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Effect of ecological restoration programs on dust concentrations in the North China Plain: a case study

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Section SI-1: Effect of ERPs on dust concentrations in NCP during another dust events from 22 to 26 May 2014.

The model simulations from 2 to 7 March 2016 show that the EPRs help to reduce the dust concentrations in NCP, especially in BTH, involving [PMC] reduction ranges from -5% to -15%. In order to further confirm the important role of ERPs transport, another dust events from 22 to 26 May 2014 in NCP is simulated using the WRF-DUST model.

Figure S6 shows the daily average calculated and measured [PMC] distributions. On 22 to 23 May 2014, the dust storm was started and strengthened in DSR region, both the observed and simulated [PMC] reached as high level in the upwind DSR region, while with low value (lower than 40 μg m^{-3}) in the downwind NCP region (Fig. S6a, S6b). On 24 May, the dust storm started to be transported from upwind DSR to downwind NCP with northwest to southeast direction due to the strong northwest prevailing winds (Fig S6c). On 25 May, the dust storm reached to the NCP region, and caused a remarkable [PMC] increase, rising to 100–250 μg m^{-3}. On 26 May, the dust storm passed through and the wind speed slowed down, the [PMC] significantly decreased in NCP region (Fig. S6e). The correlation coefficients between measured and simulated [PMC] are 0.66–0.87 during the episode (Fig. S6). Despite some model biases, the WRF-DUST model well captures the evolutions of dust storm during 22 to 26 May 2014.

Figure S7 presents the hourly near-surface [PMC] change during the dust events from 22 to 26 May 2014, including the temporal variations in concentrations and percentage averaged at monitoring sites in the regions of DSR, NCP and BTH. During the episode when the dust storm was transported from DSR to NCP, the [PMC] reduction induced by ERPs performs with the maximum reduction of [PMC] ranging -5% to -15% in NCP. The results suggest that ERPs decrease the dust concentrations in NCP, which is consistent with the previous dust events during 2 to 7 March 2016 (Tab. S2).

Tab. S1

Table S1. The land use categories in the MCD12Q1 IGBP layer and WRF-DUST pre-processor of WPS module.

Land Use Category	Value	
	WPS Module[1]	MOD12Q1[2]
Evergreen Needleleaf forest	1	1
Evergreen Broadleaf forest	2	2
Deciduous Needleleaf forest	3	3
Deciduous Broadleaf forest	4	4
Mixed forest	5	5
Closed shrublands	6	6
Open shrublands	7	7
Woody savannas	8	8
Savannas	9	9
Grasslands	10	10
Permanent wetlands	11	11
Croplands	12	12
Urban and built-up	13	13
Cropland/Natural vegetation mosaic	14	14
Snow and ice	15	15
Barren or sparsely vegetated	16	16
Water	17	0
Wooded Tundra	18	×
Mixed Tundra	19	×
Barren Tundra	20	×
Unclassified	×	254
Fill Value	×	255

1.The WRF-DUST land use table is taken from official RWF USERS PAGE, (http://www2.mmm.ucar.edu/wrf/users/docs/user_guide_V3.2/users_guide_chap3.htm#_Land_Use_and)
2.The MODIS IGBP land use table is captured from the USGS. Website: https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table/mcd12q1

Tab. S2

Table S2. The [PMC] change comparision of sensitivity experiments (SEN-ERPs) to REF case in the two dust events. Case-1 is for dust storms during 2 to 7 March 2016. And case-2 is for dust episode during 22 to 26 May 2014.

	DSR		NCP		BTH	
	mean	peak	mean	peak	mean	peak
REF − SEN-ERPs **(case-1)**	-3.5%	-6.4%	-1.9%	-7.6%	-3.2%	-12.4%
REF − SEN-ERPs **(case-2)**	-2.3%	-7.7%	-0.9%	-6.8%	-2.9%	-13.1%

Supplementary Figure Captions

Figure S1. The schematic diagram of the "Green Great Wall (GGW)" established by the ERPs in China from 2001 to 2013. The up panels are the land cover changes of **(a)** grasslands/savannas **(b)** forest. The down panel is **(c)** the horizontal distribution of GGWs, population density, Gobi and deserts. Distribution of Gobi and deserts are adapted from 1:200,00 desert distribution dataset provide by the Environmental and Ecological Science Data Center for West China, National Natural Science Foundation of China (http://westdc.westgis.ac.cn). The population density is adapted from the sixth nationwide population census provided by the National Bureau of Statistics of China (http://www.stats.gov.cn/tjsj/pcsj/rkpc/d6c/t20120718_402819792.htm).

