

Supplement of

**Assessment of emission reduction and meteorological change in PM<sub>2.5</sub> and transport flux in typical cities cluster during 2013-2017**

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**Table S1, (a) Descriptive Statistic of the comparison of the hourly observational temperature, relative humidity, wind speed, wind direction and WRF model simulations in Do2 region in 2013**

Regional	Variable	Month	Mean_obs	Mean_sim	Corr	MB	ME	RMSE	NMB(%)	NME(%)
BTH	Wind direction	BJ	167.6	178.5	0.6	10.9	13.4	33.5	6.5	6.7
		TJ	192.6	197.0	0.7	4.4	13.4	45.4	12.3	14.0
		SJZ	187.2	191.6	0.6	4.4	19.3	20.0	10.1	17.8
	Wind Speed	BJ	2.1	3.4	0.8	0.2	0.5	0.8	10.1	23.3
		TJ	2.8	3.9	0.9	0.1	0.8	1.4	34.2	39.4
		SJZ	1.9	3.1	0.7	0.1	0.2	0.9	24.6	38.4
	Temperature	BJ	12.3	11.5	0.9	-0.8	1.2	2.7	-0.6	0.8
		TJ	12.1	12.0	0.9	-0.1	0.3	2.1	-0.9	1.9
		SJZ	13.0	12.7	0.9	-0.3	2.0	2.9	0.2	0.9
	Relative humidity	BJ	57.4	62.0	0.8	4.6	8.2	11.4	7.9	11.6
		TJ	60.0	62.0	0.8	2.0	10.0	14.4	3.4	2.0
		SJZ	63.5	57.0	0.9	-6.5	13.5	-10.3	17.3	11.6
YRD	Wind direction	SH	168.9	186.4	0.6	17.5	25.1	39.2	10.3	15.1
		NJ	175.1	143.3	0.3	-21.8	28.0	60.2	-18.2	23.0
		HZ	208.8	191.5	0.8	-17.3	37.2	38.8	-8.3	10.1
	Wind Speed	SH	3.0	3.3	0.6	0.5	0.8	1.1	-22.4	30.1
		NJ	2.9	3.1	0.5	0.8	1.3	1.5	-28.3	30.4
		HZ	2.5	3.1	0.9	0.4	0.5	0.7	-18.4	20.1
	Temperature	SH	18.0	14.2	0.9	-3.8	2.3	4.8	-2.1	12.3
		NJ	17.0	13.1	0.9	-3.9	4.7	5.8	-3.0	10.3
		HZ	18.3	16.9	0.9	-1.3	1.1	2.8	-7.3	10.5
	Relative humidity	SH	63.9	68.5	0.7	4.6	10.7	15.5	7.3	19.7

	NJ	64.3	68.2	0.7	3.9	10.9	12.2	6.1	15.4
	HZ	63.8	65.2	0.8	0.6	1.4	10.3	2.2	7.3

**Table S1, (b) Descriptive Statistic of the comparison of the hourly observational temperature, relative humidity, wind speed, wind direction and WRF model simulations in Do2 region in 2014**

Regional	Variable	Month	Mean_obs	Mean_sim	Corr	MB	ME	RMSE	NMB(%)	NME(%)
BTH	Wind direction	BJ	154.9	155.8	0.7	10.9	33.5	44.1	0.9	10.1
		TJ	207.0	196.9	0.6	-10.1	24.9	44.4	-4.9	10.0
		SJZ	170.4	185.3	0.5	12.7	14.9	45.1	6.7	8.8
	Wind Speed	BJ	2.1	2.5	0.7	0.2	0.4	0.7	10.1	20.6
		TJ	2.6	2.8	0.8	0.3	0.8	0.8	15.0	27.5
		SJZ	1.3	1.7	0.6	0.3	0.6	0.8	14.8	25.1
	Temperature	BJ	14.9	15.1	0.9	0.4	1.9	2.4	0.9	14.7
		TJ	14.8	14.2	0.9	-0.6	0.8	1.1	-4.1	4.9
		SJZ	15.4	15.8	0.9	0.4	0.4	1.4	2.6	12.0
	Relative humidity	BJ	52.5	56.1	0.7	3.6	13.3	14.7	6.9	13.8
		TJ	59.0	56.9	0.7	-2.1	9.9	26.0	-3.6	6.2
		SJZ	57.2	51.4	0.8	-5.8	7.2	11.2	-10.2	17.5
YRD	Wind direction	SH	146.3	156.1	0.8	9.8	42.2	56.2	6.7	10.3
		NJ	150.2	144.7	0.7	-5.6	47.5	66.0	-3.7	10.4
		HZ	192.6	178.9	0.9	-13.6	35.6	43.6	-14.7	20.2
	Wind Speed	SH	2.7	3.7	0.9	0.2	0.7	0.9	3.3	17.3
		NJ	2.6	3.6	0.8	-0.2	0.2	0.7	-8.6	18.3
		HZ	2.2	2.7	0.7	-0.2	0.5	0.7	-29.5	37.3
	Temperature	SH	17.3	14.3	0.9	-3.0	3.3	4.1	-17.1	21.2

