



Supplement of

Disentangling controls of multi-scale variability in precipitation stable isotopes at Yadong and Ali on the Tibetan Plateau

Ke Li et al.

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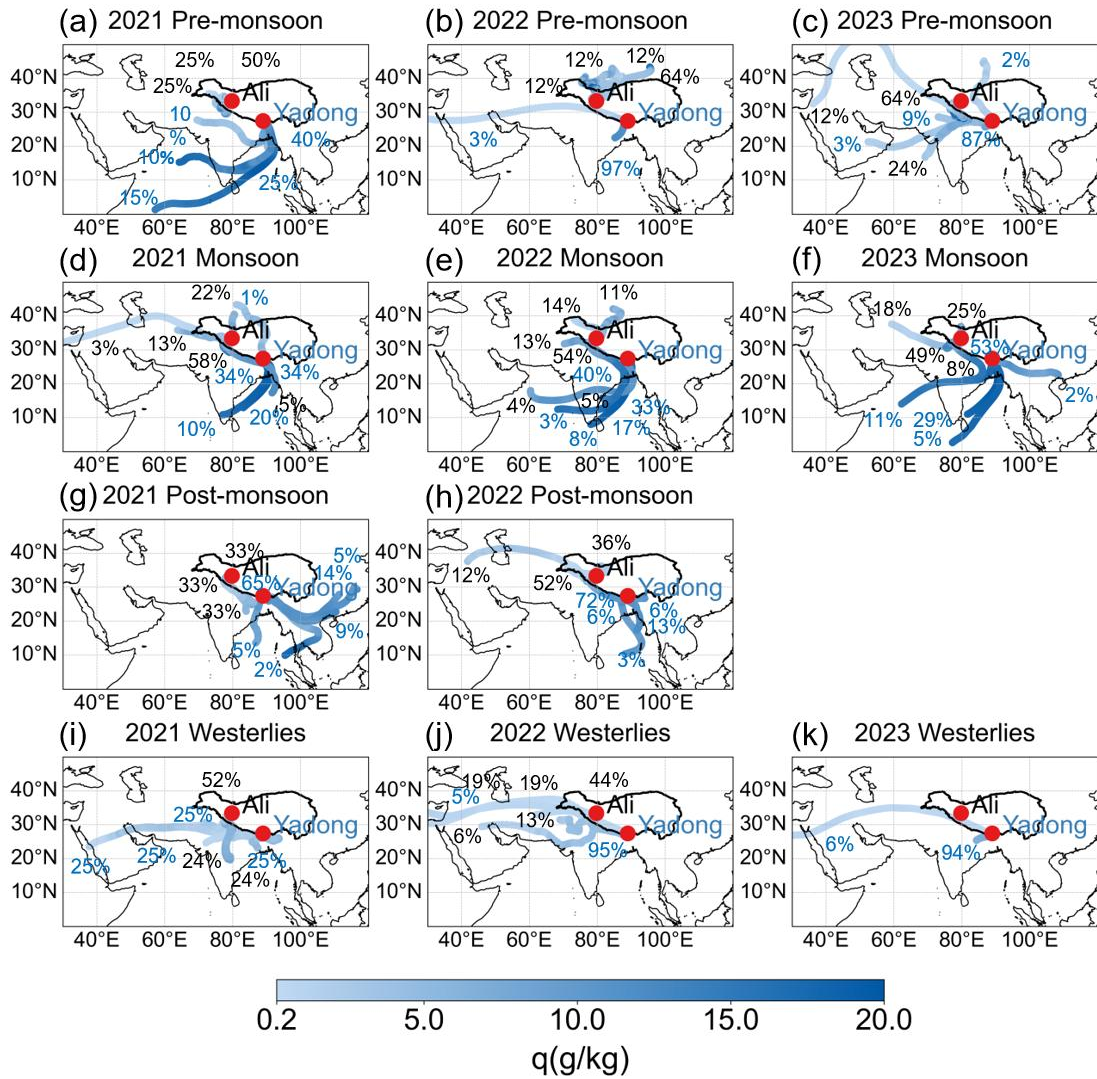


