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Atmospheric ammonia variability and link with particulate matter formation: a case study over the Paris area

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Figure S1: Time series of daily mean NH_3 concentrations (in molecules/cm^2) derived from IASI (upper panel) and $PM_{2.5}$ concentration (in in µg/m^3) observed over the IdF region between 2013 and 2016.

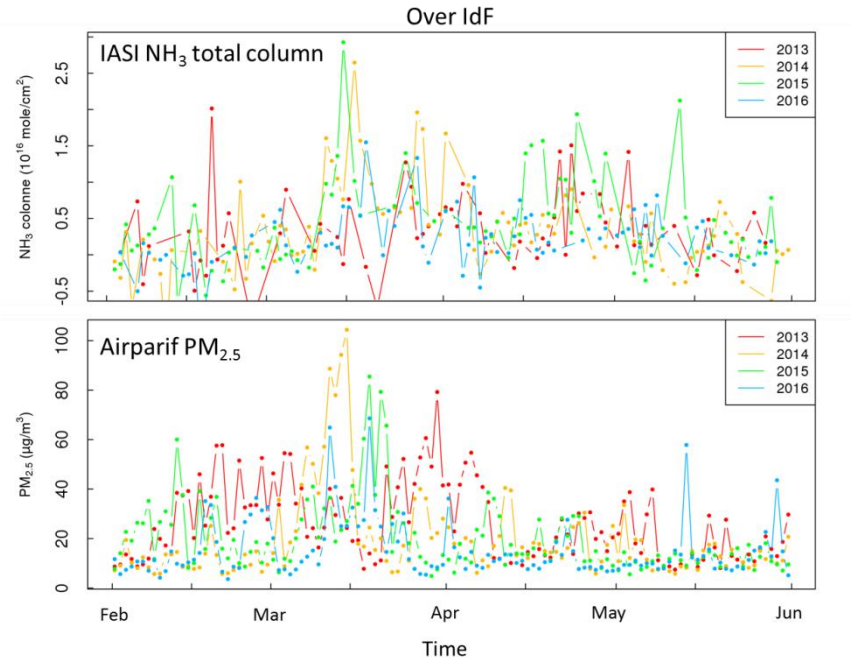


Figure S2: Bar plots of monthly mean NH_3 total columns derived from IASI (panel a), total precipitation (panel b) and skin temperature (panel c) derived from ECMWF from March to August, plotted in different colors for the different years of measurements from 2008 to 2017.

