Supplement of

OMI measured increasing SO₂ emissions due to energy industry expansion and relocation in Northwestern China

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**Comparisons between measured ambient concentration data and SO$_2$ VCD**

The OMI retrieved SO$_2$ PBL VCD were further evaluated by comparing with ambient air concentration data of SO$_2$ from routine measurements by local official air quality monitoring stations (http://www.aqistudy.cn/historydata/). These measured data include daily averaged air concentrations of SO$_2$ from 2014 to 2015, covering 188 major cities in China. We compared monthly averaged SO$_2$ VCD over all grid points (0.25×0.25 latitude/longitude resolution) with the monthly averaged monitored concentrations of SO$_2$ in 188 cities. Result is shown in **Figure S1**. The OMI retrieved SO$_2$ VCD match well with the measured SO$_2$ concentrations at a correlation coefficient of r =0.85 (p<0.001).

Table S1 Statistics between satellite derived SO$_2$ VCD and monitored SO$_2$ annually averaged air concentrations during 2014-2015 at 188 operational air quality monitoring stations across China. In the table, r is the correlation coefficient, RE is the relative error, FB is the fractional bias, NMB is the normalized mean bias, and RMSE is the root mean square error, respectively.

r	RE	FB	NMB	RMSE
0.85 (p<0.05)	0.25	0.0003	0.119	9.65
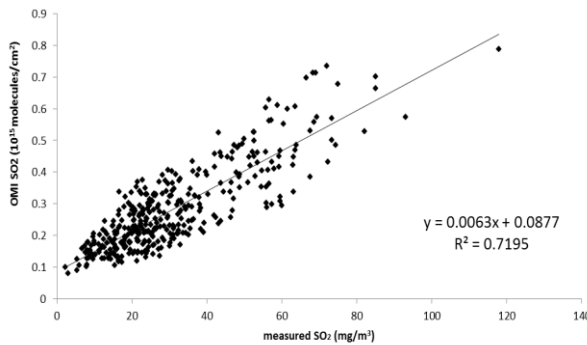
Figure S1 Comparisons between monthly averaged concentration of SO$_2$ and OMI retrieved SO$_2$ VCD from 2014 to 2015. n is the number of data points used in correlation analysis, r is the correlation coefficient, and p is the significance level.