	NJ	16.9	15.3	0.9	-1.6	2.8	3.1	-9.6	25.8
	HZ	18.0	16.9	0.9	-1.1	1.7	2.3	-6.2	8.5
Relative humidity	SH	73.0	76.6	0.7	3.6	10.6	11.3	4.9	15.5
	NJ	72.9	73.3	0.8	0.4	5.3	9.9	10.5	20.2
	HZ	70.9	72.7	0.7	1.8	2.2	10.6	-7.3	10.0

**Table S1, (c) Descriptive Statistic of the comparison of the hourly observational temperature, relative humidity, wind speed, wind direction and WRF model simulations in Do2 region in 2015**

Regional	Variable	Month	Mean_obs	Mean_sim	Corr	MB	ME	RMSE	NMB(%)	NME(%)
BTH	Wind direction	BJ	170.1	171.6	0.7	1.5	17.6	53.0	0.9	8.4
		TJ	198.8	191.7	0.8	-7.1	31.0	42.0	-3.6	12.7
		SJZ	182.0	187.5	0.7	3.4	5.4	46.3	3.0	15.1
	Wind Speed	BJ	2.2	2.5	0.7	0.3	0.8	0.8	13.7	29.3
		TJ	2.9	3.9	0.9	0.4	0.4	0.8	10.3	13.3
		SJZ	1.8	2.0	0.6	0.2	0.4	0.8	12.1	20.1
	Temperature	BJ	14.2	13.4	0.9	-0.8	3.0	3.8	-5.7	10.2
		TJ	14.1	13.6	0.9	-0.5	1.8	2.4	-3.7	10.5
		SJZ	15.1	14.6	0.9	-0.6	2.8	3.7	-3.7	20.1
	Relative humidity	BJ	51.9	56.9	0.7	5.0	7.1	15.5	9.6	14.8
		TJ	56.0	53.1	0.5	-2.9	5.4	16.8	-5.2	16.3
		SJZ	52.3	45.2	0.7	-7.1	6.9	14.8	-13.6	20.1
YRD	Wind direction	SH	142.3	164.3	0.8	22.0	23.1	50.3	13.2	15.5
		NJ	157.9	149.5	0.8	-8.4	40.0	44.1	-5.4	10.6
		HZ	197.0	178.7	0.7	-18.3	33.1	51.4	-9.3	13.6
	Wind Speed	SH	2.5	3.6	0.8	0.3	0.6	0.7	9.0	12.3

	NJ	2.5	3.4	0.8	-0.1	0.6	0.7	-14.5	19.0
	HZ	2.3	2.9	0.8	-0.3	0.6	0.8	-14.4	27.6
Temperature	SH	17.1	14.6	0.9	-2.5	2.2	3.9	-4.4	10.5
	NJ	16.4	13.8	0.9	-2.6	3.5	4.0	-5.9	17.3
	HZ	17.6	15.7	0.9	-1.9	1.9	3.8	-10.6	18.9
Relative humidity	SH	70.8	77.8	0.6	7.0	18.8	15.7	9.9	21.5
	NJ	71.3	72.4	0.6	1.2	5.2	14.7	1.7	5.9
	HZ	71.9	73.2	0.7	1.4	7.0	12.0	1.9	18.0

**Table S1, (d) Descriptive Statistic of the comparison of the hourly observational temperature, relative humidity, wind speed, wind direction and WRF model simulations in Do2 region in 2016**

