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First multi-year ground-based measurements of NH3 total columns over the Paris region (France), from the OASIS FTIR solar observatory

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Ammonia (NH3) is a reactive air pollutant strongly affecting both environment and human health. Massive industrial production of ammonia and the development of crops enhancing biological nitrogen fixation disturb the natural cycle and contribute to eutrophication, and acidification of various environments (lakes, streams, coastal ecosystems, soils etc.) (Vitousek et al., 1997; Howarth et al., 2000; Galloway et al., 2003). Within the troposphere, NH3 can react with H2SO4 or HNO_3 to produce fine particulate matter (PM2.5) of ammonium salts (Swartz et al., 1999 ; Lin and Cheng, 2007). Thus, measuring atmospheric ammonia is necessary to better constrain particulate matter formation and reactive nitrogen budgets in air quality models.
In this study, we present the first multi-year time series of NH3 ground-based measurements in Paris region (2009-2016), which is a European megacity (12 Million people) surrounded by a large rural region. To obtain it, we use the mid-resolution OASIS (Observations of the Atmosphere by Solar absorption Infrared Spectroscopy) groundbased FTIR solar observatory (Viatte et al., 2011 ; Chelin et al., 2015) to derive ammonia total columns over Paris suburbs (Créteil, 48.79°N, 2.44°E, France) using the PROFFIT inversion code (Hase et al., 2004). Previously used to analyse solar absorption spectra measured at high resolution for the NDACC (Network for the Detection of Atmospheric Composition Change) or TCCON (Total Carbon Column Observing Network) stations, the retrieval code PROFFIT has been adapted to deal with spectra recorded at medium spectral resolution with a Bruker Optics Vertex 80 FTIR spectrometer. The OASIS observatory is located at the Paris megacity urban region and has been already used to the study of air quality (tropospheric ozone and CO), given its sensitivity to surface pollutant concentrations.
We analyse seasonal variabilities of NH3 and study the relationship with meteorological variables. We also compare NH3 total columns derived from OASIS and those from IASI satellite measurements (Whitburn et al., 2016).

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