

## Supplementary Material

**Table S-1.** International codes for present weather reported from a manned weather station (WMO-No.306, 2017)

code	Description
00-49	No precipitation at the station at the time of observation
00-19	No precipitation, fog, ice fog (except for 11 and 12), duststorm, sandstorm, drifting or blowing snow at the station* at the time of observation or, except for 09 and 17, during the preceding hour
00-03	No meteors except photometeors
04-09	Haze, dust, sand or smoke
10	Mist
20-29	Precipitation, fog, ice fog or thunderstorm at the station during the preceding hour but not at the time of observation
30-39	Duststorm, sandstorm, drifting or blowing snow
40-49	Fog or ice fog at the time of observation
50-99	Precipitation at the station at the time of observation
50-59	Drizzle
60-69	Rain
70-79	Solid precipitation not in showers
80-99	Showery precipitation, or precipitation with current or recent thunderstorm

**Table S-2.** The two-letter abbreviations of weather phenomena for significant present weather reported in METAR (aerodrome routine meteorological report) (WMO-No.306, 2017)

Precipitation		Obscuration		Others	
DZ*	Drizzle	BR*	Mist	PO	Dust/sand whirls (dust devils)
RA*	Rain	FG*	Fog	SQ	Squalls
SN*	Snow	FU	Smoke	FC	Funnel cloud(s) (tornado or waterspout)
SG	Snow grains	VA	Volcanic ash	SS	Sandstorm
PL	Ice pellets	DU*	Widespread dust	DS	Duststorm
GR	Hail	SA	Sand		
GS	Small hail and/or snow pellets	HZ*	Haze		
UP	Unknown precipitation				

\* 7 Present weather is used in this study

**Table S-3.** Explanation of weather phenomena significant to aviation (WMO-No.782, 2014)

Haze (HZ)	The suspension in the air of extremely small dry particles invisible to the naked eye and sufficiently numerous to give the air an opalescent appearance with a reduction in horizontal visibility to 5,000 m or less.
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Dust (DU)	The reduction of horizontal visibility to 5,000 m or less caused by the suspension in the air of small particles of dust raised from the ground.
Mist (BR)	The suspension of microscopic water droplets or wet hygroscopic particles in the air, reducing horizontal visibility to 1,000 to 5,000 m.
Fog (FG)	The suspension in the air of very small water droplets, which reduces horizontal visibility to less than 1,000 m.
Drizzle (DZ)	Fairly uniform precipitation in very fine drops of water with a diameter of less than 0.5 mm.
Rain (RA)	Precipitation of liquid water droplets of appreciable size (greater than 0.5 mm).
Snow (SN)	Solid precipitation of single or agglomerated ice crystals falling from a cloud.

**Table S-4.** All Individual Multicollinearity Diagnostics Result

Variables	WS	TMP	RH	PM10	PM2.5
VIF*	1.292	2.623	1.403	1.442	1.525

\* VIF: Variance Inflation Factor

**Table S-5.** Estimation results of Model 0

	Without PM and WX		
	Estimate	Std. Error	p-value <sup>a</sup>
(Intercept):1	26.227247	0.213269	0.0000 ***
(Intercept):2	1.440097	0.007226	0.0000 ***
TMP	0.002199	0.003607	0.5420
RH	-0.231858	0.002649	0.0000 ***
WS	0.005688	0.008858	0.5210

<sup>a</sup> Signif. codes: \*, \*\*, \*\*\* Significant at the 0.05, 0.01, and 0.001 probability level, respectively.

**Table S-6.** Estimation results of Model 1

	PM incorporated		
	Estimate	Std. Error	p-value <sup>a</sup>
(Intercept):1	31.6153212	0.2175318	0.0000 ***
(Intercept):2	1.1452523	0.0071335	0.0000 ***
PM <sub>10</sub>	-0.0091047	0.0007995	0.0000 ***
PM <sub>2.5</sub>	-0.1555467	0.0021705	0.0000 ***
TMP	-0.0496700	0.0030378	0.0000 ***
RH	-0.2277534	0.0023273	0.0000 ***