Figure S1 Clustered 140-hour backward trajectories for air masses arriving 200 m above ground level at Yadong and Ali on rainy days across different seasons (pre-monsoon, monsoon, post-monsoon, westerlies season) from May 2021 to September 2023 based on the HYSPLIT model, with specific humidity value along trajectories and the proportion of each trajectory cluster. Red dots show the locations of both sites. Trajectory colors indicate changes the values of q , while numbers indicate the proportion of clustered trajectories to total trajectories at Yadong (blue) and Ali (black).

Table S1 Total Spatial Variance (TSV, units: σ^2) of trajectory clusters at Yadong and Ali in different seasons of each year. - indicates insufficient trajectories for cluster analysis, all individual trajectories are displayed in Fig. 4.

Site	Year	Pre-monsoon	Monsoon	Post-monsoon	Westerlies
Yadong	2021	-	66.4	37.2	-
	2022	154.8	38.4	30.8	70
	2023	63.0	39.8	-	-
Ali	2021	-	64.4	-	-
	2022	-	36.5	-	-

Table S2 Daily minimum, maximum, and weighted average values of $\delta^{18}\text{O}$, δD , and d-excess at Yadong and Ali in different seasons

		Yadong			Ali				
		Samples (n)	min	max	weighted average	Samples (n)	min	max	weighted average
Year	$\delta^{18}\text{O}$ (‰)	359	-25.7	7.2	-9.5	80	-35.0	7.3	-15.0
	δD (‰)		-190.4	58.1	-64.6		-264.7	68.0	-104.6
	d-excess (‰)		-28.4	29.5	11.4		-18.2	32.6	15.6
Pre-monsoon	$\delta^{18}\text{O}$ (‰)	106	-12.9	7.2	-2.7	5	-21.5	-6.2	-8.4
	δD (‰)		-92.4	58.1	-6.6		-162.1	-24.5	-46.0
	d-excess (‰)		-1.2	25.7	15.3		5.2	25.0	20.9
Monsoon	$\delta^{18}\text{O}$ (‰)	215	-22.4	6.2	-10.7	66	-25.7	7.3	-13.3
	δD (‰)		-170.3	39.3	-78.6		-194.4	68.0	-92.4
	d-excess (‰)		-28.4	17.5	6.7		-18.2	32.6	14.0
Post- monsoon	$\delta^{18}\text{O}$ (‰)	20	-25.7	-6.6	-22.9	3	-34.6	-19.6	-26.7
	δD (‰)		-190.4	-55.0	-170.1		-257.3	-126.7	-188.5
	d-excess (‰)		-19.7	15.6	13.1		13.6	30.2	24.7
Westerlies	$\delta^{18}\text{O}$ (‰)	18	-17.2	1.7	-9.6	6	-35.0	-13.7	-21.8
	δD (‰)		-121.6	34.2	-57.1		-264.7	-123.3	-175.9
	d-excess (‰)		14.7	29.5	19.9		-13.5	15.4	-1.5