Figure S2. The representative examples of GGWs to control desertification and dust storms in the news media in China, including (a)/(b) news for grass GGW and (c)/(d) Netnews for forest GGW.

Figure S3. Same as Figure 2, but only with the land cover change related to "Green Great Wall (GGW)", which was mainly induced by national ERPs in China (SEN-ERP case).

Figure S4. Same as Figure 2, but only with the land cover change related to grass "Green Great Wall (GGW)", which was mainly induced by national ERPs in China (SEN-GRASS case).

Figure S5. Same as Figure 2, but only with the land cover change related to forest "Green Great Wall (GGW)", which was mainly induced by national ERPs in China (SEN-TREE case).

Figure S6. Same as Figure 5, but for dust events during 22 to 26 May 2014.

Figure S7. Same as Figure 7, but for dust events during 22 to 26 May 2014.

Fig. S1

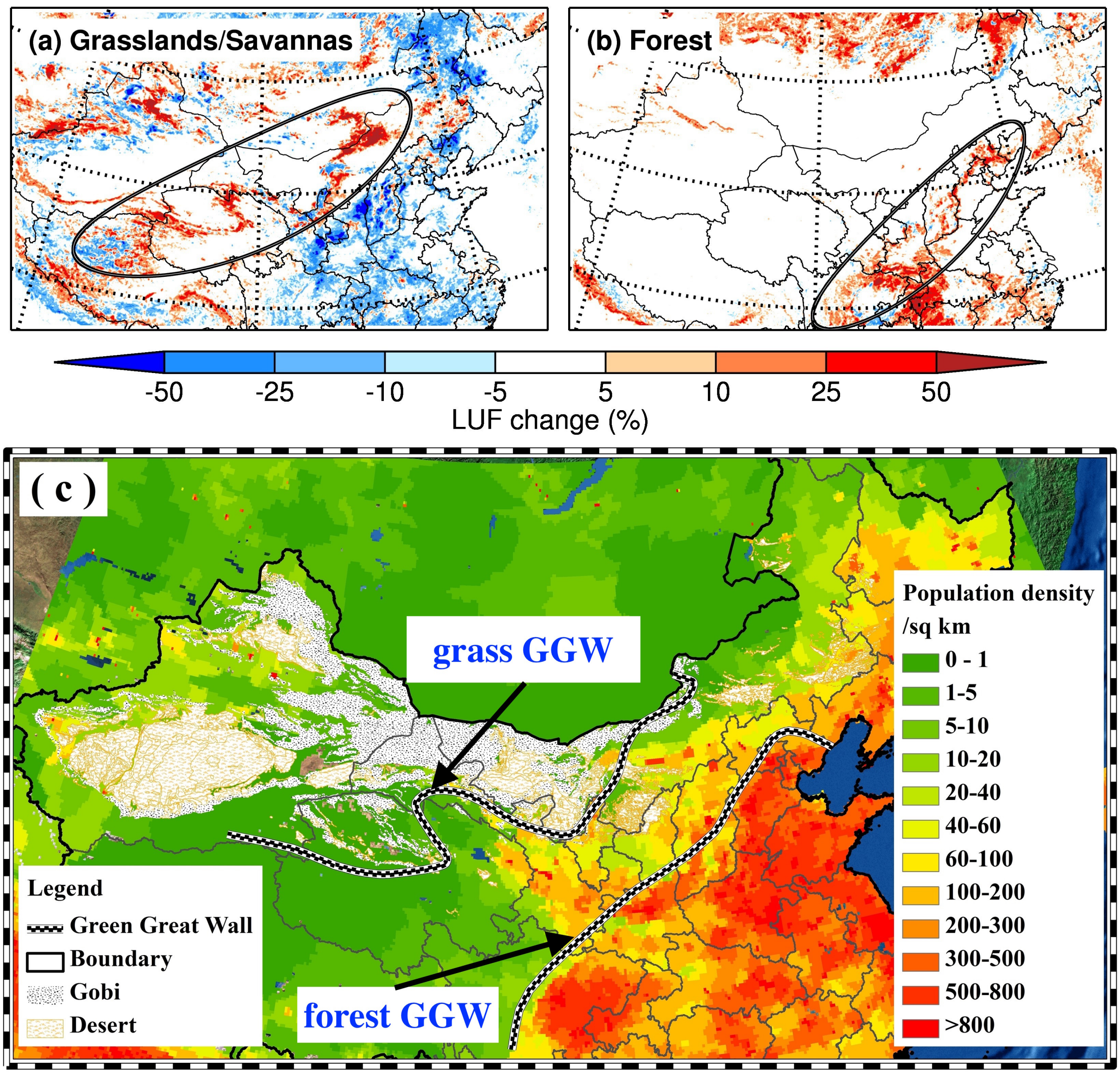

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Fig. S2

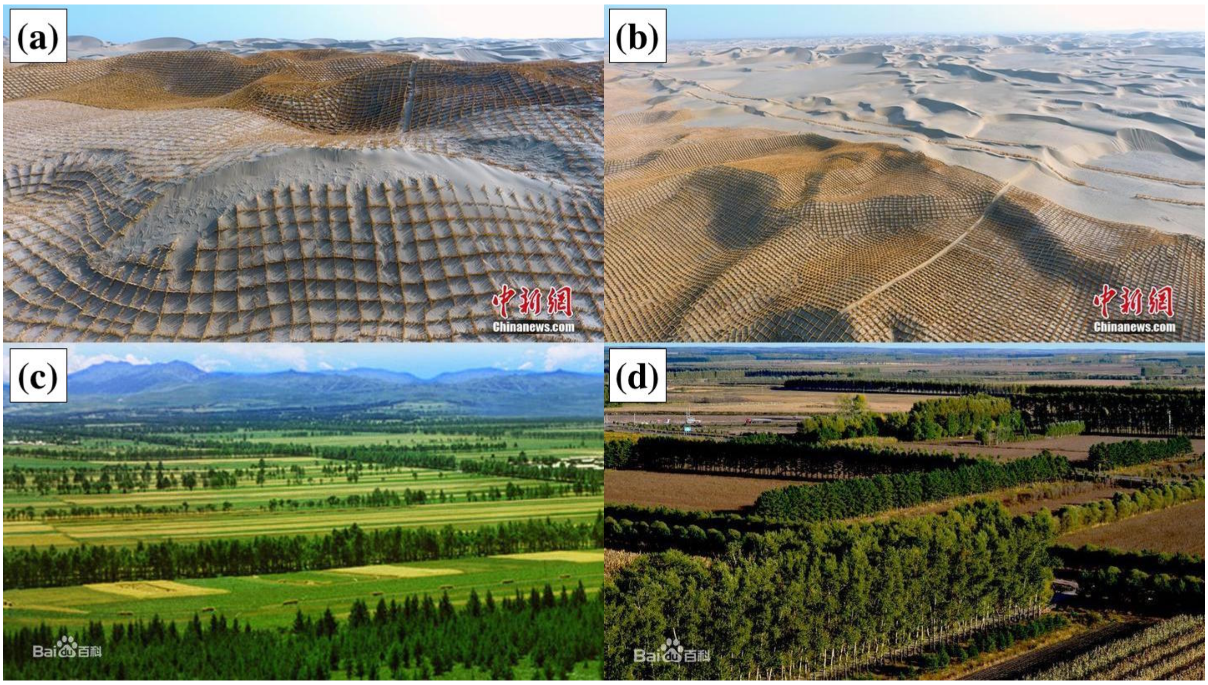

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Fig. S3

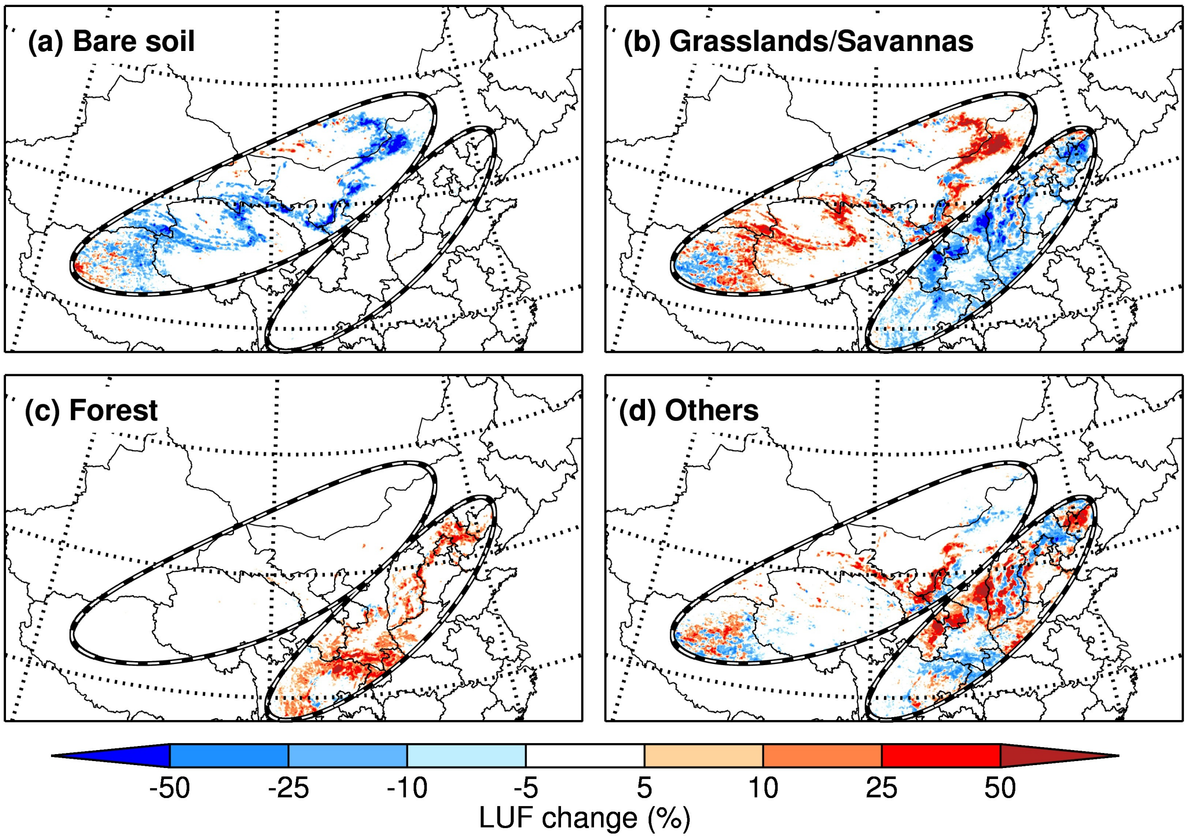

Figure S3. Same as Figure 2, but only with the land cover change related to "Green Great Wall (GGW)", which was mainly induced by national ERPs in China (SEN-ERP case).