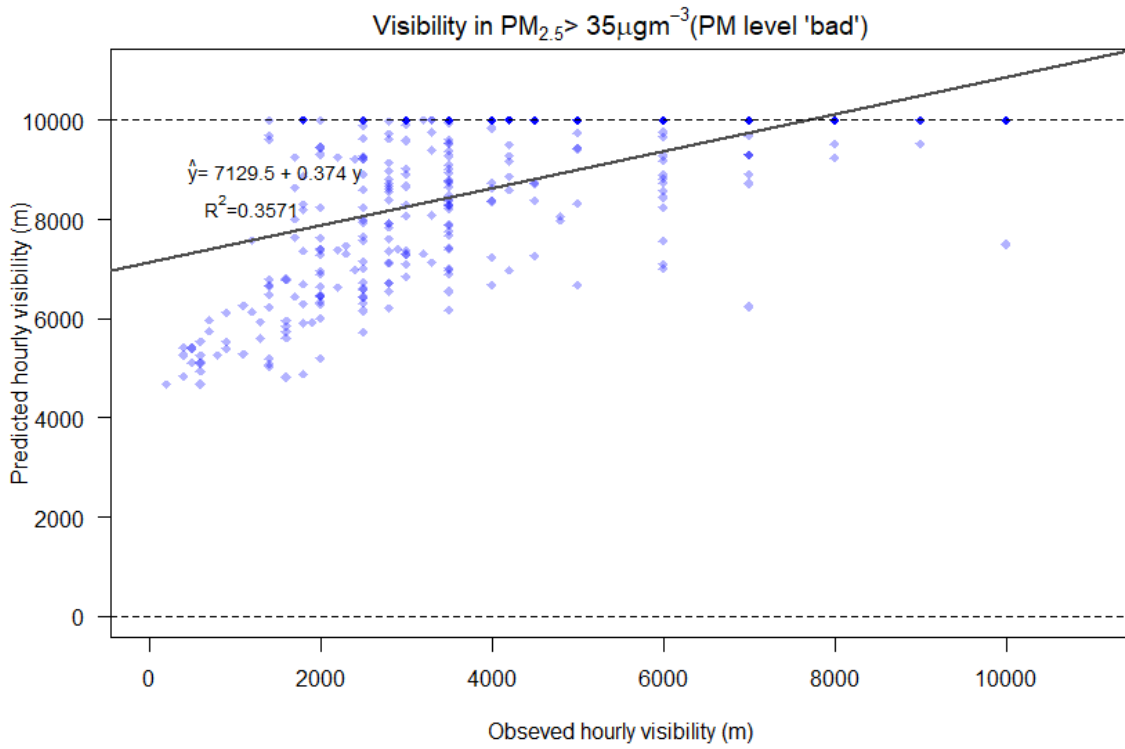
WS	-0.0949147	0.0071392	0.0000	***
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<sup>a</sup> Signif. codes: \*, \*\*, \*\*\* Significant at the 0.05, 0.01, and 0.001 probability level, respectively.

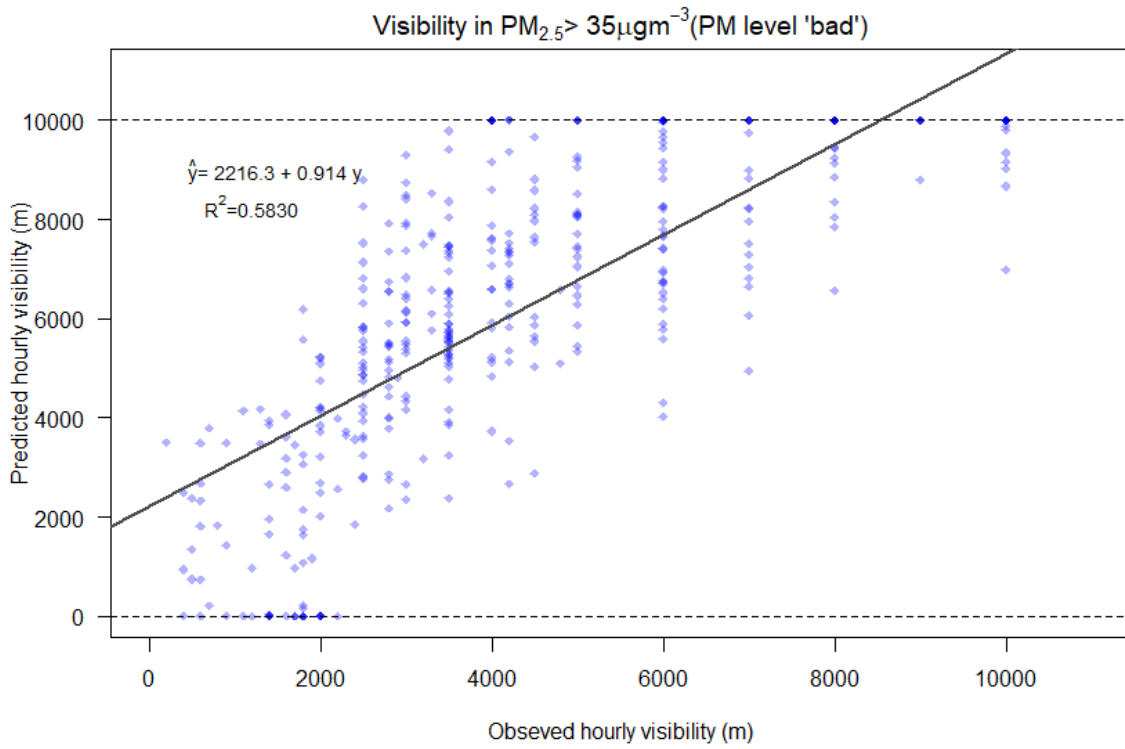
**Table S-7.** Estimation results of Model 2