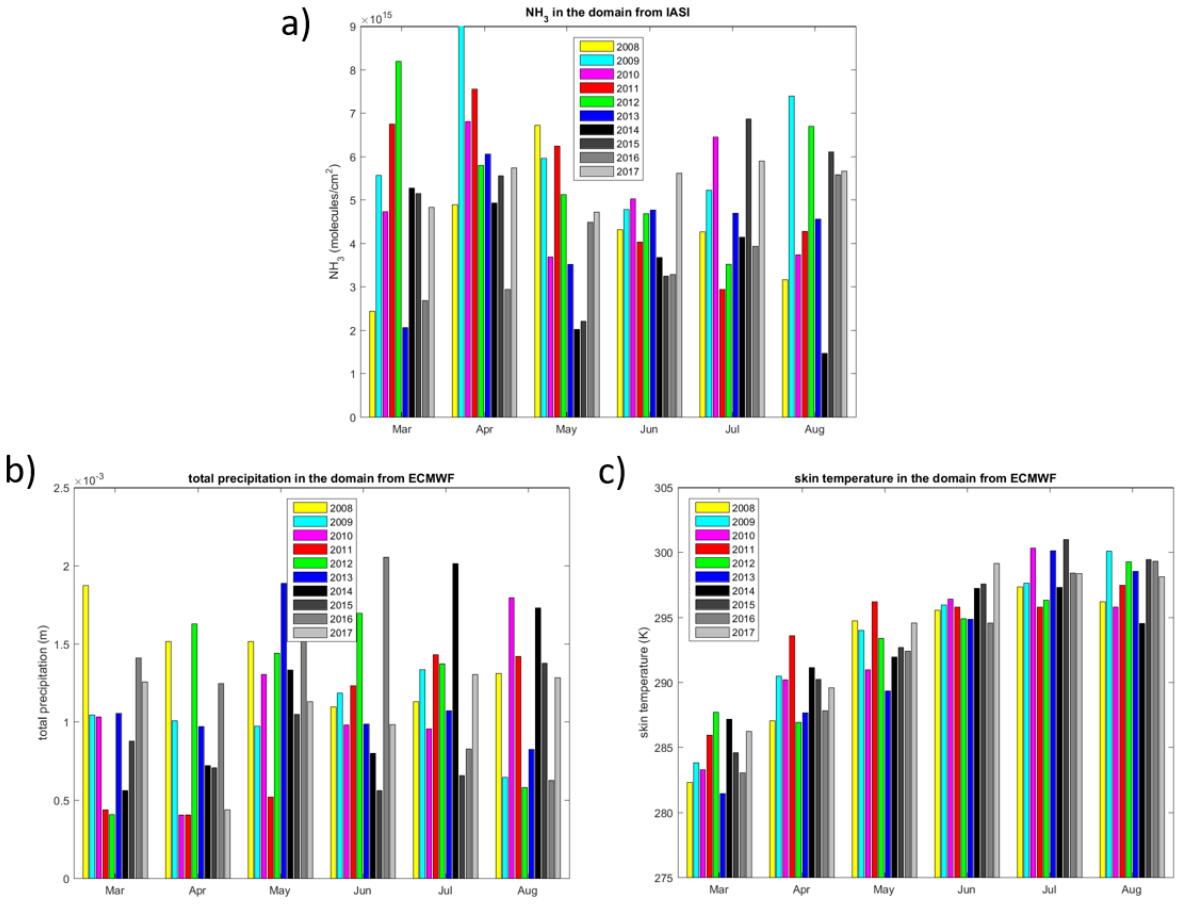


Figure S3: Difference (model - observations) between the standardized NH_3 columns derived from the satellite instruments (IASI - left panels, and CrIS - right panels) and the corresponding NH_3 columns derived from the CHIMERE model for March-April 2014 and 2015.

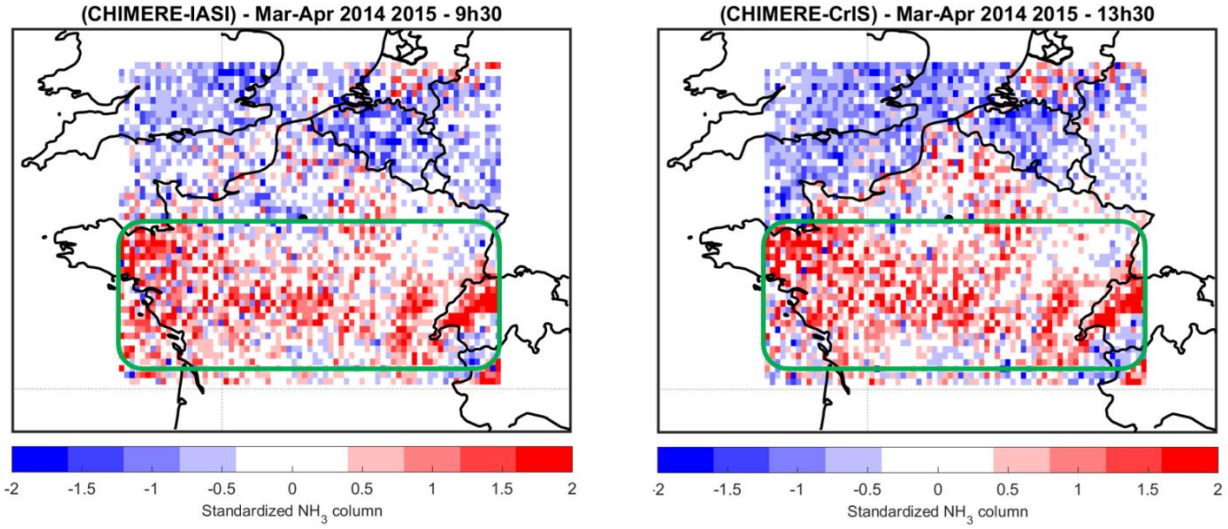


Figure S4: 10-years of monthly mean concentrations of NH_3 total columns derived from IASI in orange and $PM_{2.5}$ derived from the Airparif network in red from 2008 to 2017.

