99th percentile hourly rainfall and 90th percentile daily rainfall. For each time resolution, CCs are shown for both the short-period (SO) of 2006–2022 and the long-period (LO) of 2058–2010. Bold font indicates statistical significance at α=0.05.

			East (130-135 °E)															
			water vapour flux jet latitude								front latitude							
			anomaly				variance				anomaly				variance			
			hour		day		hour		day		hour		day		hour		day	
region	station		SO	LO	SO	LO	SO	LO	SO	LO	SO	LO	SO	LO	SO	LO	SO	LO
1 KYUS	Aburatsu	油津	-0.05	-0.06	-0.19	-0.05	-0.26	-0.20	-0.44	**-0.33**	-0.12	-0.23	0.01	-0.19	-0.33	-0.04	-0.27	0.03
	Miyakonojo	都城		-0.12		-0.14		-0.25		**-0.38**		-0.24		-0.23		0.07		-0.04
	Makurazaki	枕崎		-0.06		-0.06		-0.21		**-0.27**		-0.08		-0.08		-0.03		-0.08
	Kagoshima	鹿児島		-0.13		-0.06		**-0.28**		**-0.36**		-0.17		-0.26		-0.08		-0.02
2 KYUW	Nagasaki	長崎	-0.15	-0.20	-0.10	-0.18	-0.26	-0.14	-0.46	-0.17	0.27	-0.04	0.29	-0.09	-0.38	-0.16	-0.22	-0.12
	Mount Unzen	雲仙岳		**-0.28**		-0.22		-0.24		-0.14		-0.19		-0.12		-0.03		-0.02
	Hitoyoshi	人吉		0.05		-0.02		**-0.29**		**-0.38**		-0.11		-0.15		-0.10		0.03
	Kumamoto	熊本		-0.09		-0.13		**-0.27**		**-0.30**		-0.03		-0.07		-0.10		-0.04
	Akune	阿久根		0.06		-0.12		~		-0.23		-0.04		-0.15		-0.14		0.08
3 KYUN	Saga	佐賀	0.13	-0.06	0.11	-0.07	-0.10	-0.19	-0.38	-0.19	0.05	-0.05	0.30	0.02	-0.35	-0.07	-0.27	-0.08
	Sasebo	佐世保		0.02		0.03		-0.07		-0.22		-0.13		-0.13		~		0.02
	Hirado	平戸		0.04		~		-0.15		-0.11		-0.10		-0.10		0.05		0.08
	Hita	日田		-0.04		-0.08		-0.19		**-0.35**		-0.03		-0.14		-0.16		0.02
4 KYUE	Mount Aso	阿蘇山	-0.20	-0.13	-0.30	-0.17	~	**-0.27**	-0.32	**-0.31**	~	-0.01	0.21	-0.16	-0.13	-0.10	-0.04	-0.08
	Oita	大分		-0.14		-0.11		-0.22		-0.21		-0.06		-0.02		-0.10		-0.01
	Miyazaki	宮崎		0.05		-0.07		-0.08		**-0.30**		-0.14		-0.22		-0.04		0.01
