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Atmospheric Chemistry and Physics Discussions

Supplement of

Assessing the ammonium nitrate formation regime in the Paris megacity and its representation in the CHIMERE model

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Supplementary material

S.1 Ions balance

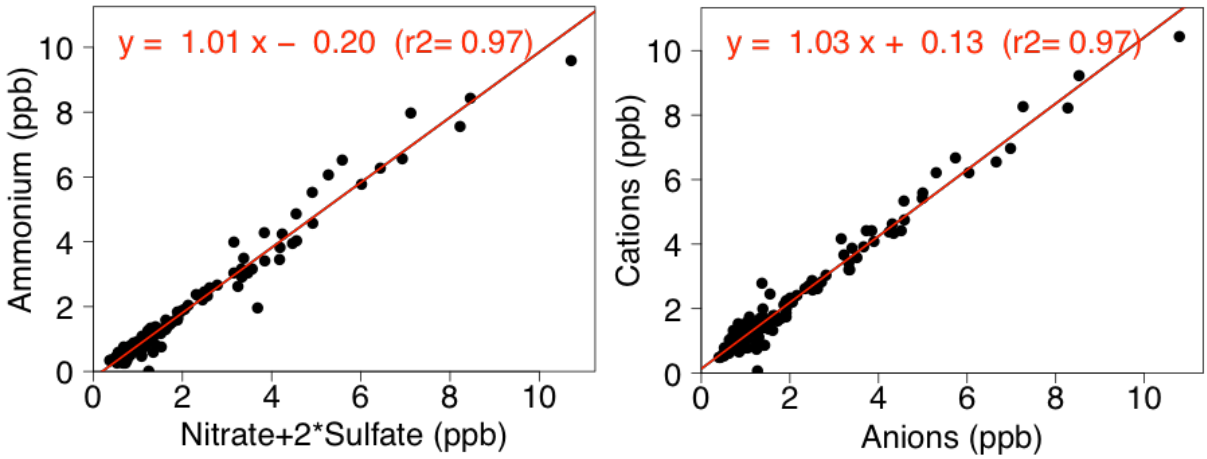

Figure S1: Ions balance in Paris (based on daily observations), considering only NH_4^+ versus NO_3^- $+2SO_4^{2-}$ (left panel) and all available cations and anions (i.e. NH_4^++K^++$2Ca^{2+}$+Na^++$2Mg^{2+}$ versus NO_3^-+$2SO_4^{2-}$+Cl-) (right panel).