	PM and WX incorporated			
	Estimate	Std. Error	p-value <sup>a</sup>	
(Intercept):1	25.49	0.2559	0.0000	***
(Intercept):2	0.5524	0.007812	0.0000	***
PM <sub>10</sub>	-0.005161	0.0005516	0.0000	***
PM <sub>2.5</sub>	-0.05938	0.001507	0.0000	***
WXHZ	-8.724	0.1782	0.0000	***
WXDU	-7.975	0.2381	0.0000	***
WXBR	-8.326	0.1715	0.0000	***
WXFG	-11.67	0.1948	0.0000	***
WXDZ	-11.14	0.2792	0.0000	***
WXRA	-8.741	0.1771	0.0000	***
WXSN	-9.579	0.2191	0.0000	***
TMP	-0.02176	0.002313	0.0000	***
RH	-0.1144	0.002169	0.0000	***
WS	-0.01673	0.005015	0.0009	***

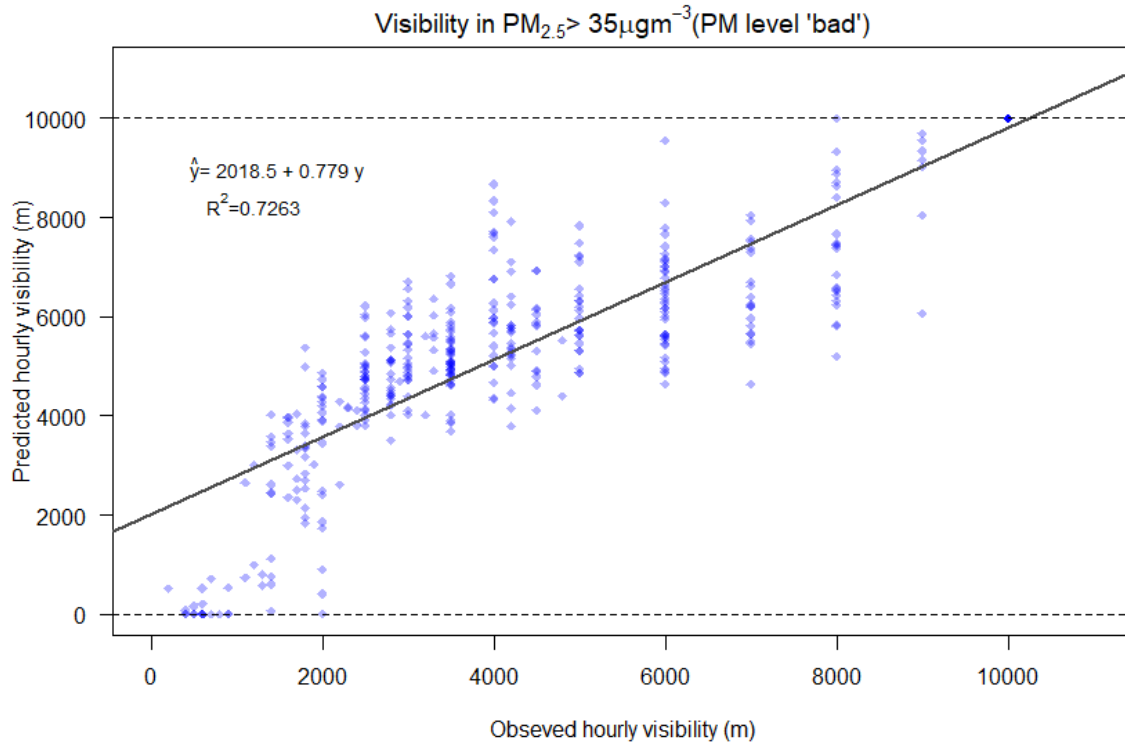
<sup>a</sup> Signif. codes: \*, \*\*, \*\*\* Significant at the 0.05, 0.01, and 0.001 probability level, respectively.



**Fig. S-1.** Observed and predicted hourly visibility for  $PM_{2.5} > 35 \mu g m^{-3}$  at IIA from 1 January till 25 May 2018 from the Model 0, in which  $PM_{10}$ ,  $PM_{2.5}$  and WX are excluded.



**Fig. S-2.** Observed and predicted hourly visibility for  $\text{PM}_{2.5} > 35 \mu\text{g m}^{-3}$  at IIA from 1 January till 25 May 2018 from Model 1, in which WX is excluded.



**Fig. S-3.** Observed and predicted hourly visibility for  $\text{PM}_{2.5} > 35 \mu\text{g m}^{-3}$  at IIA from 1 January till 25 May 2018 from Model 2, in which interactions between variables are excluded.