Fig. S4

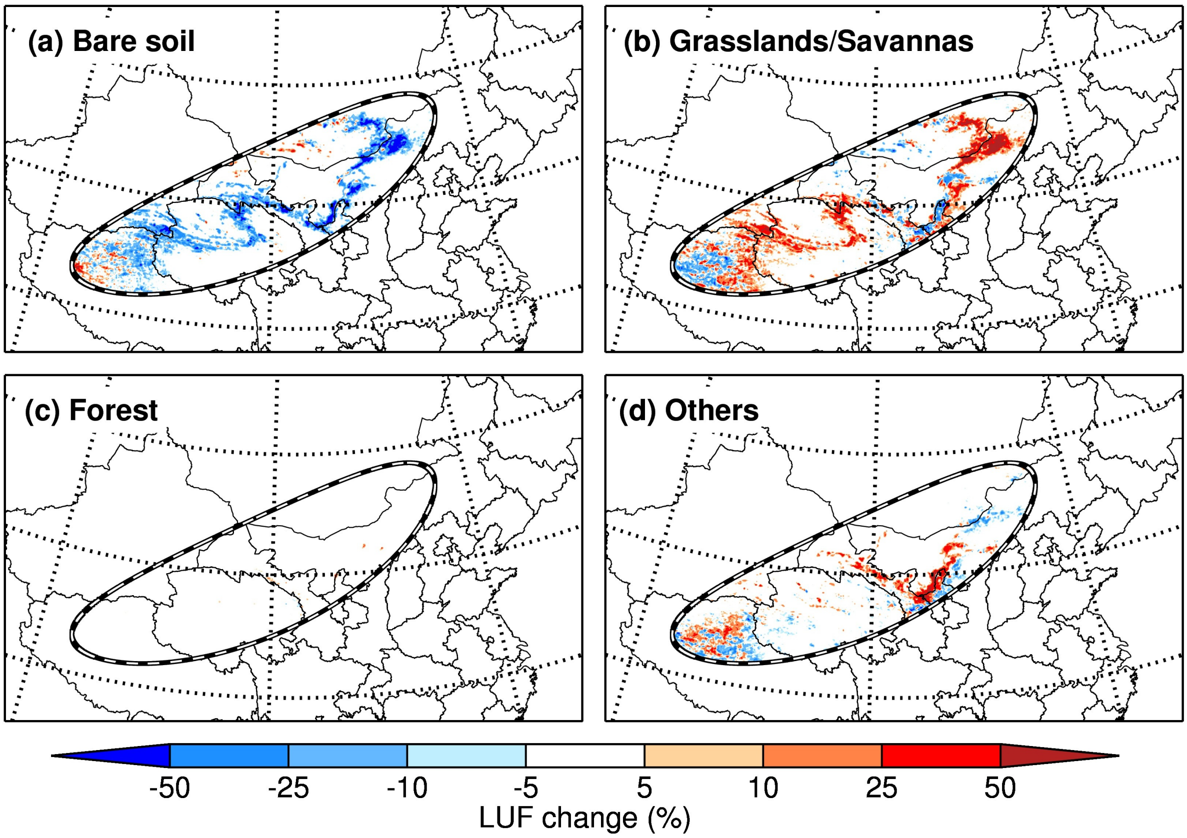

Figure S4. Same as Figure 2, but only with the land cover change related to grass "Green Great Wall (GGW)", which was mainly induced by national ERPs in China (SEN-GRASS case).