S.2 Evaluation of the meteorology

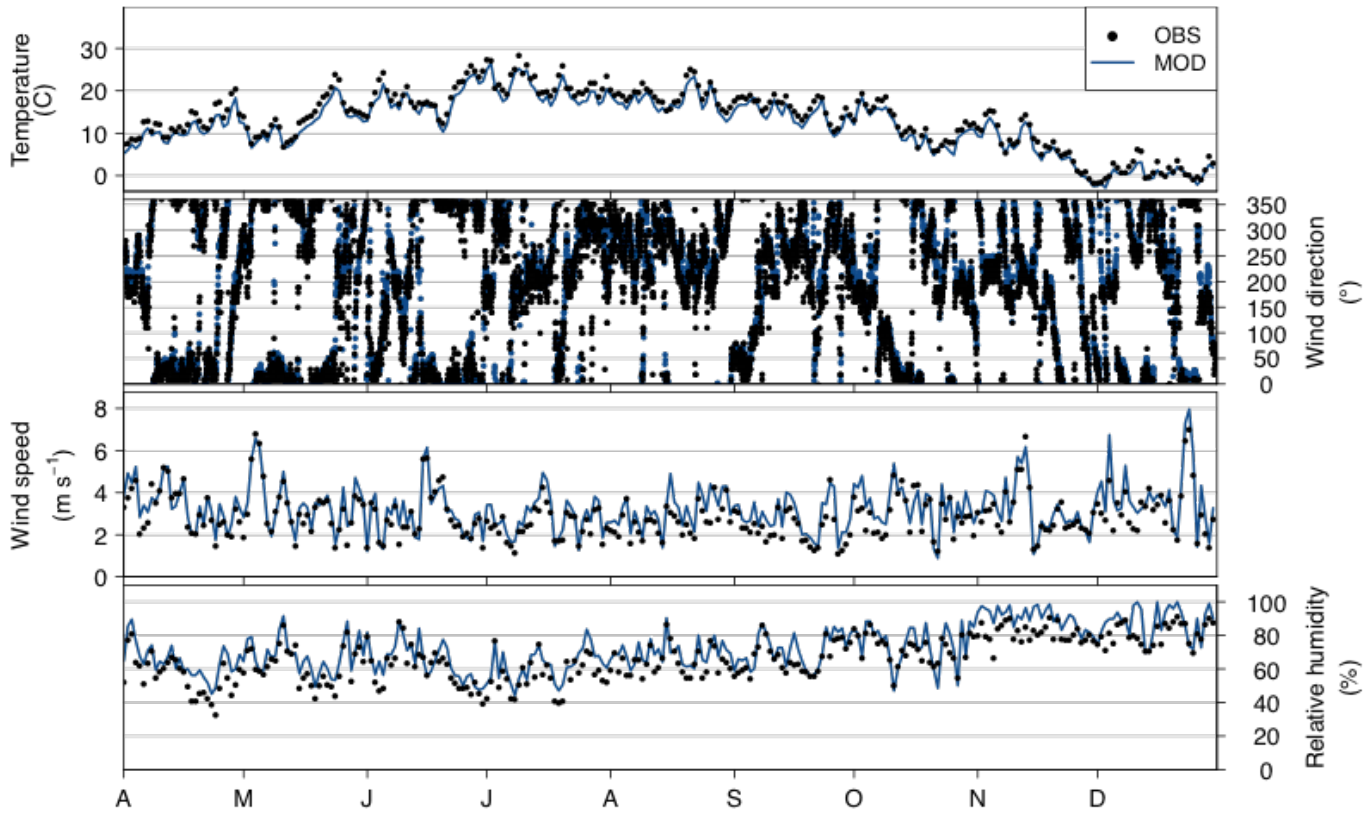

Figure S2: Measured and simulated daily temperature, hourly wind direction, daily wind speed and relative humidity at the MONTSOURIS site in Paris.

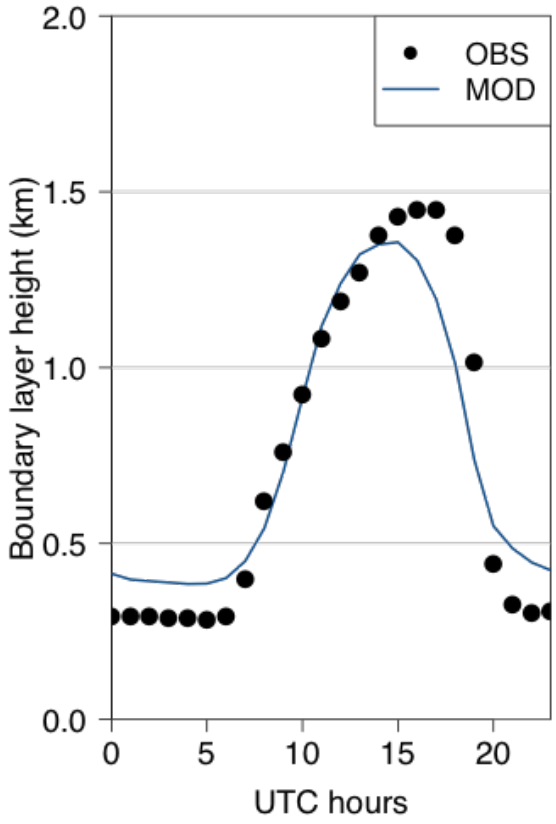

Figure S3: Measured and simulated boundary layer height (BLH) diurnal profile (average over the whole studied period) at the SIRTA site, measurements being derived from aerosol lidar observations.

Table S1: Statistical results on the meteorological parameters at the MONTSOURIS station (and at SIRTA site for the boundary layer height).