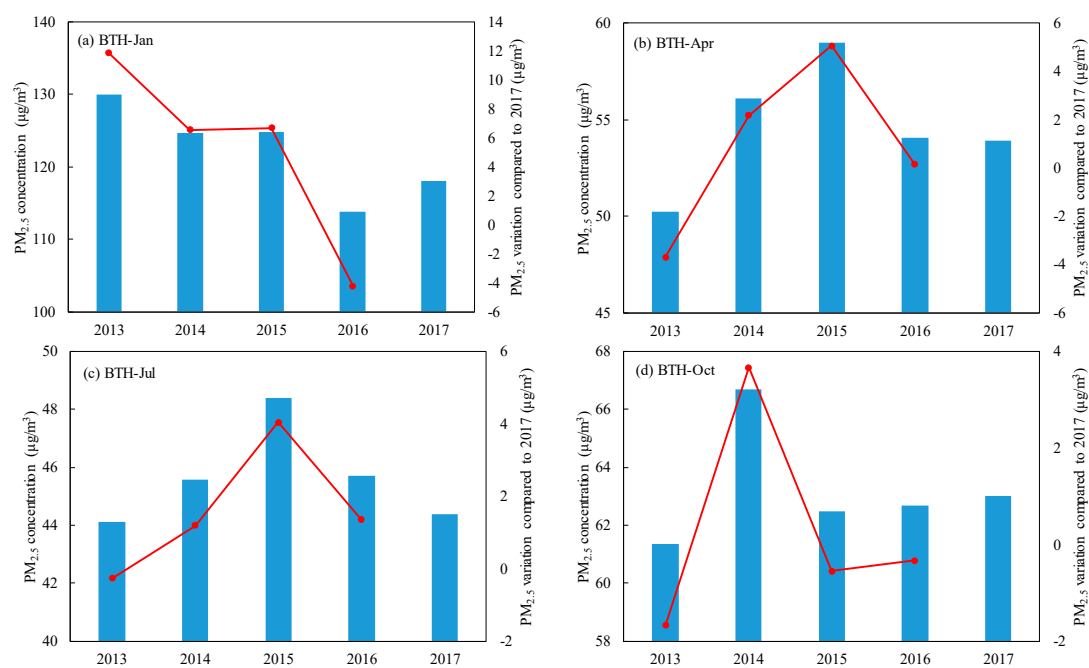
Regional	Variable	Month	Mean_obs	Mean_sim	Corr	MB	ME	RMSE	NMB(%)	NME(%)
BTH	Wind direction	BJ	163.0	164.1	0.7	1.1	44.2	48.4	6.9	10.2
		TJ	183.1	181.3	0.8	-1.8	20.7	43.0	-9.6	19.2
		SJZ	170.5	170.9	0.5	0.4	50.2	71.7	10.2	18.3
	Wind Speed	BJ	2.2	2.8	0.6	0.6	0.8	1.2	28.4	30.1
		TJ	2.9	3.1	0.9	0.2	0.5	0.8	5.6	15.3
		SJZ	1.9	2.1	0.5	0.2	0.3	0.8	11.1	13.5
	Temperature	BJ	13.6	12.9	1.0	-0.6	1.9	3.2	-4.6	11.6
		TJ	13.6	13.3	1.0	-0.3	1.1	2.2	-2.1	6.8
		SJZ	14.2	14.7	1.0	0.5	1.1	3.2	3.4	6.5
	Relative humidity	BJ	53.4	56.1	0.6	3.1	4.6	19.5	5.9	7.1
		TJ	58.1	56.8	0.8	-1.4	5.2	11.0	-2.3	7.2
		SJZ	61.4	44.4	0.6	-17.0	17.0	23.6	-17.6	22.6
YRD	Wind direction	SH	146.1	162.8	0.8	16.7	23.5	44.4	11.4	13.1

	NJ	149.8	145.5	0.8	-4.3	30.5	48.6	-2.8	16.6
	HZ	198.9	174.8	0.8	-24.1	33.3	49.9	-12.1	13.6
Wind Speed	SH	2.6	3.5	0.8	-0.5	0.5	0.7	-19.3	27.2
	NJ	2.6	3.6	0.9	0.3	0.4	0.7	11.4	11.1
	HZ	2.2	3.0	0.9	-0.2	0.6	0.7	-9.2	24.3
Temperature	SH	18.0	15.3	1.0	-2.7	2.2	3.8	-14.8	20.3
	NJ	16.9	14.1	0.9	-2.8	2.9	4.3	-16.8	31.2
	HZ	18.4	16.4	0.9	-2.0	2.6	3.8	-10.8	17.1
Relative humidity	SH	75.0	80.8	0.8	5.8	2.1	10.0	7.7	12.3
	NJ	75.9	79.7	0.8	3.9	6.8	9.7	5.1	7.3
	HZ	77.9	80.4	0.8	2.5	7.2	8.9	3.2	7.5