5 CHUW	Kure	呉	0.24	-0.05	0.02	-0.13	-0.31	**-0.29**	-0.28	**-0.28**	0.05	~	-0.15	-0.10	-0.15	-0.02	-0.37	0.08
	Hiroshima	広島		0.04		-0.04		**-0.38**		**-0.39**		-0.11		-0.20		0.03		0.05
	Shimonoseki	下関		0.20		0.13		**-0.30**		-0.17		-0.10		-0.07		-0.05		-0.10
	Hagi	萩		0.17		0.09		-0.12		-0.10		0.01		-0.06		-0.06		-0.04
6 CHUN	Sakai	境	0.04	-0.05	0.04	-0.10	-0.04	-0.09	-0.42	-0.19	0.11	0.13	-0.15	0.06	-0.20	-0.11	-0.40	-0.01
	Yonago	米子		-0.02		0.01		-0.17		-0.19		0.17		0.09		-0.19		-0.07
	Tottori	鳥取		-0.16		0.07		-0.17		-0.10		-0.04		0.15		-0.05		0.06
	Matsue	松江		-0.12		-0.02		-0.16		-0.23		0.11		0.10		-0.11		-0.01
7 CHUS	Himeji	姫路	0.24	-0.07	0.10	0.04	-0.12	-0.19	-0.37	**-0.28**	0.27	0.05	0.23	0.09	-0.18	-0.24	-0.41	-0.07
	Okayama	岡山		0.02		~		-0.23		**-0.30**		0.17		0.11		-0.13		-0.12
	Fukuyama	福山		0.05		0.05		-0.14		-0.21		0.11		0.04		-0.10		-0.09
	Takamatsu	高松		-0.02		0.08		-0.19		-0.17		0.24		**0.36**		-0.25		-0.02
	Ushibuka	牛深		-0.07		-0.07		-0.04		-0.13		-0.04		-0.10		-0.08		0.05
8 SHIP	Murotomisaki	室戸岬	-0.13	-0.06	-0.40	-0.09	-0.13	-0.05	-0.38	-0.22	0.14	0.02	0.10	-0.07	-0.04	0.01	0.02	0.09
	Kochi	高知		0.16		0.10		-0.07		-0.18		0.14		0.06		0.12		0.09
9 KANS	Owase	尾鷲	0.16	0.04	0.07	0.04	-0.41	0.01	**-0.50**	-0.05	0.29	~	0.23	-0.03	-0.22	0.09	-0.30	0.10
	Wakayama	和歌山		0.08		-0.09		-0.23		**-0.38**		0.10		-0.06		-0.15		-0.03
	Shionomisaki	潮岬		-0.05		-0.17		**-0.27**		**-0.35**		**-0.27**		-0.25		0.02		0.14
10 KANN	Kyoto	京都	-0.08	-0.09	-0.12	-0.13	-0.35	**-0.32**	-0.32	**-0.27**	0.26	0.03	0.27	0.05	**-0.62**	0.03	-0.43	0.01
	Osaka	大阪		0.02		-0.03		**-0.45**		**-0.31**		0.01		0.24		0.10		0.03
	Nara	奈良		-0.10		-0.03		**-0.39**		**-0.34**		-0.02		0.04		0.01		-0.04
	Kobe	神戸		0.16		0.07		**-0.33**		**-0.30**		0.07		0.17		0.03		~