Fig. S5

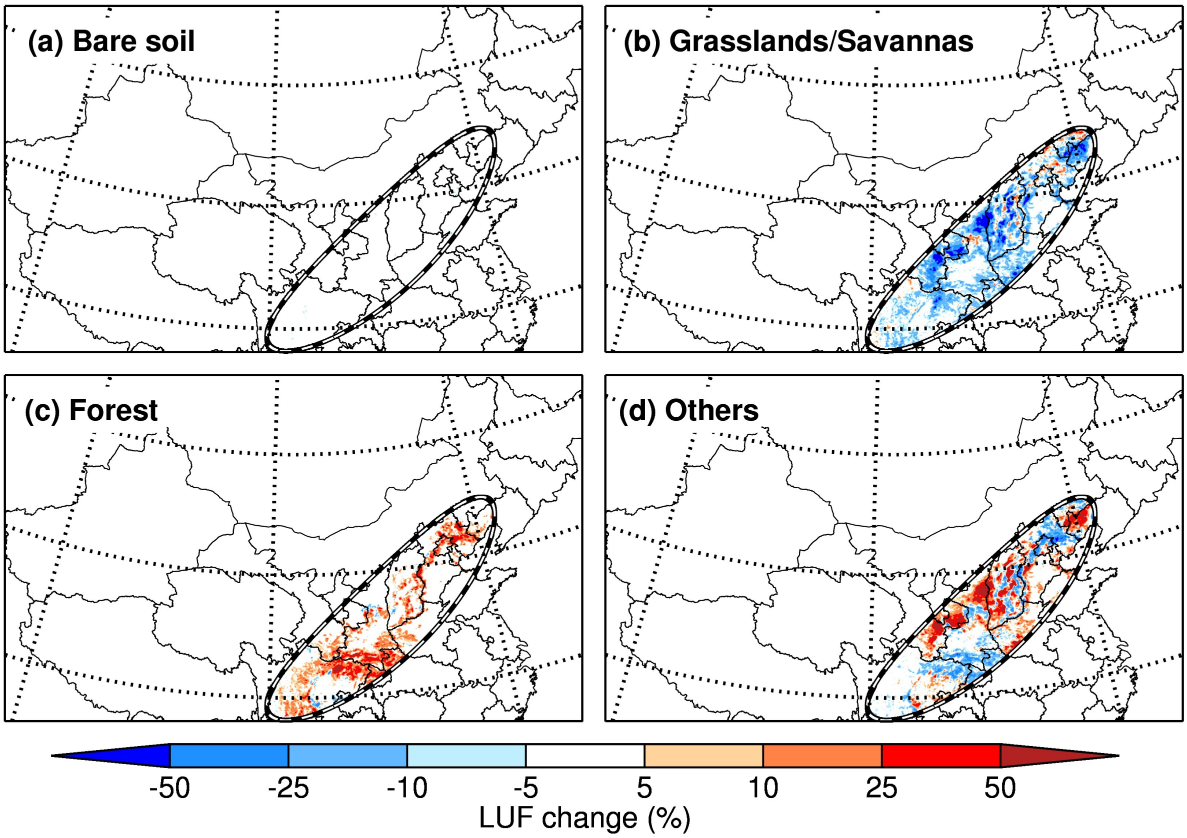

Figure S5. Same as Figure 2, but only with the land cover change related to forest "Green Great Wall (GGW)", which was mainly induced by national ERPs in China (SEN-TREE case).