**Table S1, (e) Descriptive Statistic of the comparison of the hourly observational temperature, relative humidity, wind speed, wind direction and WRF model simulations in Do2 region in 2017**

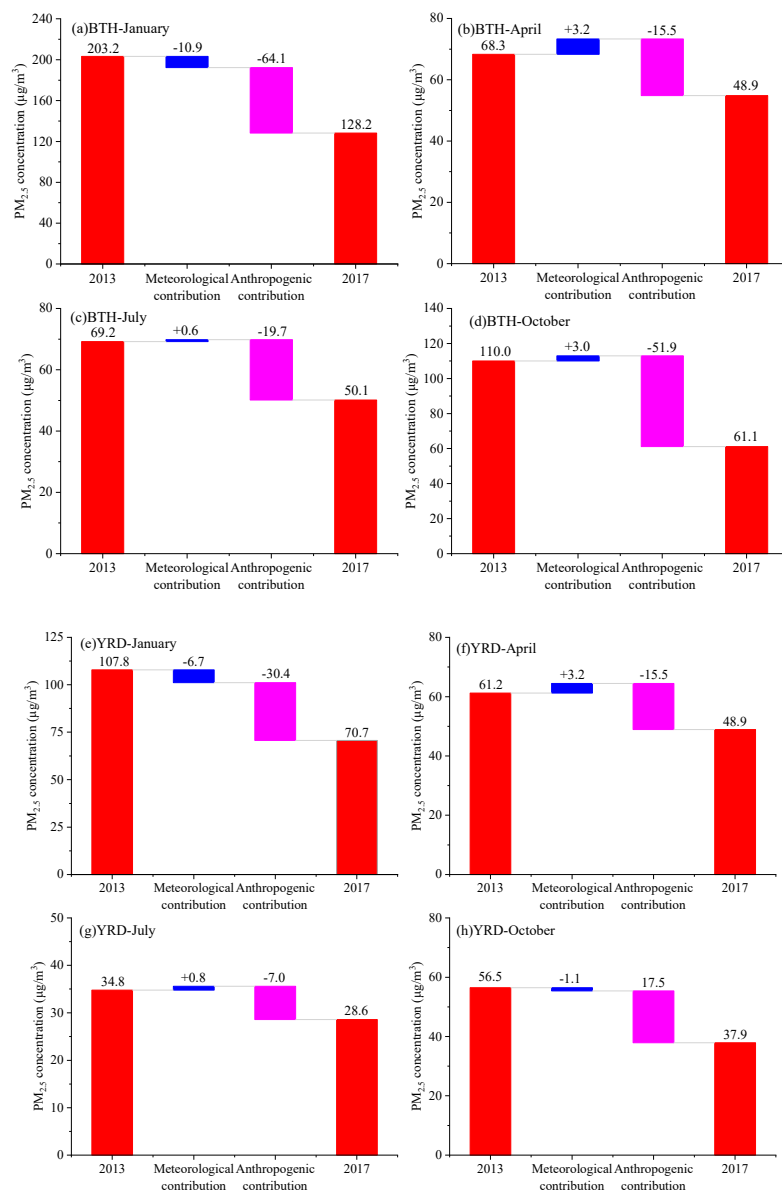
Regional	Variable	Month	Mean_obs	Mean_sim	Corr	MB	ME	RMSE	NMB(%)	NME(%)
BTH	Wind direction	BJ	162.3	166.2	0.7	3.8	47.4	49.9	2.4	12.5
		TJ	199.0	190.8	0.7	-8.2	43.5	58.4	-4.1	12.4
		SJZ	173.2	178.3	0.6	5.1	42.7	51.4	2.9	12.0
	Wind Speed	BJ	2.0	2.4	0.6	0.4	0.4	0.9	17.9	22.2
		TJ	2.6	3.5	0.9	-0.1	0.6	0.9	-3.9	27.1
		SJZ	1.8	2.1	0.5	0.3	0.4	1.0	16.1	18.0
	Temperature	BJ	14.1	13.0	1.0	-1.1	2.8	4.8	-7.6	12.8
		TJ	14.3	11.4	0.9	-2.9	2.6	5.9	-20.2	31.8
		SJZ	14.7	15.0	1.0	0.2	2.9	3.1	1.6	10.3
	Relative humidity	BJ	56.4	62.5	0.7	6.1	28.2	19.7	10.8	0.4