Supplementary Table S7.2. Strength of Spearman CCs between rainfall extremes in the 10 analysis regions (rows) and indices describing the monsoon front (columns). The CCs are shown using the same colors as Figs 4 and 5. The CCs are shown using the same colors as Figs 4 and 5. The columns are for monsoon jet zonal water vapour flux anomaly μ_{JQU}, monsoon jet meridional water vapour flux anomaly μ_{JQV}, monsoon jet water vapour flux variance $\sigma_{JQ(U,V)}$, monsoon jet latitude anomaly μ_{JLat}, monsoon jet latitude variance σ_{JLat}, monsoon front latitude anomaly μ_{FLat}, and monsoon front latitude variance σ_{FLat}. For each region, sub-rows are for seasonal 99th percentile hourly rainfall and 90th percentile daily rainfall. For each index, sub-columns show CCs from radar-AMeDas over the 2006–2022 period, and from d4PDF for the 2058–2010 period. Bold font indicates statistical significance at α=0.05.

		West (125-130)						East (130-135)							
		water vapour jet						water vapour jet latitude				front latitude			
		QU anomaly		QV anomaly		variance		anomaly		variance		anomaly		variance	
region	rain	radar	d4PDF	radar	d4PDF	radar	d4PDF	radar	d4PDF	radar	d4PDF	radar	d4PDF	radar	d4PDF
1 KYUS	hourly	**0.65**	**0.38**	0.31	**0.35**	-0.35	0.10	-0.05	**-0.40**	-0.26	**-0.61**	-0.12	**-0.35**	-0.33	**-0.33**
	daily	0.40	**0.40**	0.43	**0.39**	-0.19	0.04	-0.19	**-0.34**	-0.44	**-0.64**	0.01	**-0.28**	-0.27	**-0.32**
2 KYUW	hourly	0.12	**0.40**	**0.67**	**0.51**	-0.02	0.15	-0.15	**-0.26**	-0.26	**-0.63**	0.27	-0.13	-0.38	-0.23
	daily	0.20	**0.52**	**0.70**	**0.56**	-0.04	0.07	-0.10	-0.19	-0.46	**-0.69**	0.29	-0.10	-0.22	-0.22
3 KYUN	hourly	0.24	**0.55**	**0.48**	**0.61**	-0.10	0.02	0.13	-0.10	-0.10	**-0.73**	0.05	-0.05	-0.35	-0.20
	daily	0.13	**0.59**	**0.74**	**0.64**	-0.09	-0.05	0.11	0.01	-0.38	**-0.68**	0.30	~	-0.27	-0.18
4 KYUE	hourly	0.15	0.03	0.33	0.13	-0.07	**0.45**	-0.20	**-0.52**	~	**-0.42**	~	-0.19	-0.13	**-0.28**
	daily	0.05	0.06	**0.59**	0.24	0.15	**0.40**	-0.30	**-0.45**	-0.32	**-0.43**	0.21	-0.13	-0.04	**-0.27**
5 CHUW	hourly	0.08	**0.41**	0.45	**0.37**	~	0.11	0.24	-0.19	-0.31	**-0.64**	0.05	-0.10	-0.15	-0.20
	daily	0.01	**0.52**	**0.58**	**0.46**	0.12	-0.01	0.02	-0.12	-0.28	**-0.72**	-0.03	-0.02	-0.37	-0.20
6 CHUN	hourly	-0.13	0.20	-0.02	0.05	0.10	0.39	0.04	**-0.49**	-0.04	**-0.47**	0.11	-0.25	-0.20	0.05
	daily	0.14	**0.34**	0.31	**0.31**	0.08	0.12	0.04	-0.18	-0.42	**-0.50**	-0.15	-0.04	-0.40	0.02
7 CHUS	hourly	0.01	0.21	0.22	0.08	0.13	**0.36**	0.24	**-0.45**	-0.12	**-0.40**	0.27	-0.22	-0.18	-0.01
	daily	0.20	**0.33**	**0.61**	**0.35**	0.06	0.15	0.10	**-0.28**	-0.37	**-0.56**	0.23	-0.05	-0.41	-0.11
8 SHIP	hourly	0.27	0.04	0.37	0.05	~	0.24	-0.13	**-0.42**	-0.13	**-0.37**	0.14	-0.13	-0.04	-0.19
	daily	0.16	0.08	**0.53**	0.23	0.22	0.24	-0.40	**-0.37**	-0.38	**-0.47**	0.10	0.01	0.02	-0.25
9 KANS	hourly	0.38	0.08	**0.51**	0.17	0.02	0.14	0.16	**-0.41**	-0.41	**-0.43**	0.29	-0.18	-0.22	-0.24
	daily	0.37	0.19	**0.51**	**0.28**	-0.03	0.15	0.07	**-0.38**	**-0.50**	**-0.52**	0.23	-0.18	-0.30	-0.19
10 KANN	hourly	0.03	0.13	0.30	0.13	0.16	**0.29**	-0.08	**-0.44**	-0.35	**-0.41**	0.26	-0.20	**-0.62**	0.02
	daily	0.10	0.22	**0.50**	**0.32**	0.12	0.16	-0.12	**-0.28**	-0.32	**-0.47**	0.27	-0.12	-0.43	-0.05

Supplementary Table S7.3a. Strength of Spearman CCs from **JRA55**, between indices describing the monsoon front (rows) and the scores of 5 Pacific SST modes (columns), using different datasets and time periods. The CCs are shown using the same colors as Figs 4 and 5. The rows are for monsoon jet zonal water vapour flux anomaly μ_{JQU}, monsoon jet meridional water vapour flux anomaly μ_{JQV}, monsoon jet water vapour flux variance $\sigma_{JQ(U,V)}$, monsoon jet latitude anomaly μ_{JLat}, monsoon jet latitude variance σ_{JLat}, monsoon front latitude anomaly μ_{FLat}, and monsoon front latitude variance σ_{FLat}. Bold font indicates statistical significance at α=0.05.