Fig. S6

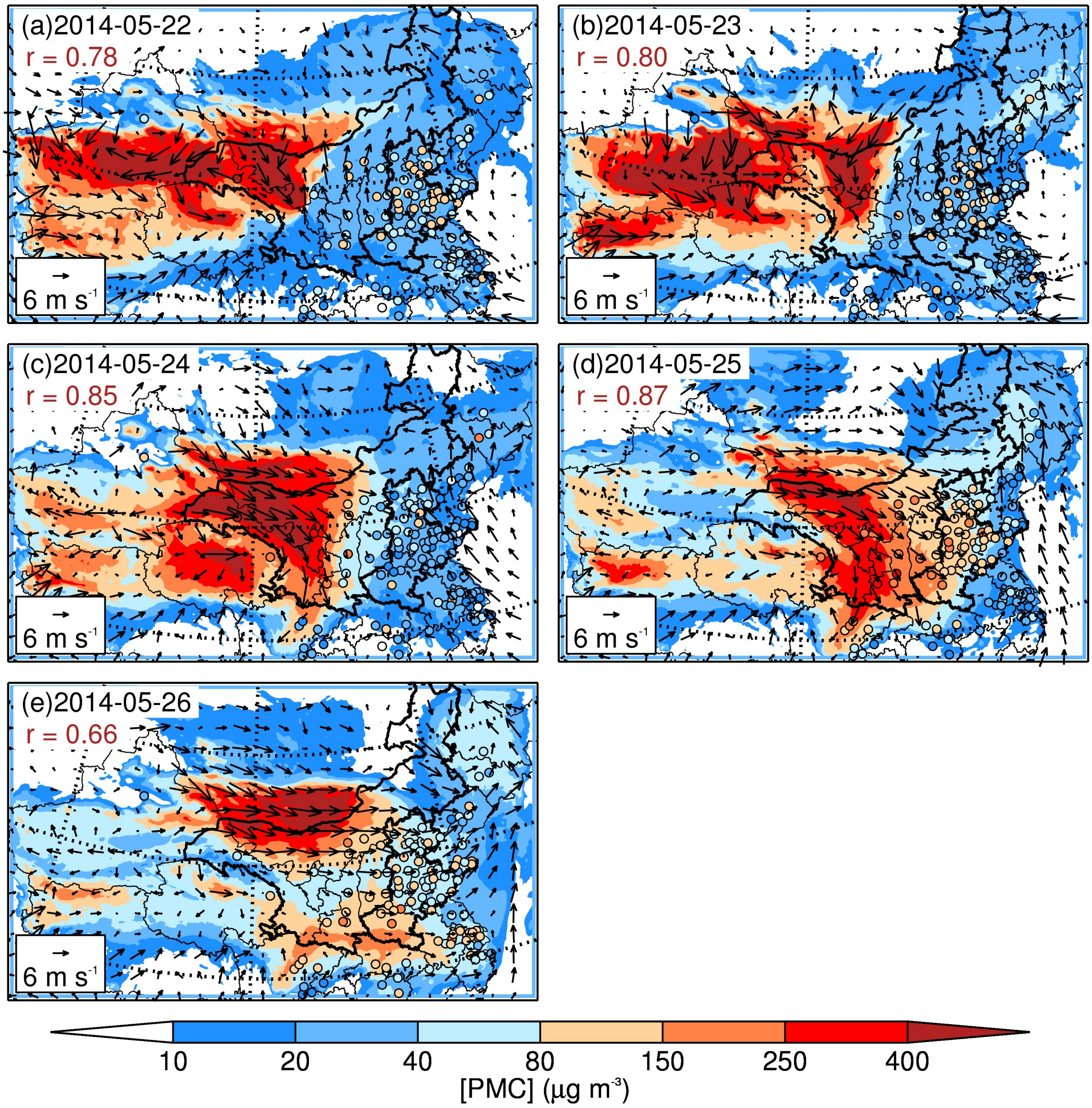

Figure S6. Same as Figure 5, but for dust events during 22 to 26 May 2014.