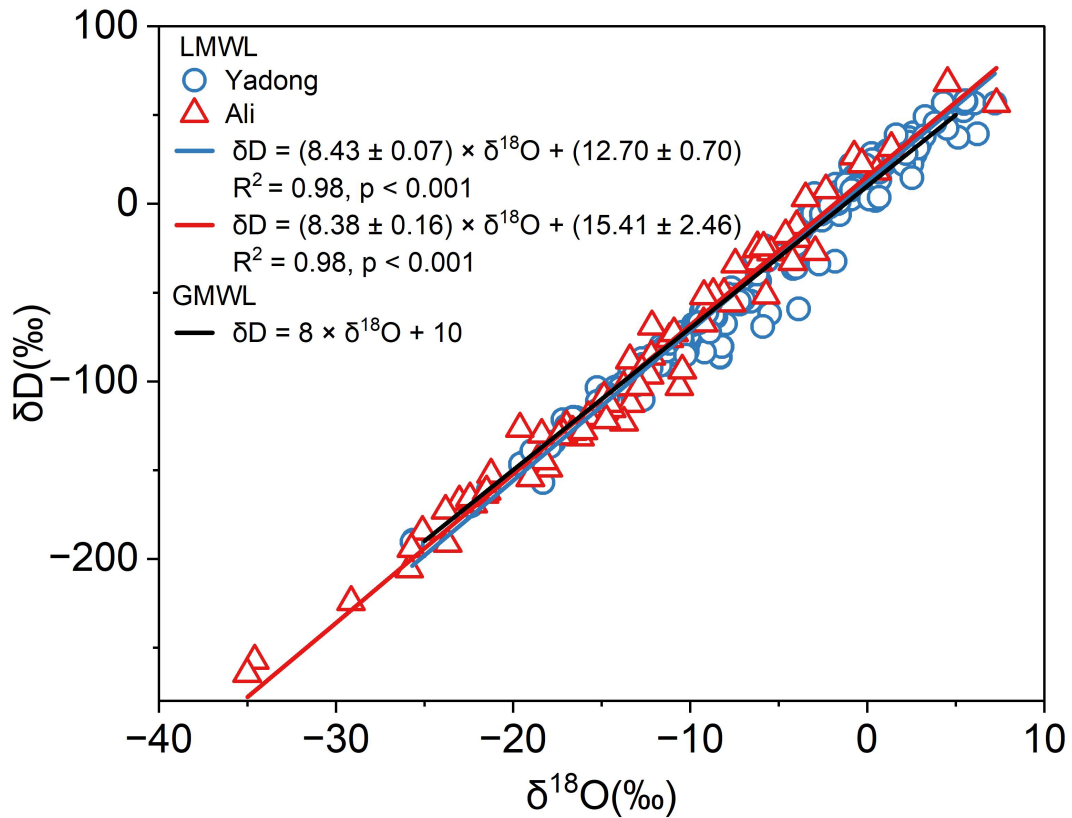


Figure S2 A comparison between the annual Local Meteoric Water Line (LMWL) of Yadong and Ali and the Global Meteoric Water Line (GMWL).

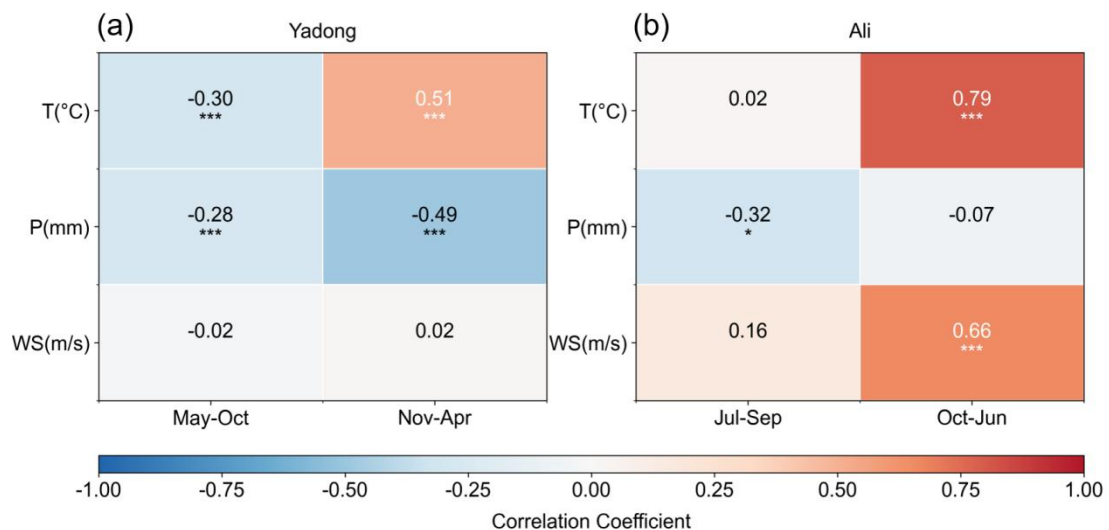


Figure S3 A heatmap showing the correlation coefficients between precipitation $\delta^{18}O$ and temperature (T), precipitation amount (P), and wind speed (WS) for Yadong and Ali during different months. The relationship between (a) Yadong daily $\delta^{18}O$ and temperature (T), precipitation (P), and wind speed (WS) during different months. (b) same as (a), but for Ali. *** and * indicate significant

correlation at levels 0.001 and 0.05, respectively.