JRA55			**ENSO+**		**ENSO-**		**Trend+**		**PDV**	
			1958-2022	1958-2010	1958-2022	1958-2010	1958-2022	1958-2010	1958-2022	1958-2010
West 125–130 °E	front lat	anomaly	-0.15	-0.14	-0.17	-0.18	0.04	-0.09	0.06	0.04
		variance	-0.08	-0.05	-0.18	-0.15	0.17	0.21	0.05	0.12
	water vapour flux jet lat	anomaly	**-0.29**	-0.20	0.03	0.08	-0.11	-0.16	0.15	0.14
		variance	0.14	0.15	-0.13	-0.07	-0.12	-0.09	0.08	0.21
	water vapour flux jet QU	anomaly	-0.22	-0.20	**0.36**	**0.31**	0.18	0.12	0.01	-0.13
		variance	**0.38**	**0.31**	**-0.32**	**-0.32**	-0.07	-0.08	-0.07	-0.05
	water vapour flux jet QV	anomaly	0.08	0.05	0.07	0.03	**0.25**	0.17	-0.16	**-0.27**
		variance	**0.24**	0.18	-0.19	-0.17	-0.02	~	-0.09	-0.09
	water vapour flux jet	variance	**0.37**	**0.30**	**-0.32**	**-0.32**	-0.06	-0.07	-0.06	-0.02
East 130–135 °E	front lat	anomaly	-0.11	-0.15	-0.18	-0.24	~	-0.08	-0.09	-0.17
		variance	0.11	0.14	-0.02	0.06	0.22	0.21	0.03	0.04
	water vapour flux jet lat	anomaly	-0.19	-0.15	0.19	0.17	-0.14	-0.12	-0.03	0.01
		anomaly	0.06	0.13	-0.16	-0.10	-0.09	-0.03	-0.04	0.05
	water vapour flux jet QU	variance	-0.23	-0.20	**0.45**	**0.44**	0.17	0.14	-0.01	-0.10
		eddvar	**0.40**	**0.36**	**-0.33**	**-0.35**	-0.05	-0.03	0.01	0.04
	water vapour flux jet	eddvar	**0.39**	**0.32**	**-0.33**	**-0.35**	-0.03	~	-0.02	0.01

Supplementary Table S7.3b. Strength of Spearman CCs from **d4PDF**, between indices describing the monsoon front (rows) and the scores of 5 Pacific SST modes (columns), using different datasets and time periods. The CCs are shown using the same colors as Figs 4 and 5. The rows are for monsoon jet zonal water vapour flux anomaly μ_{JQU}, monsoon jet meridional water vapour flux anomaly μ_{JQV}, monsoon jet water vapour flux variance $\sigma_{JQ(U,V)}$, monsoon jet latitude anomaly μ_{JLat}, monsoon jet latitude variance σ_{JLat}, monsoon front latitude anomaly μ_{FLat}, and monsoon front latitude variance σ_{FLat}. Bold font indicates statistical significance at α=0.05.

d4PDF			ENSO+		ENSO-		Trend+		PDV	
			1958-2010	1952-2010	1958-2010	1952-2010	1958-2010	1952-2010	1958-2010	1952-2010
West 125–130 °E	front lat	anomaly	**-0.37**	**-0.41**	**-0.27**	**-0.30**	-0.10	-0.05	0.01	-0.05
		variance	0.12	0.08	~	0.01	-0.12	-0.08	-0.01	0.03
	water vapour flux jet lat	anomaly	**-0.30**	**-0.34**	**-0.29**	**-0.31**	-0.09	-0.06	-0.04	-0.07
		variance	-0.04	-0.08	**-0.32**	**-0.28**	-0.05	0.02	0.10	0.08
	water vapour flux jet QU	anomaly	-0.08	~	**0.47**	**0.47**	0.05	0.07	-0.18	-0.18
		variance	0.19	0.16	-0.05	~	0.16	0.14	0.14	0.17
	water vapour flux jet QV	anomaly	**-0.28**	**-0.26**	**0.30**	**0.27**	0.13	0.11	0.07	0.06
		variance	**0.41**	**0.37**	-0.23	-0.23	0.04	~	0.03	0.08
	water vapour flux jet	variance	**0.29**	**0.26**	-0.12	-0.10	0.10	0.08	0.10	0.16
East 130–135 °E	front lat	anomaly	**-0.42**	**-0.44**	**-0.28**	**-0.32**	-0.13	-0.12	0.03	~
		variance	0.23	0.24	-0.11	-0.08	-0.05	-0.05	-0.14	-0.13
	water vapour flux jet lat	anomaly	**-0.31**	**-0.34**	-0.22	**-0.26**	-0.06	-0.07	-0.10	-0.13
		anomaly	0.08	~	**-0.57**	**-0.54**	-0.06	~	-0.02	~
	water vapour flux jet QU	variance	-0.11	-0.06	**0.54**	**0.55**	0.12	0.14	-0.10	-0.09
		eddvar	0.18	0.16	-0.16	-0.13	0.06	0.05	0.13	0.15
	water vapour flux jet	eddvar	0.25	0.22	-0.20	-0.18	0.04	0.01	0.09	0.13