YRD		TJ	60.3	71.6	0.5	11.3	22.2	35.1	18.7	0.3
		SJZ	61.7	50.5	0.8	-11.3	25.2	18.1	-18.3	0.3
	Wind direction	SH	147.5	171.8	0.8	24.3	25.3	48.1	13.9	16.5
		NJ	163.1	156.3	0.8	-6.8	32.7	44.9	-4.2	16.3
		HZ	202.3	184.3	0.8	-17.9	48.5	69.7	-8.9	10.3
	Wind Speed	SH	2.6	3.5	0.7	-0.1	0.5	0.8	-2.3	15.7
		NJ	2.6	3.6	0.8	0.1	0.4	0.7	2.8	12.8
		HZ	2.5	3.2	0.8	-0.3	0.3	0.6	-11.2	33.0
	Temperature	SH	18.7	13.8	0.9	-0.9	1.5	2.3	-16.2	23.4
		NJ	17.7	14.5	1.0	-0.3	0.4	2.3	-18.4	19.6
		HZ	19.2	16.6	0.9	-2.5	0.5	4.2	-13.3	23.0
	Relative humidity	SH	69.4	83.2	0.6	6.7	13.9	19.7	20.0	37.8
		NJ	72.5	79.6	0.8	7.1	13.1	14.2	9.8	15.9
		HZ	69.2	75.8	0.6	4.7	6.6	14.6	9.5	15.5