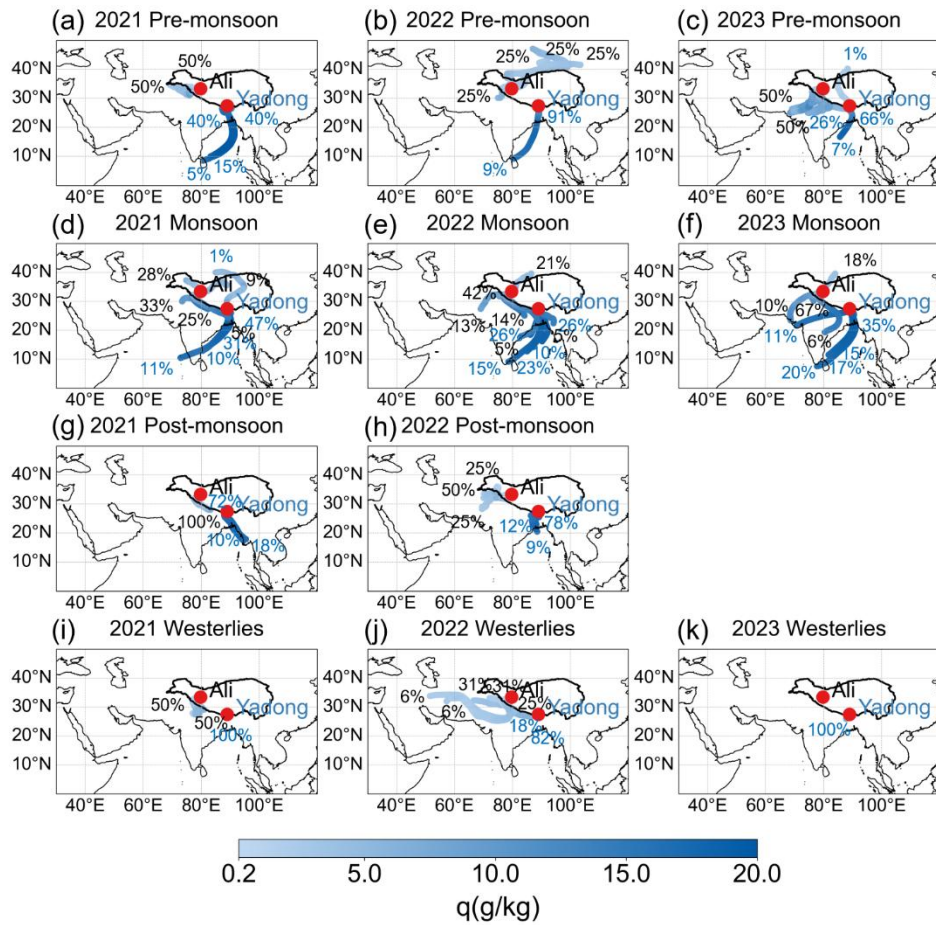


Figure S4 Clustered 120-hour backward trajectories for air masses at condensation level at Yadong and Ali on rainy days across different seasons (pre-monsoon, monsoon, post-monsoon, westerlies season) from May 2021 to September 2023 based on the HYSPLIT model, with specific humidity value along trajectories and the proportion of each trajectory cluster. Red dots show the locations of both sites. Trajectory colors indicate changes in q , while numbers indicate the proportion of clustered trajectories to total trajectories at Yadong (blue) and Ali (black).