Parameter	MB	NMB (%)	RMSE	NRMSE (%)	R	N (%)
Temperature (°C)	-1.6	-	2.3	-	0.98	99
Wind speed (m s^{-1})	+0.4	+13	0.9	32	0.80	99
Relative humidity (%)	+5.9	+9	11.0	17	0.80	99
Boundary layer height (m)	+84	+11	384	52	0.80	58

S.3 NH_3 emissions in the Paris region

According to the TNO-MP inventory (see Table S2), the main NH_3 emission sources in the Paris region are the agriculture (SNAP 10, 67%), the combustion in manufacturing industry (SNAP 3, 20%), followed by production processes (SNAP 4, 8%) and non-industrial combustion plants (SNAP 2, 4%). Compared to the repartition of emissions at the national scale, the main

discrepancies are found in SNAP 10 (that represent 96% of French NH_3 emissions) and SNAP 3 (whose emissions are essentially concentrated in the Paris region). Despite the much higher contribution of emission sources other than agricultural in the Paris region (33 against 4%), the local formation of ammonia in Paris remains very low, which underlines again the importance of SNAP 10 emissions outside the Paris region.

Table S2: Annual NH_3 emissions (t yr^{-1}) in France (and percentage of total) in the TNO-MP inventory.

SNAP* sector and description	France	Paris region
1. Combustion in energy and transformation industries	49 (<1%)	0 (0%)
2. Non-industrial combustion plants	240 (<1%)	194 (4%)
3. Combustion in manufacturing industry	1 032 (<1%)	1 012 (20%)
4. Production processes	3 034 (<1%)	416 (8%)
5. Extraction/distribution of fossil fuels/geothermal energy	6 (<1%)	0 (0%)
6. Solvent use and other product use	15 (<1%)	0.05 (<1%)
7. Road transport	13 617 (2%)	0 (0%)
8. Other mobile sources and machinery	6 (<1%)	0 (0%)
9. Waste treatment and disposal	10 315 (1%)	11 (<1%)
10. Agriculture	717 177 (96%)	3 361 (67%)
Total	745 489 (100%)	4994 (100%)

* SNAP: Selected Nomenclature Air Pollution.

S.4 Other supplementary figures

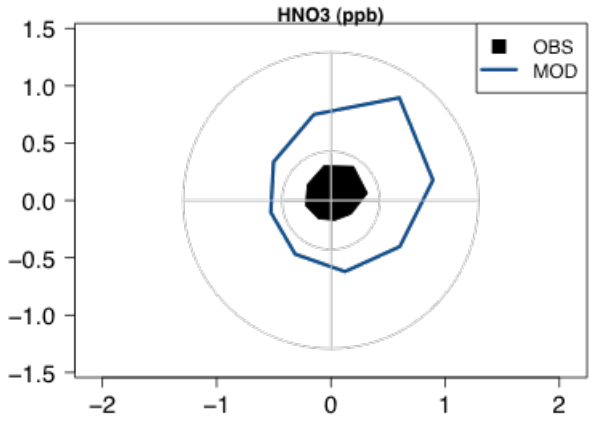

Figure S4 : Measured and simulated pollution rose of HNO_3 in Paris. HNO_3 concentrations are measured at LHVP, wind direction is measured at the MONTSOURIS site (two kilometers from LHVP).

