



*Supplement of*

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

**Hervé Petetin et al.**

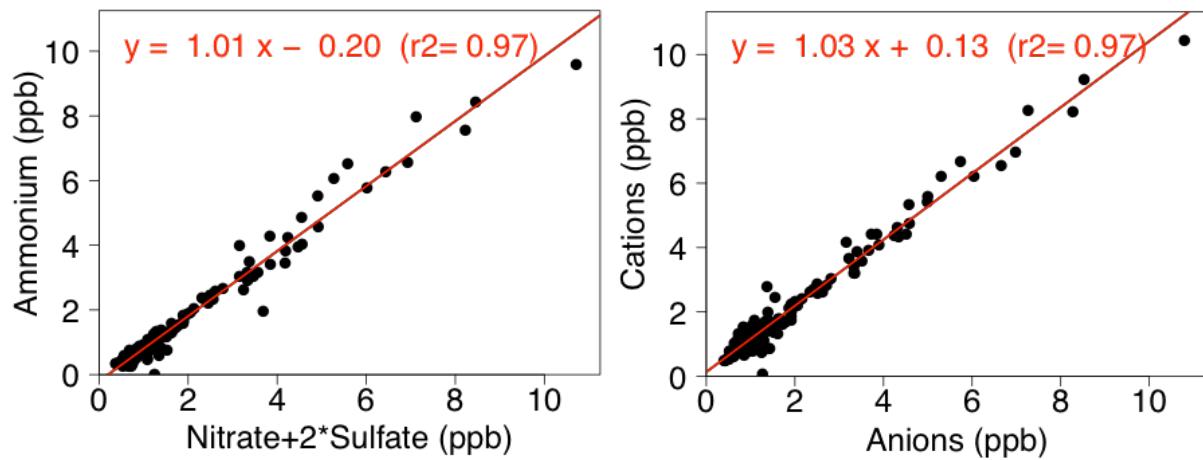
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# 1 Supplementary material