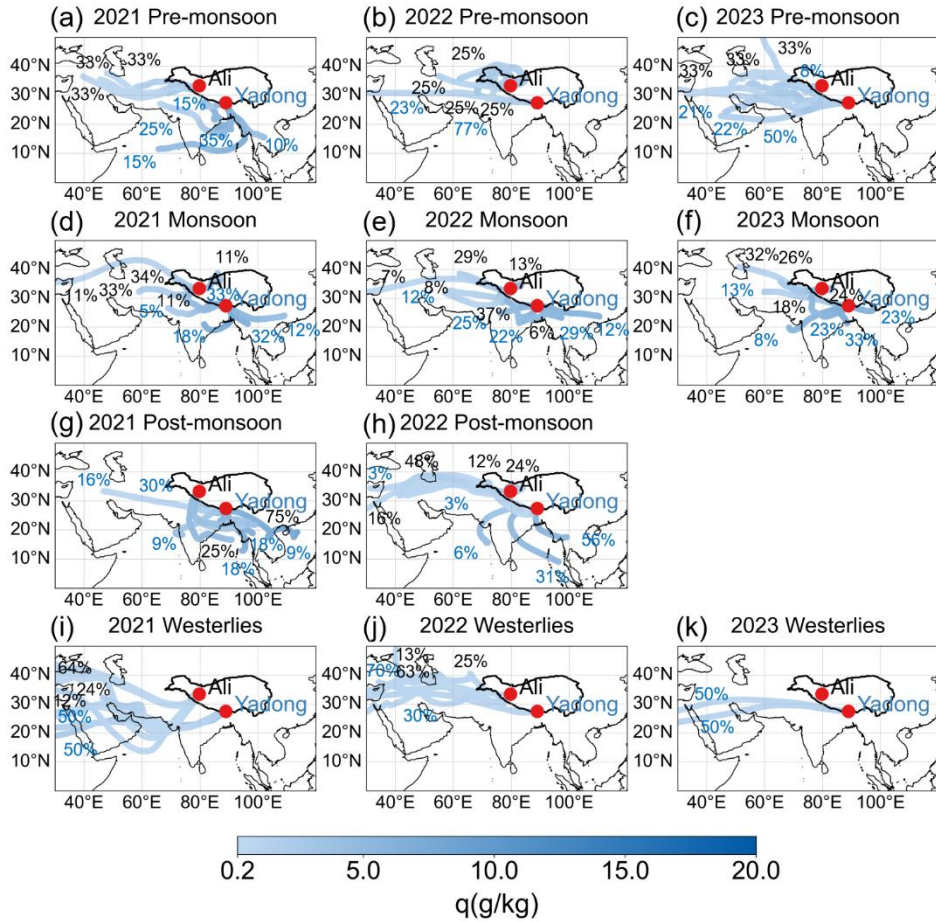


Figure S5 Clustered 120-hour backward trajectories for air masses at 500 hPa at Yadong and Ali on rainy days across different seasons (pre-monsoon, monsoon, post-monsoon, westerlies season) from May 2021 to September 2023 based on the HYSPLIT model, with specific humidity value along trajectories and the proportion of each trajectory cluster. Red dots show the locations of both sites. Trajectory colors indicate changes in q , while numbers indicate the proportion of clustered trajectories to total trajectories at Yadong (blue) and Ali (black).

Table S3 Dates of precipitation events used for seasonal integrated water vapor flux averaging at Yadong and Ali sites.

Yadong			Ali		
2021	2022	2023	2021	2022	2023
2021/5/25	2022/1/20	2023/2/23	2021/5/31	2022/1/23	2023/5/3
2021/5/26	2022/1/24	2023/2/26	2021/6/1	2022/2/3	2023/5/30
2021/5/27	2022/1/26	2023/2/27	2021/6/4	2022/2/23	2023/6/3
2021/5/28	2022/2/1	2023/2/28	2021/6/5	2022/2/27	2023/6/6
2021/5/31	2022/2/2	2023/3/4	2021/6/6	2022/5/8	2023/6/12
2021/6/5	2022/2/4	2023/3/6	2021/6/18	2022/5/27	2023/6/13
2021/6/7	2022/2/16	2023/3/7	2021/7/12	2022/6/16	2023/6/17
2021/6/8	2022/2/19	2023/3/11	2021/7/19	2022/6/17	2023/6/26
2021/6/9	2022/2/20	2023/3/14	2021/7/25	2022/6/30	2023/7/2