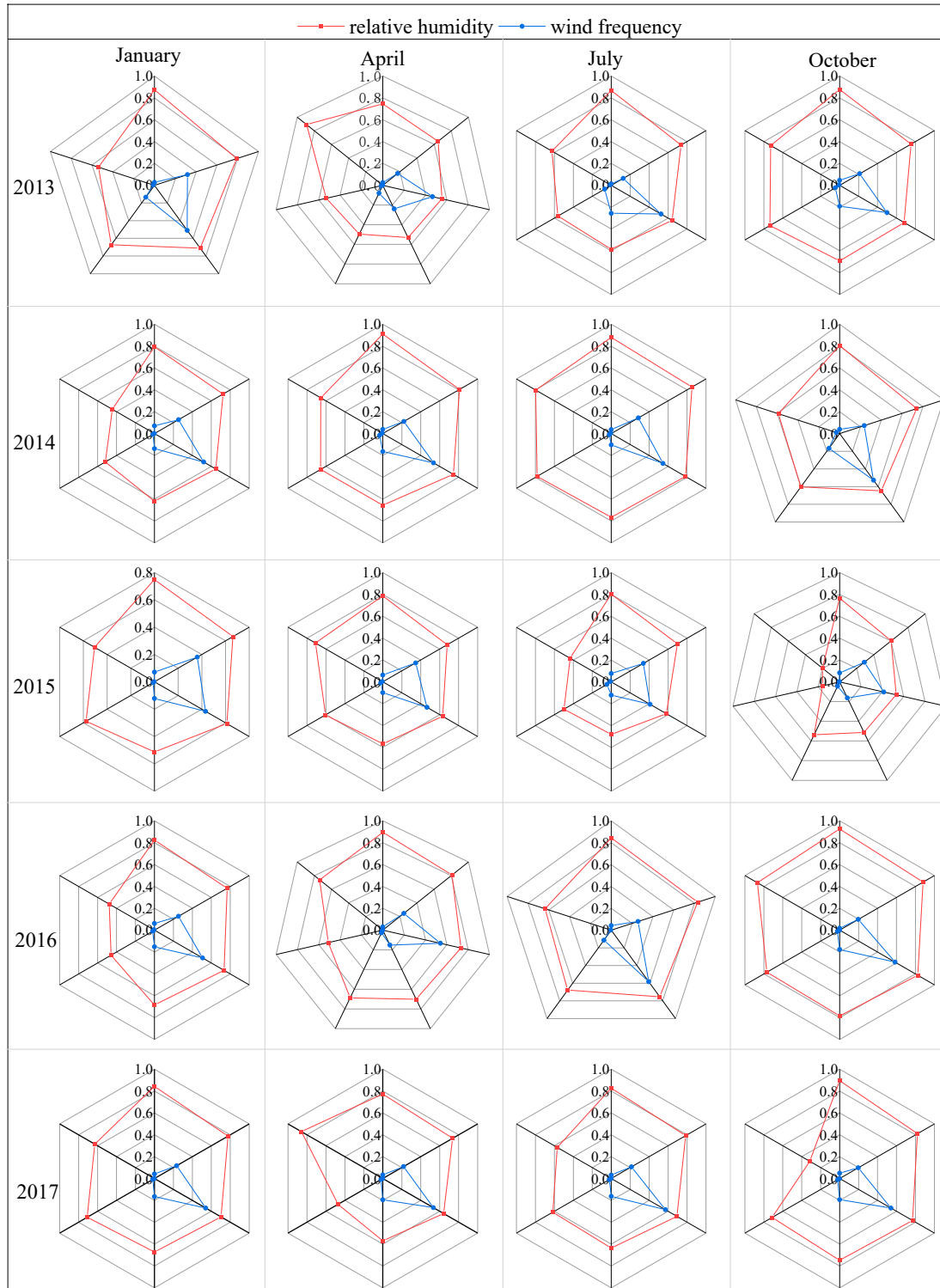


**Fig.S1** Relative contribution concentration of meteorological conditions changes in 2017 and typical month in BTH and YRD regions

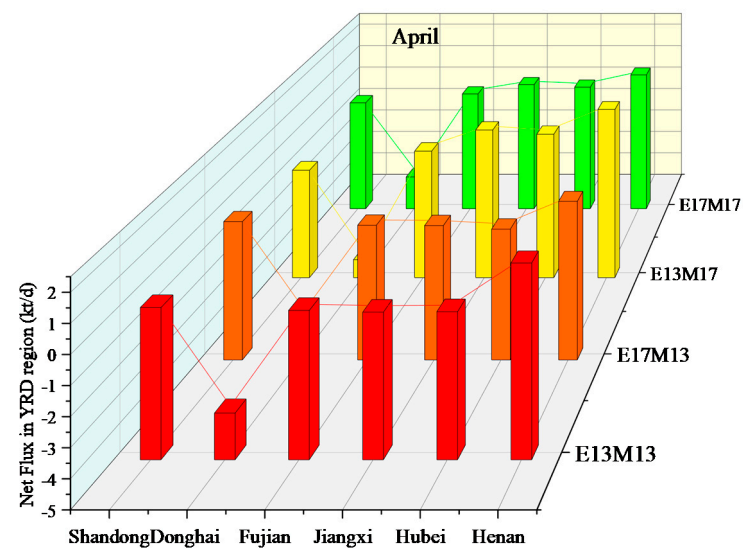
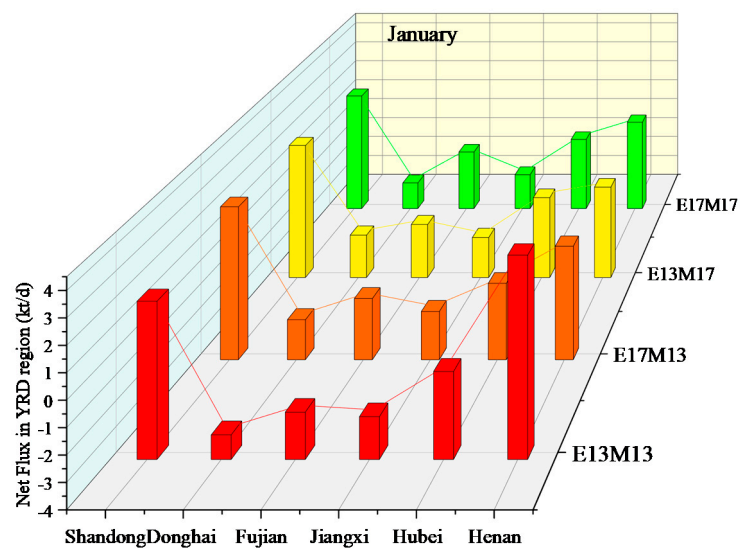