## 2 S.1 Ions balance

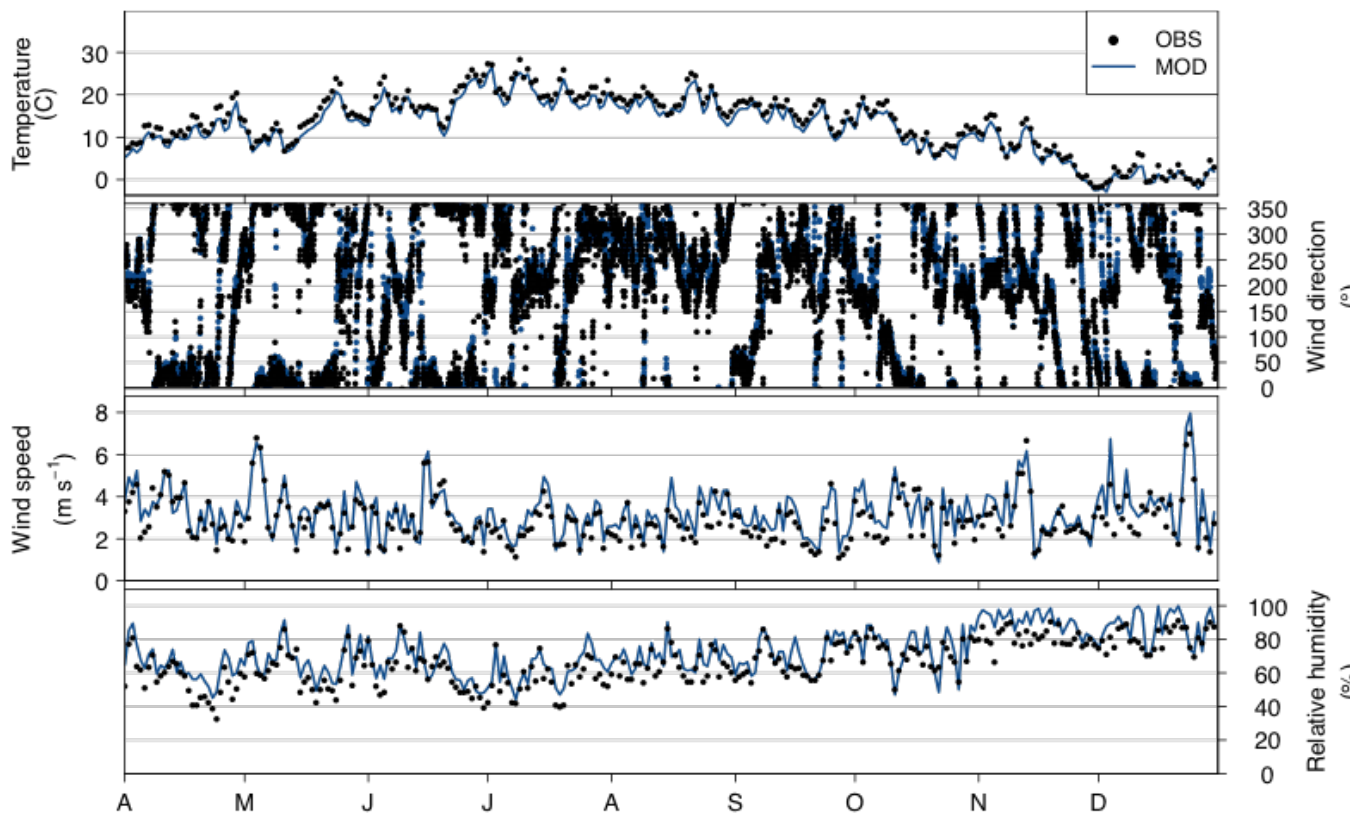
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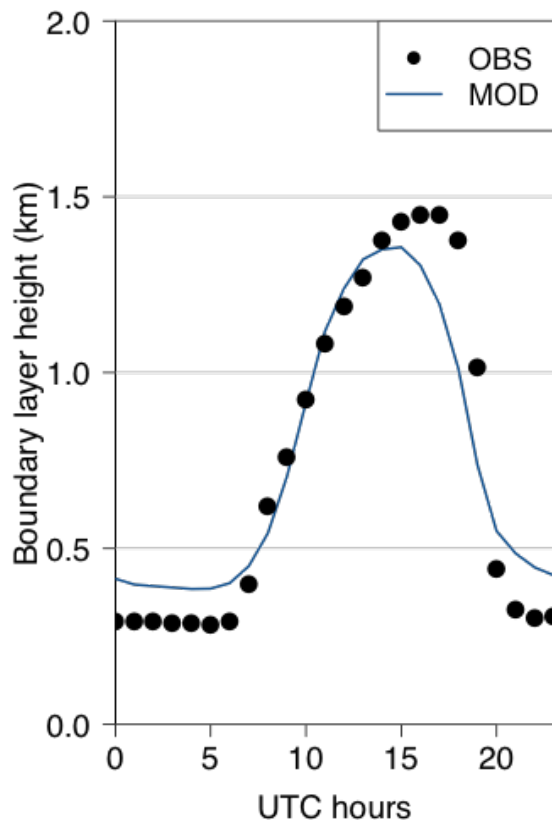
5 Figure S1: Ions balance in Paris (based on daily observations), considering only  $\text{NH}_4^+$  versus  $\text{NO}_3^-$   
6  $+2\text{SO}_4^{2-}$  (left panel) and all available cations and anions (i.e.  $\text{NH}_4^+ + \text{K}^+ + 2\text{Ca}^{2+} + \text{Na}^+ + 2\text{Mg}^{2+}$  versus  
7  $\text{NO}_3^- + 2\text{SO}_4^{2-} + \text{Cl}^-$ ) (right panel).

## 8 S.2 Evaluation of the meteorology

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



1  
 2 Figure S3: Measured and simulated boundary layer height (BLH) diurnal profile (average over the  
 3 whole studied period) at the SIRTA site, measurements being derived from aerosol lidar  
 4 observations.

