

# Project Newsletter



## Spring 2024

Project updates and activities  
Meet more partners

## Welcome to the 3<sup>rd</sup> newsletter!

This newsletter contains a brief report of some ammonia flux measurements taking place in the summer of 2023 together with a number of presentations at symposia and workshops. We also introduce more of the project consortium.

### Date for the diary:

There will be a special session concerning the **quantiAGREMI** project at the 14<sup>th</sup> **International Conference on Air Quality** held between the 14<sup>th</sup> and 17<sup>th</sup> **May 2024** at Kumpula, Helsinki. Information can be found at the conference website: <https://www.helsinki.fi/en/conferences/air-quality-2024>.

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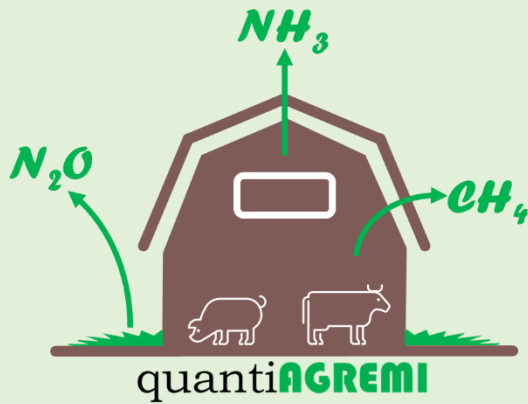
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# Project updates and activities

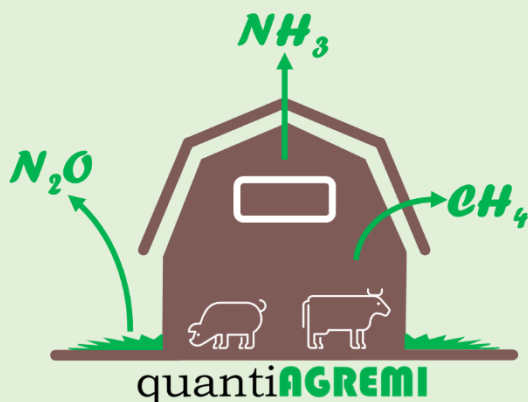
## Testing and evaluation of $NH_3$ flux measurement systems

Since  $NH_3$  has distinct adhesive properties and is extremely soluble in water,  $NH_3$  flux measurements have remained a challenge. As such, quantification of the uncertainty of different  $NH_3$  flux methods is pertinent to improve quantification of  $NH_3$  emissions and deposition around livestock buildings.

**QuantiAGREMI** project partners KIT, METAS, UKCEH and TI were joined by Bern University of Applied Sciences (Switzerland), EMORY University (USA), INRAE (France) to test and evaluate different measurement systems for the determination of ammonia fluxes.

To address both emission and deposition fluxes a series of experiments was conducted during a field study in June/July 2023 in Germany. As a start, background measurements were undertaken where it was assumed deposition fluxes would be the dominant feature. Subsequently, a known amount of  $NH_3$  was released from a circular area within a small footprint of the field. Finally, a known amount of manure was applied to the entire agricultural site in order to cover the footprints of the different measurement approaches. This experiment will contribute to contextualize different measurement approaches as well as identify and characterize technologies for  $NH_3$  flux measurements.





## Symposium on ammonia emissions

On November 24<sup>th</sup> 2023 the Bayerischer Bauernverband (BBV, Bavarian Farmer Association) organized a symposium on ammonia emissions, manure acidification and manure amendments in the “House of Bavarian Agriculture” in Herrsching, Germany.

**quantiAGREMI** project partner KIT, together with Justus-Liebig University Giessen, was invited to give a keynote. Among other results from literature studies and laboratory incubation experiments, preliminary findings of the campaign to test and evaluate different ammonia flux measurement systems in June/July were presented.