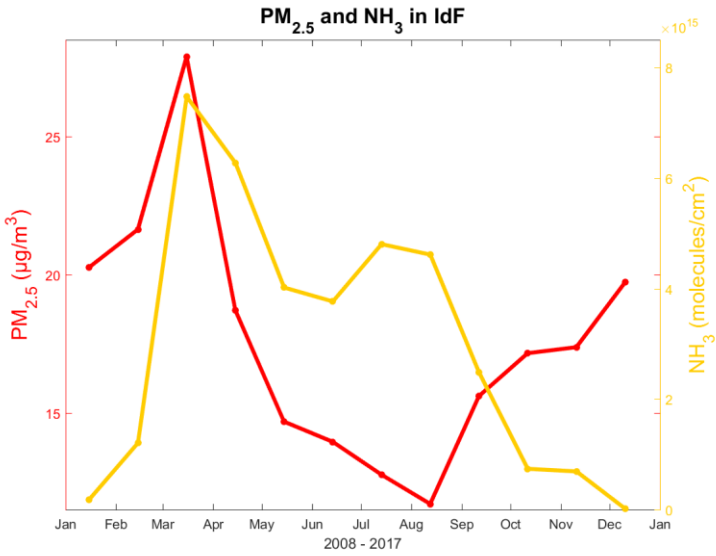
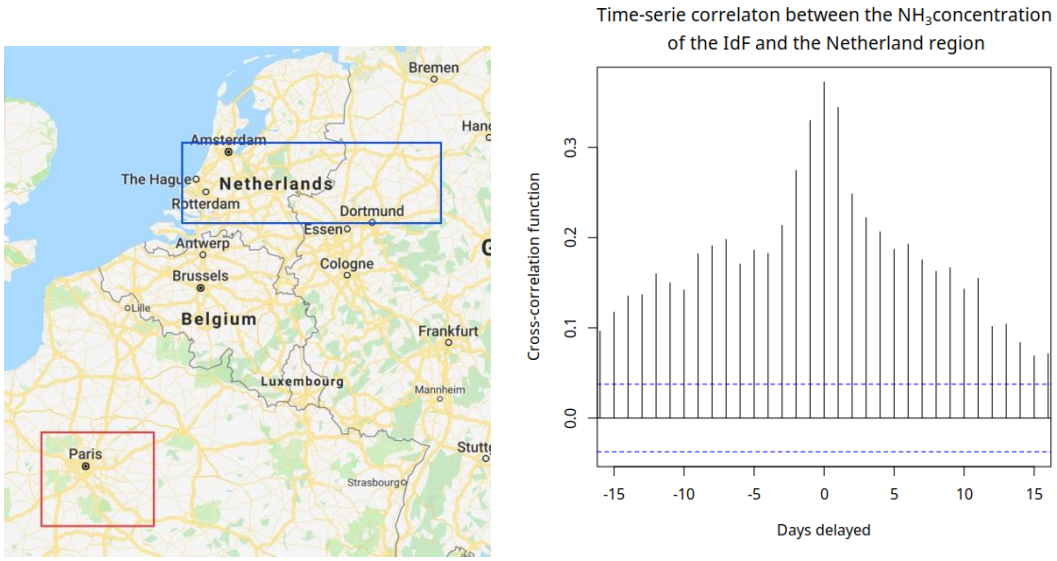


Figure S5: Cross-correlation analysis of NH_3 concentrations between the Northeast part of the domain (over the Netherlands) and the IdF region. Map provided by GOOGLE EARTH V7.3.2.5776, US Dept. of State Geographer, © Google maps, 2019, Image Landsat/Copernicus, Data SIO, NOAA, US, Navy, NGA, and GEBCO.



The cross-correlation function (CCF) is calculated between the daily averaged mean of the IASI NH_3 columns observed over these two regions (both are average values of available pixels of the same day). From the CCF plot, we can see that when lag = 0 (i.e. within the same day), the cross-correlation is maximum with CCF = 0.37, and the CCF is above 0.3 when lag=±1 (i.e. 1 day before or after) for the whole time period (2008-2016). Therefore, correlation between NH_3 concentrations over the northeast part of the domain and the IdF region is relatively correlated. This confirms the result suggested by the back-trajectory analysis in Figure 10. We have also computed the CCF over these two regions considering months with high NH_3: the maximum CCF between March and August and between March and April are 0.35 and 0.26, respectively.

Figure S6: Wind roses of studied cases corresponding to the ensemble (all observations from 2013 to 2016), case A (NH_3 and $PM_{2.5}$ exhibits simultaneous enhancements over Paris) and case B (NH_3 and $PM_{2.5}$ are enhanced independently).