5  
 6  
 7 Table S1: Statistical results on the meteorological parameters at the MONTsouris station (and at  
 8 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 <sup>-1</sup> )	+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

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10 **S.3 NH<sub>3</sub> emissions in the Paris region**

11 According to the TNO-MP inventory (see Table S2), the main NH<sub>3</sub> emission sources in the Paris  
 12 region are the agriculture (SNAP 10, 67%), the combustion in manufacturing industry (SNAP 3,  
 13 20%), followed by production processes (SNAP 4, 8%) and non-industrial combustion plants  
 14 (SNAP 2, 4%). Compared to the repartition of emissions at the national scale, the main

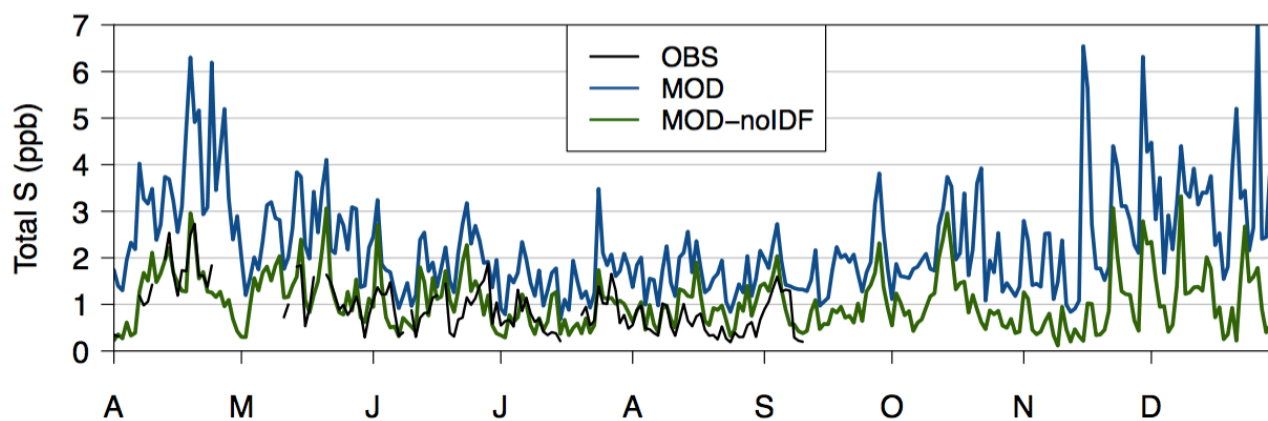
1 discrepancies are found in SNAP 10 (that represent 96% of French NH<sub>3</sub> emissions) and SNAP 3  
 2 (whose emissions are essentially concentrated in the Paris region). Despite the much higher  
 3 contribution of emission sources other than agricultural in the Paris region (33 against 4%), the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

6 Table S2: Annual NH<sub>3</sub> emissions (t yr<sup>-1</sup>) in France (and percentage of total) in the TNO-MP  
 7 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%)

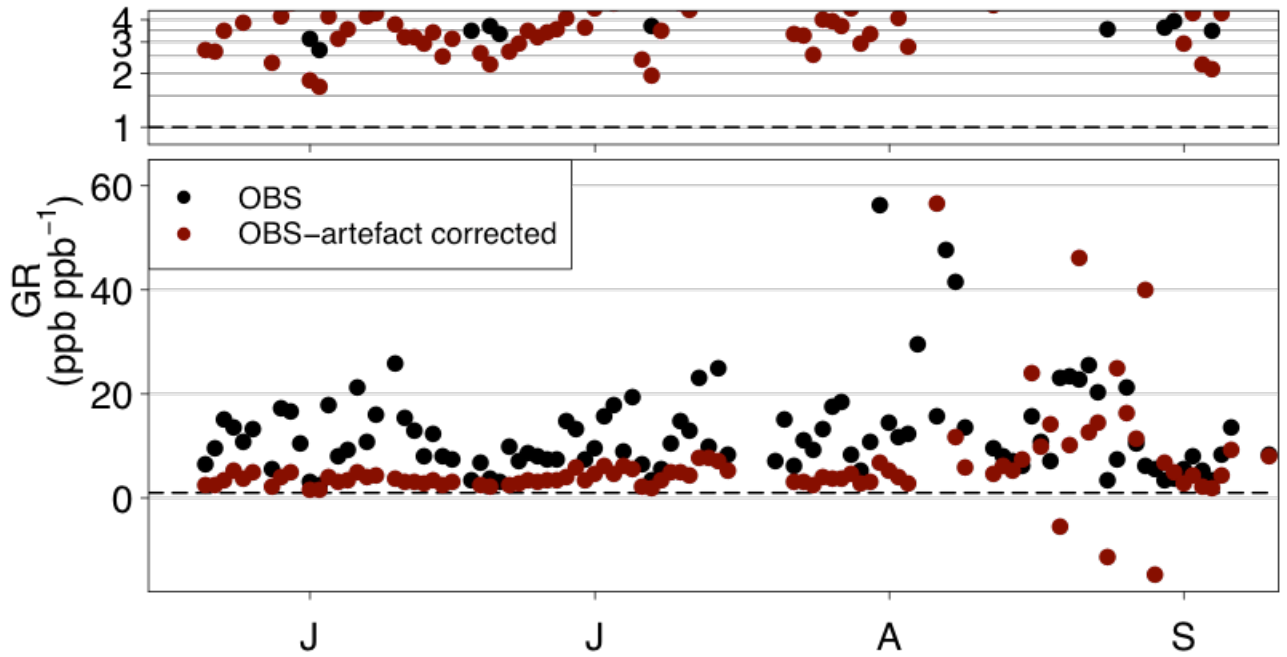
8 \* SNAP: Selected Nomenclature Air Pollution.