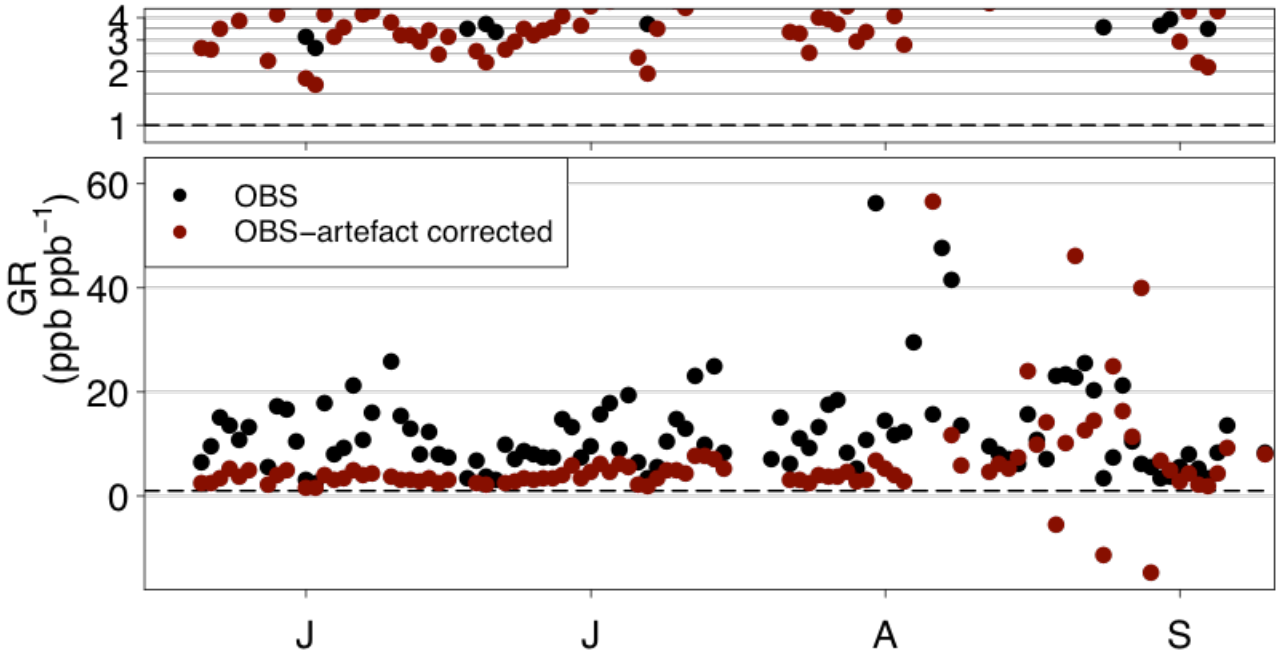

Figure S5: Experimentally determined GR with raw concentration data (in black) and with artefact-corrected ammonium and nitrate concentrations (in red) (see text in Sect. 4.4.2 for explanations) in the low panel. Zoom with logarithmic scale in the top panel.

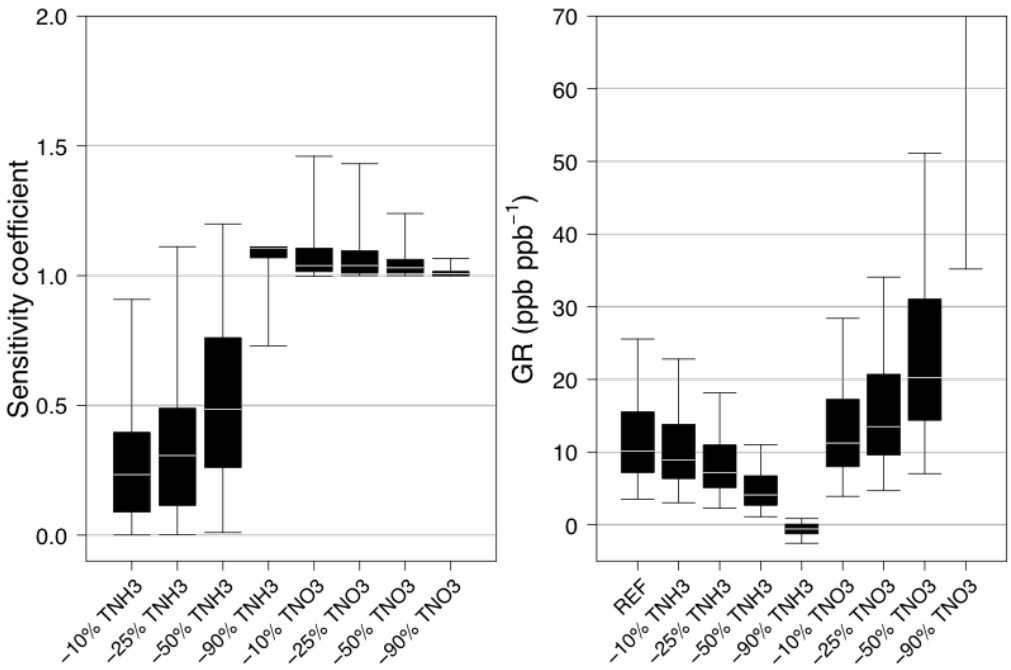

Figure S6: Sensitivity coefficient of aerosol nitrate to different changes (-10, -25, -50 and -90%) in TNH_3 and TNO_3 concentrations (left panel) and resulted GR (right panel) during the period from 2010 May 15 to September 10, deduced from observations with temperature decreased by 10°C and RH increased by 0.20.