

EGU23-4564, updated on 24 Apr 2024

<https://doi.org/10.5194/egusphere-egu23-4564>

EGU General Assembly 2023

© Author(s) 2024. This work is distributed under the Creative Commons Attribution 4.0 License.



Measurements of ammonia in ambient air and over a controlled artificial source during the AMICA field campaign at a rural site in the Ile-de-France region

Pascale Chelin¹, Sylvain Caville^{1,7}, Nadir Guendouz³, Vincent Michoud², Antonin Bergé¹, Alain Fortineau⁴, Céline Decuq⁴, Pauline Buysse⁴, Benjamin Loubet⁴, Baptiste Esnault⁴, Sophie Générumont⁴, Raluca Ciuraru⁴, Michel Burban⁴, Jérémie Depuydt⁴, Brigitte Durand⁴, Camille Viatte³, Cristelle Cailteau-Fischbach³, Jean-Eudes Petit⁵, Sabine Crunaire⁶, Pablo Espina⁶, Nathalie Redon⁶, Lilian Joly⁷, Julien Cousin⁷, Florian Parent⁷, Jean-Louis Bonne⁷, Christophe Flechard⁸, Yannick Fauvel⁸, Anne-Claude Romain⁹, and Marie Scheuren⁹

¹Univ Paris Est Creteil and Université de Paris Cité, CNRS, LISA, F-94010 Créteil, France.

²Université de Paris Cité and Univ Paris Est Creteil, CNRS, LISA, F-75013 Paris,

³LATMOS/IPSL, Sorbonne Université, UVSQ, CNRS, Paris, France

⁴UMR ECOSYS, INRAE, AgroParisTech, Université Paris-Saclay, 78850, Thiverval-Grignon, France.

⁵Laboratoire des Sciences du Climat et de l'Environnement, LSCE, UMR CNRS-CEA-UVSQ, IPSL, 91191 Gif-sur-Yvette, Île-de-France, France

⁶IMT Nord Europe, Institut Mines-Telecom, Univ. Lille, Centre d'Enseignement, de Recherche et d'Innovation Énergie Environnement, 59000 Lille, France

⁷GSMa, UMR CNRS 7331, U.F.R. Sciences Exactes et Naturelles, Université de Reims, Reims, France

⁸Institut National de la Recherche en Agriculture, Alimentation et Environnement (INRAE), UMR 1069 SAS, 65 rue de Saint-Brieuc, 35042 Rennes, France

⁹Sensing of Atmospheres and Monitoring (SAM), Department of Environmental Sciences and Management, University of Liege, - Avenue de Longwy 185, 6700 Arlon (Belgium)

Ammonia is an atmospheric pollutant precursor of inorganic fine particles (sulphate and ammonium nitrate particles) that are particularly harmful to human health. Ammonia and particulate matter (PM) are responsible for severe pollution outbreaks over Europe (LCSQA, LCSQA 2019), during springtime of 2012 (Kutzner et al., 2021), 2014 (Fortems-Cheiney et al., 2016), 2015 (Petit et al., 2017), 2016 (Tournadre et al., 2020; Viatte et al., 2020) and 2020 (Viatte et al., 2021). Despite this major societal and scientific interest, there is a crucial lack of routine ammonia and aerosol speciation observations. One of the scientific reasons comes from the difficulty to measure atmospheric ammonia due to its sticky, volatile, and reactive nature (von Bobruzki et al., 2010).

The objective of the Multi-Instrumental Analysis of Ammonia Concentrations (AMICA) project is to compare the response of different available systems for measuring atmospheric ammonia at a rural site in the Île-de-France region. The 14 instruments based on different NH₃ measurement techniques are compared over a wide range of ammonia concentrations from ambient atmospheric to boosted concentrations (10 to 600 ppbv) using an innovative 400 m² ammonia

emission system. They are all synchronized with a cross-correlation function based on the median value. At elevated concentrations all inlet-based instruments sampling to the same manifold performed very well on precision, even at high temporal resolution monitoring (1 min) that highlights a great progress for current in situ NH₃ analysers. By comparing with the data from a mini Differential Optical Absorption Spectrometer (miniDOAS) and a sequential acid trap-IC (ROSAA), we demonstrated that inlet design perturbs the response time of the instruments connected to the manifold, which was already mentioned in literature. This measurement campaign is part of a series of ammonia projects that have recently taken place in France.

References

Fortems-Cheiney, A., *et al.*, *Geophys. Res. Lett.*, 43, 5475–5482, <https://doi.org/10.1002/2016GL069361>, 2016.

Kutzner, R. D., *et al.*, *Atmos. Chem. Phys.*, 21, 12091–12111, <https://doi.org/10.5194/acp-21-12091-2021>, 2021.

LCSQA, Le Laboratoire Central de Surveillance de la Qualité de l'Air, Bilan des travaux 2018-2019 du programme CARA, Ref. INERIS : DRC-19-181155-02828A, 2019.

Petit, J.-E. , *et al.*, *T, Atmospheric Environment*, Volume 155, 2017, Pages 68-84, ISSN 1352-2310, <https://doi.org/10.1016/j.atmosenv.2017.02.012>.

Tournadre, B., *et al.*, *Atmos. Meas. Tech.*, 13, 3923–3937, <https://doi.org/10.5194/amt-13-3923-2020>, 2020.

Viatte, C., *et al.*, *Atmos. Chem. Phys.*, 20, 577–596, <https://doi.org/10.5194/acp-20-577-2020>, 2020.

Viatte C., *et al.*, *Atmosphere*, 2021, 12, 160, <https://doi.org/10.3390/atmos12020160>.

von Bobruzki, *et al.*, *Atmos. Meas. Tech.*, 3, 91–112, <https://doi.org/10.5194/amt-3-91-2010>, 2010.