#### 9 S.4 Other supplementary figures



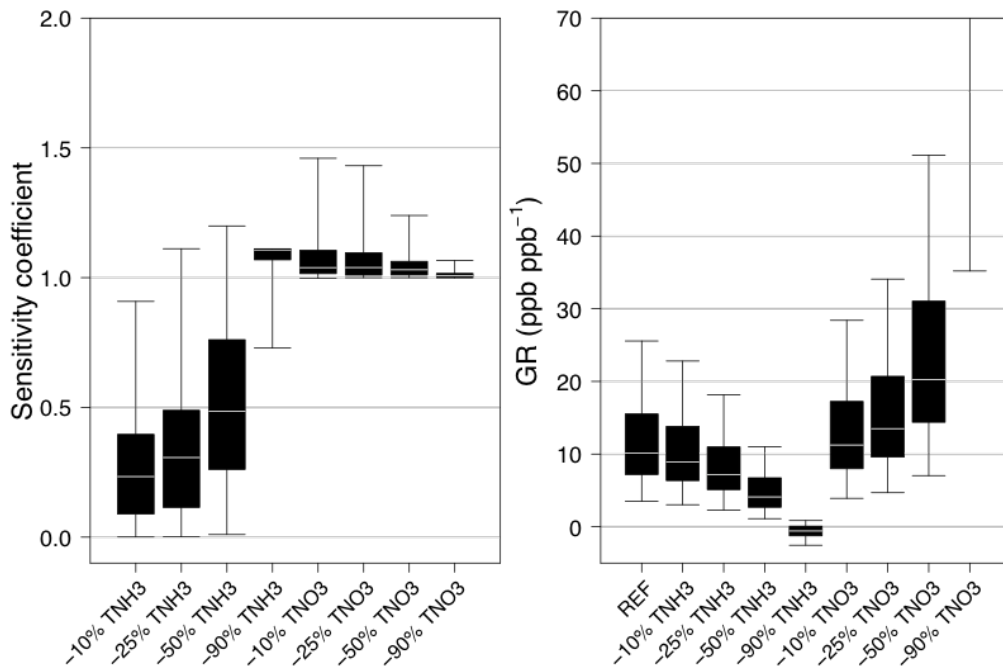
10  
 11 Figure S4: Observed and modelled (with – MOD case – and without – MOD-noIDF case –  
 12 emissions over the Paris region) daily total S (=SO<sub>2</sub>+SO<sub>4</sub><sup>2-</sup>) concentrations in Paris.

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1  
 2 Figure S5: Experimentally determined GR with raw concentration data (in black) and with artefact-  
 3 corrected ammonium and nitrate concentrations (in red) (see text in Sect. 4.4.2 for explanations) in  
 4 the low panel. Zoom with logarithmic scale in the top panel.

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6  
 7 Figure S6: Sensitivity coefficient of aerosol nitrate to different changes (-10, -25, -50 and -90%) in  
 8 TNH<sub>3</sub> and TNO<sub>3</sub> concentrations (left panel) and resulted GR (right panel) during the period from  
 9 2010 May 15 to September 10, deduced from observations with temperature decreased by 10°C and  
 10 RH increased by 0.20.

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