2021/6/10	2022/2/25	2023/3/15	2021/7/31	2022/7/27	2023/7/11
2021/6/11	2022/2/27	2023/3/17	2021/8/2	2022/7/28	2023/7/16
2021/6/12	2022/3/1	2023/3/18	2021/8/3	2022/7/29	2023/7/17
2021/6/13	2022/3/3	2023/3/19	2021/8/4	2022/7/30	2023/7/22
2021/6/14	2022/3/20	2023/3/20	2021/9/9	2022/8/6	2023/7/24
2021/6/15	2022/3/24	2023/3/21	2021/9/12	2022/8/8	2023/7/26
2021/6/16	2022/3/25	2023/3/22	2021/9/23	2022/8/9	2023/7/29
2021/6/17	2022/3/26	2023/3/24	2021/9/26	2022/8/12	2023/8/6
2021/6/18	2022/3/30	2023/3/25	2021/10/18	2022/8/16	2023/8/11
2021/6/19	2022/4/2	2023/3/28	2021/12/3	2022/9/4	2023/9/7
2021/6/20	2022/4/3	2023/3/31	2021/12/6	2022/9/5	2023/9/18
2021/6/21	2022/4/4	2023/4/1		2022/9/6	
2021/6/22	2022/4/7	2023/4/2		2022/9/10	
2021/6/24	2022/4/8	2023/4/3		2022/9/11	
2021/6/25	2022/4/13	2023/4/4		2022/9/15	
2021/6/26	2022/4/15	2023/4/5		2022/9/16	
2021/6/29	2022/4/16	2023/4/9		2022/9/17	
2021/7/1	2022/4/17	2023/4/16		2022/9/25	
2021/7/2	2022/4/20	2023/4/18		2022/10/18	
2021/7/3	2022/4/21	2023/4/19		2022/10/22	
2021/7/8	2022/4/23	2023/4/20			
2021/7/10	2022/4/24	2023/4/21			
2021/7/11	2022/4/25	2023/4/22			
2021/7/12	2022/4/26	2023/4/23			
2021/7/17	2022/4/30	2023/4/27			
2021/7/18	2022/5/2	2023/4/28			
2021/7/19	2022/5/6	2023/4/29			
2021/7/21	2022/5/7	2023/5/1			
2021/7/22	2022/5/9	2023/5/4			
2021/7/23	2022/5/11	2023/5/7			
2021/7/24	2022/5/12	2023/5/8			
2021/7/25	2022/5/13	2023/5/9			
2021/7/26	2022/5/14	2023/5/10			
2021/7/28	2022/5/15	2023/5/13			
2021/7/29	2022/5/16	2023/5/14			
2021/7/30	2022/5/17	2023/5/17			
2021/8/1	2022/5/18	2023/5/19			
2021/8/2	2022/5/19	2023/5/20			
2021/8/3	2022/5/20	2023/5/24			
2021/8/4	2022/5/21	2023/5/25			
2021/8/5	2022/5/22	2023/5/26			
2021/8/6	2022/5/31	2023/5/27			
2021/8/7	2022/6/4	2023/5/28			