Supplementary Table S7.4a. Combinations of the CCs of rainfall extremes with monsoon indices (regional CC), and the monsoon indices with the score of the ENSO+ mode (hemispheric CC). In each style, the three letters represent the hypothesized combined effect of the ENSO+ mode on rainfall extremes, using hemispheric CCs for 17-year (2006–2022) observations, 53-year (1958–2010) observations, and 53-year (1958–2010) d4PDF. The letters "n" or "N" represent anti-correlated effect, "p" or "P" represent correlated effect, "×" or blank represent no effect. Normal font n/p means both regional and hemispheric CCs were not significant. Bolded **n**/**p** means significant regional CC only. Normal font N/P means significant hemispheric CC only. Bolded **N**/**P** means both regional and hemispheric CCs were significant, and cells with these letters are shaded.

ENSO+		**West (125-130°E)**			**East (130-135°E)**			
		water vapour jet strength			**jet latitude**		**front latitude**	
region	**rain**	**QU anom**	**QV anom**	**var**	**anom**	**var**	**anom**	**var**
1 KYUS	**hourly**	**nn**×	××**N**	**NN**×	××**P**		××**P**	××**n**
	daily	**nn**×	p×**N**	**NN**×	××**P**		××**P**	××**n**
2 KYUW	**hourly**	**nn**×	**p**×**N**	NN×	p×**P**			××n
	daily	**nn**×	**p**×**N**	**NN**×	p××			××n
3 KYUN	**hourly**	nn×	**p**×**N**					××n
	daily	nn×	**p**×**N**					
4 KYUE	**hourly**	**nn**×	p××	NN**P**	p×**P**			××**n**
	daily	**nn**×	**p**×N	××**P**	p×**P**			××**n**
5 CHUW	**hourly**	**nn**×	p×**N**		n××			××n
	daily	**nn**×	**p**×**N**					××n
6 CHUN	**hourly**			PPP	××**P**		××P	
	daily		p×**N**	PP×				
7 CHUS	**hourly**	**nn**×	**p**××	××**P**	××**P**		××P	
	daily	**nn**×	**p**×**N**	PP×	××**P**			
8 SHIP	**hourly**	nn×			××**P**			
	daily	**nn**×	××N	××P	p×**P**			××n
9 KANS	**hourly**	**nn**×			××**P**			××n
	daily	**nn**×	××**N**	NN×	××**P**			
10 KANN	**hourly**	nn×		××**P**	××**P**		××P	
	daily	nn×	××**N**		××**P**			

Supplementary Table S7.4b. Combinations of the CCs of rainfall extremes with monsoon indices (regional CC), and the monsoon indices with the score of the ENSO- mode (hemispheric CC). In each style, the three letters represent the hypothesized combined effect of the ENSO- mode on rainfall extremes, using hemispheric CCs for 17-year (2006–2022) observations, 53-year (1958–2010) observations, and 53-year (1958–2010) d4PDF. The letters “n” or “N” represent anti-correlated effect, “p” or “P” represent correlated effect, “×” or blank represent no effect. Normal font n/p means both regional and hemispheric CCs were not significant. Bolded **n/p** means significant regional CC only. Normal font N/P means significant hemispheric CC only. Bolded **N/P** means both regional and hemispheric CCs were significant, and cells with these letters are shaded.

ENSO-		West (125-130°E)			East (130-135°E)			
		water vapour jet strength			jet latitude		front latitude	
region	rain	QU anom	QV anom	var	anom	var	anom	var
1 KYUS	hourly	**PPP**	××**P**	**pP**×	××**p**	p×**P**	×p**P**	p××
	daily	**PP**P	p×**P**	**pP**×	××**p**	p×**P**	××**P**	p××
2 KYUW	hourly	**PPP**	**p**×**P**	pP×	**n**×**p**	**p**×**P**		p××
	daily	**PPP**	**p**×**P**	**pP**×	n××	p×**P**		p××
3 KYUN	hourly	PP**P**	**p**×**P**			××**P**		p××
	daily	PP**P**	**p**×**P**			**p**×**P**		p××
4 KYUE	hourly	**PP**×	p××	pP×	n×**p**	**p**×**P**		
	daily	**PP**×	**p**×P		n×**p**	**p**×**P**		
5 CHUW	hourly	**PPP**	p×**P**		p××	**p**×**P**		
	daily	**PPP**	**p**×**P**			**p**×**P**	×p×	p××
6 CHUN	hourly	××P		nN×	××**p**	××**P**	××P	p××
	daily	××**P**	p×**P**	nN×		p×**P**		p××
7 CHUS	hourly	**PP**P	**p**×P		××**p**	p×**P**	×nP	p××
	daily	**PPP**	**p**×**P**	nN×	××**p**	**p**×**P**	×**n**×	p××
8 SHIP	hourly	PP×			××**p**	××**P**		
	daily	**PP**×	××P		n×**p**	p×**P**		
9 KANS	hourly	**PP**×			××**p**	p×**P**		
	daily	**PP**×	××**P**	pP×	××**p**	**p**×**P**		
10 KANN	hourly	PP×			××**p**	p×**P**	×nP	
	daily	PPP	××**P**		××**p**	p×**P**	×n×	