**Fig.S2** The anthropogenic and meteorological contribution of PM<sub>2.5</sub> in typical months in BTH and YRD regions



**Fig.S3** Distribution of downwind frequency and relative humidity of different grades in different years in YRD region



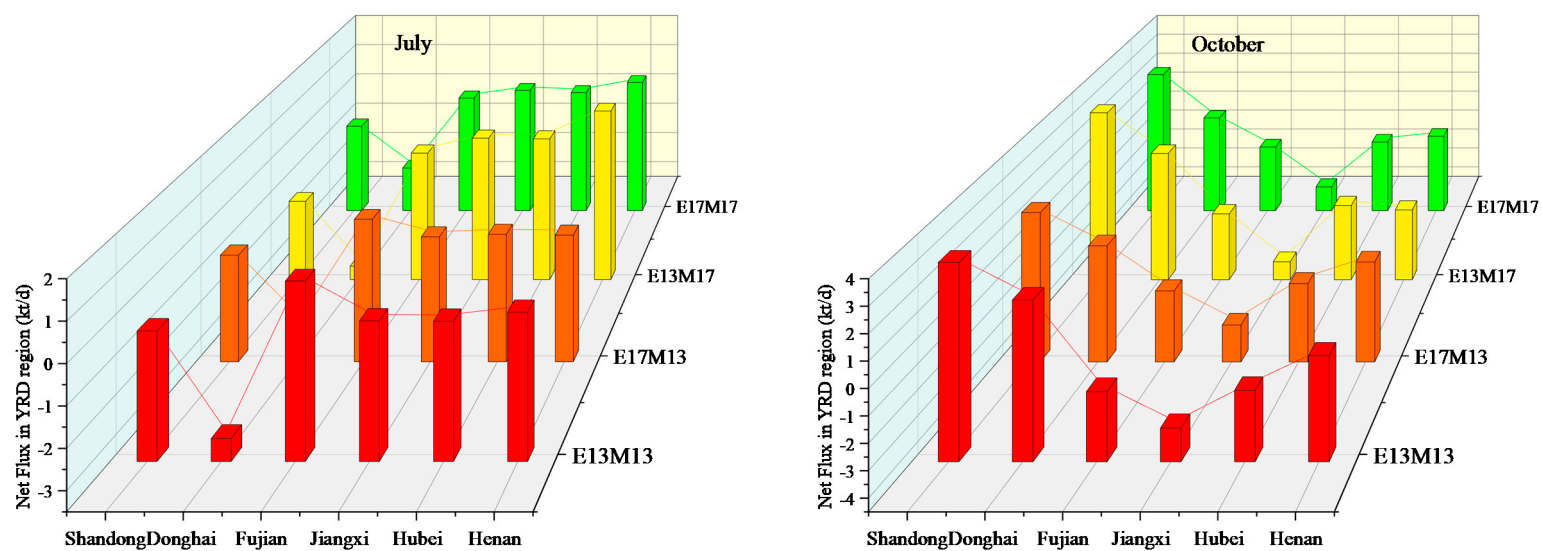
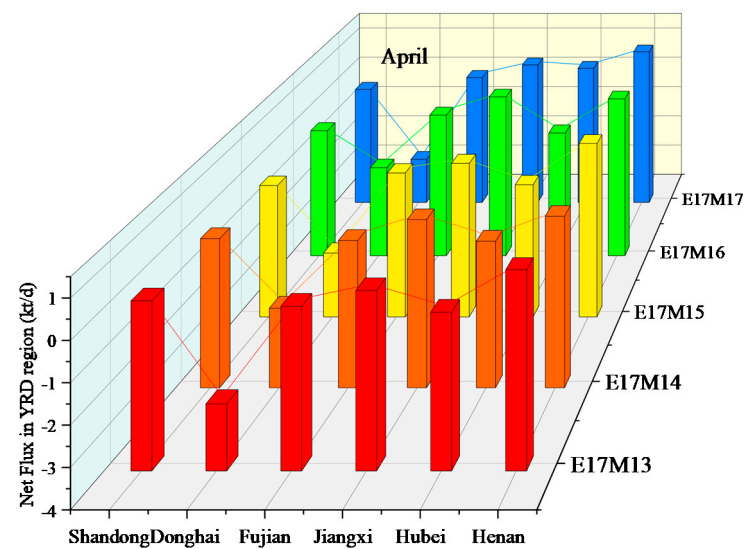
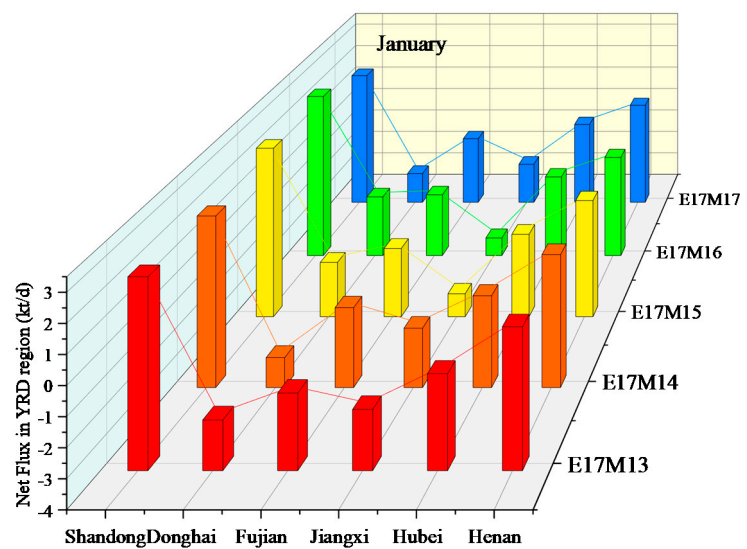