2021/8/9	2022/6/5	2023/5/29
2021/8/11	2022/6/7	2023/5/31
2021/8/13	2022/6/8	2023/6/12
2021/8/15	2022/6/9	2023/6/13
2021/8/16	2022/6/12	2023/6/14
2021/8/17	2022/6/13	2023/6/15
2021/8/18	2022/6/15	2023/6/16
2021/8/19	2022/6/16	2023/6/17
2021/8/20	2022/6/17	2023/6/19
2021/8/23	2022/6/18	2023/6/21
2021/8/26	2022/6/19	2023/6/27
2021/8/27	2022/7/8	2023/6/28
2021/8/28	2022/7/20	2023/6/29
2021/8/30	2022/7/22	2023/7/1
2021/9/1	2022/7/25	2023/7/2
2021/9/5	2022/7/26	2023/7/4
2021/9/6	2022/7/27	2023/7/9
2021/9/7	2022/7/31	2023/7/10
2021/9/8	2022/8/1	2023/7/13
2021/9/9	2022/8/2	2023/7/14
2021/9/10	2022/8/3	2023/7/17
2021/9/14	2022/8/6	2023/7/18
2021/9/15	2022/8/7	2023/7/21
2021/9/17	2022/8/8	2023/7/22
2021/9/18	2022/8/11	2023/7/23
2021/9/22	2022/8/14	2023/7/25
2021/9/28	2022/8/18	2023/7/26
2021/9/29	2022/8/19	2023/7/27
2021/9/30	2022/8/21	2023/7/29
2021/10/1	2022/8/22	2023/7/30
2021/10/2	2022/8/23	2023/8/5
2021/10/3	2022/8/27	2023/8/9
2021/10/8	2022/8/29	2023/8/11
2021/10/9	2022/8/30	2023/8/13
2021/10/10	2022/8/31	2023/8/16
2021/10/17	2022/9/1	2023/8/17
2021/10/18	2022/9/2	2023/8/20
2021/10/19	2022/9/3	2023/8/23
2021/10/20	2022/9/6	2023/8/24
2021/10/21	2022/9/7	2023/8/25
2021/12/29	2022/9/8	2023/8/28
	2022/9/9	2023/9/5
	2022/9/10	2023/9/9

2022/9/11	2023/9/11
2022/9/13	2023/9/12
2022/9/15	2023/9/19
2022/9/16	2023/9/22
2022/9/19	2023/9/23
2022/9/21	
2022/9/24	
2022/9/26	
2022/9/27	
2022/9/28	
2022/9/29	
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2022/10/25	

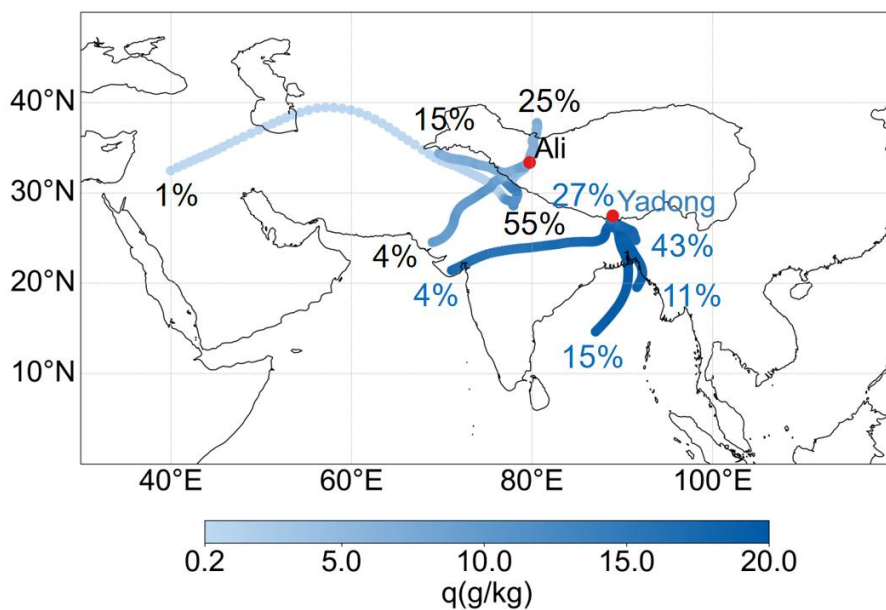


Figure S6 120-hour backward trajectories of 5 clusters on simultaneous rainy days during the monsoon season at Yadong (a) and Ali (b) based on the HYSPLIT model.