Fig. S7

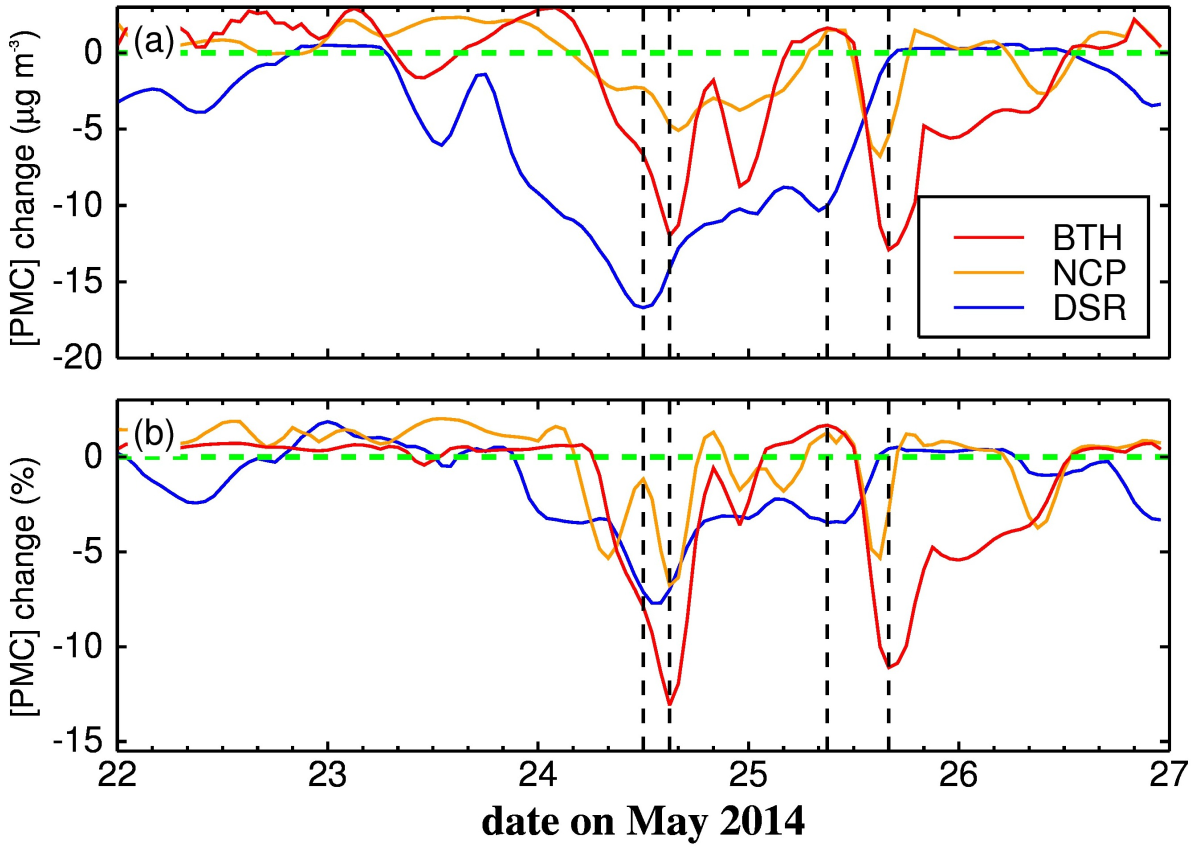

Figure S7. Same as Figure 7, but for dust events during 22 to 26 May 2014.