Fig.S4 The characteristics of net flux of typical month under different anthropogenic scenarios in YRD region



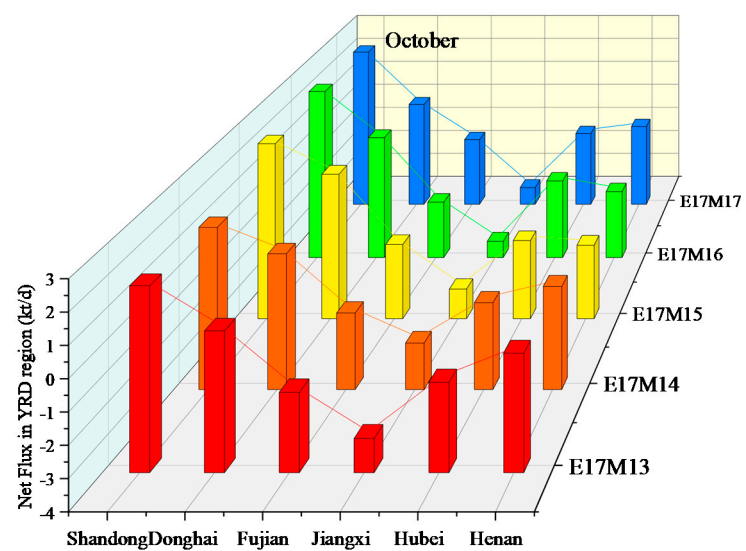
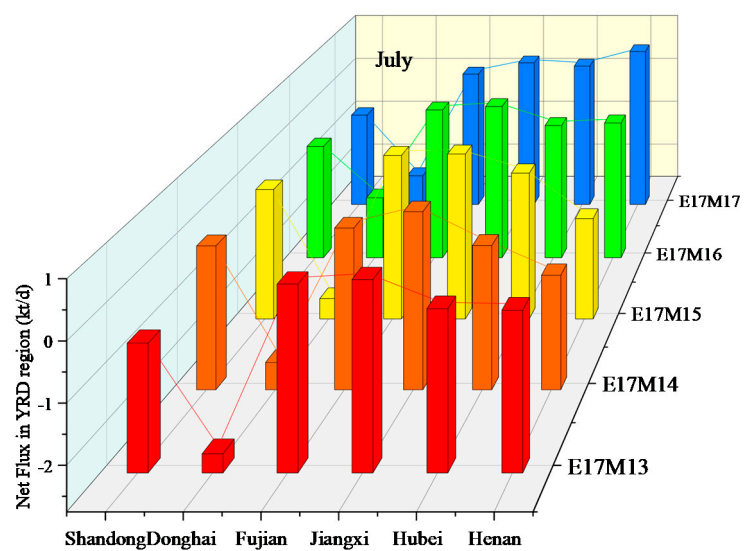


Fig.S5 The characteristics of net flux of typical month under different meteorological scenarios in YRD region