Supplementary Table S7.4c. Combinations of the CCs of rainfall extremes with monsoon indices (regional CC), and the monsoon indices with the score of the Trend+ mode (hemispheric CC). In each style, the three letters represent the hypothesized combined effect of the Trend+ mode on rainfall extremes, using hemispheric CCs for 17-year (2006–2022) observations, 53-year (1958–2010) observations, and 53-year (1958–2010) d4PDF. The letters "n" or "N" represent anti-correlated effect, "p" or "P" represent correlated effect, "×" or blank represent no effect. Normal font n/p means both regional and hemispheric CCs were not significant. Bolded **n**/**p** means significant regional CC only. Normal font N/P means significant hemispheric CC only. Bolded **N**/**P** means both regional and hemispheric CCs were significant, and cells with these letters are shaded.

Trend+		**West (125-130°E)**			**East (130-135°E)**			
		water vapour jet strength			**jet latitude**		**front latitude**	
region	**rain**	**QU anom**	**QV anom**	**var**	**anom**	**var**	**anom**	**var**
1 KYUS	**hourly**	**p**××						pn×
	daily	**p**××						pn×
2 KYUW	**hourly**	**p**××			**p**××			pn×
	daily	**p**××			p××			pn×
3 KYUN	**hourly**	p××						pn×
	daily	p××						pn×
4 KYUE	**hourly**	**p**××			p××			
	daily	**p**××			p××			
5 CHUW	**hourly**	**p**××			n××			
	daily	**p**××						pn×
6 CHUN	**hourly**							pn×
	daily							pn×
7 CHUS	**hourly**	**p**××						pn×
	daily	**p**××						pn×
8 SHIP	**hourly**	p××						
	daily	**p**××			p××			
9 KANS	**hourly**	**p**××						
	daily	**p**××						
10 KANN	**hourly**	p××						
	daily	p××						

Supplementary Table S7.4d. Combinations of the CCs of rainfall extremes with monsoon indices (regional CC), and the monsoon indices with the score of the PDV mode (hemispheric CC). In each style, the three letters represent the hypothesized combined effect of the PDV mode on rainfall extremes, using hemispheric CCs for 17-year (2006–2022) observations, 53-year (1958–2010) observations, and 53-year (1958–2010) d4PDF. The letters "n" or "N" represent anti-correlated effect, "p" or "P" represent correlated effect, "×" or blank represent no effect. Normal font n/p means both regional and hemispheric CCs were not significant. Bolded **n/p** means significant regional CC only. Normal font N/P means significant hemispheric CC only. Bolded **N/P** means both regional and hemispheric CCs were significant, and cells with these letters are shaded.

PDV		**West (125-130°E)**			**East (130-135°E)**			
		water vapour jet strength			**jet latitude**		**front latitude**	
region	**rain**	**QU anom**	**QV anom**	**var**	**anom**	**var**	**anom**	**var**
1 KYUS	**hourly**							
	daily		nN×					
2 KYUW	**hourly**		**nN**×		**p**××			
	daily		**nN**×		p××			
3 KYUN	**hourly**		**nN**×					
	daily		**nN**×					
4 KYUE	**hourly**		nN×		p××			
	daily		**nN**×		p××			
5 CHUW	**hourly**		nN×		n××			
	daily		**nN**×					
6 CHUN	**hourly**							
	daily		nN×					
7 CHUS	**hourly**		**nN**×					
	daily		**nN**×					
8 SHIP	**hourly**							
	daily				p××			
9 KANS	**hourly**							
	daily							
10 KANN	**hourly**							
	daily							