The [BBV website](#) contains a summary of the symposium (in German)

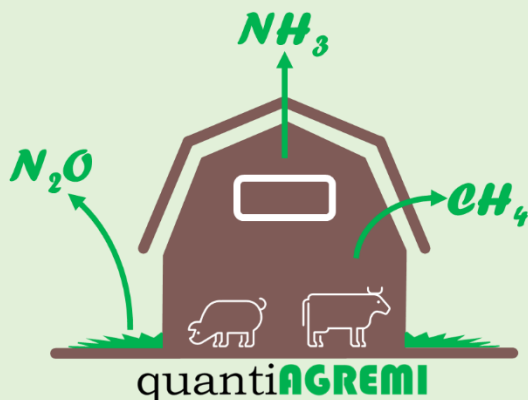
## Workshop

On December 7<sup>th</sup> 2023 **quantiAGREMI** project partner KIT invited stakeholders to a workshop on “*Relevance of manure, biogas residues, fertilizer additives and ammonia emissions for Nitrogen cycling in agricultural ecosystems*” to the KIT Institute of Meteorology and Climate Research in Garmisch-Partenkirchen.

The workshop was advertised through the German trade association of Biogas farmers. The fourteen participants, comprising farmers, consultants and researchers showed lively interest in the preliminary results of the campaign to test and evaluate different ammonia flux measurement systems in June/July 2023. The campaign was carried out by the **quantiAGREMI** partners KIT, METAS, UKCEH and TI, who were joined by Bern University of Applied Sciences (Switzerland), EMORY University (USA) and INRAE (France).

## Picarro Ammonia Summit 2024

In March 2024 Picarro organized the [Ammonia Summit](#) in Aarhus, Denmark, where experts in agriculture and biology from different countries met. During the two-day event participants presented their research and experience an ammonia analysis and emission measurements under various fertilization schemes and farm settings, Picarro provided hands-on technical demonstrations on their state-of-the-art analytical instruments, and Aarhus University offered a visit to one of their experimental field sites. METAS had the opportunity to present the **quantiAGREMI** project to the audience and exchange the goals and actions of our work. The lively discussions reassured that **quantiAGREMI** can provide valuable input and services to the wider research community.



## Meet the Consortium

In this newsletter, we introduce more of the project partners within the **quantiAGREMI** project – this time it's the sensor manufacturers and some others.

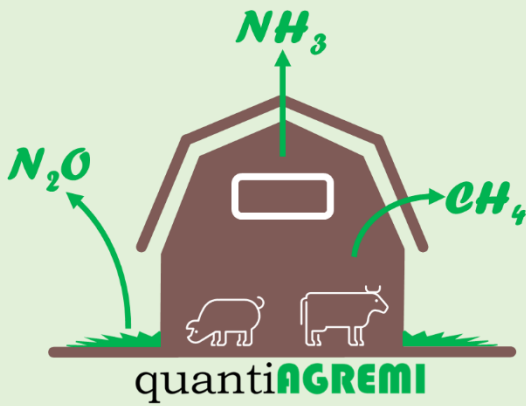
### IMTelecom

IMT Nord Europe is a French Graduate School of Engineering affiliated to the Institut Mines-Télécom and a partner of the University of Lille. The school is developing research in three main areas of expertise: energy and environment (CERI EE), digital systems, materials and processes. CERI EE's research area focuses on the physicochemistry of trace species in the air and its fields of application. They concern both outdoor ambient air (troposphere) and indoor air (premises and confined spaces). The aim is to achieve a better understanding of the processes of generation and transformation of air pollutants and to propose solutions adapted to the needs of society and economic operators. In 2020, IMT Nord Europe joined the Shanghai world ranking for the theme "Atmospheric Sciences" based on the quantity and quality of its international publications. CERI EE has around ten active patents, demonstrating its ability to promote its research work, particularly to companies. Finally, in 2020, CERI EE became European national center for the measurement of reactive trace species in ambient air.

Within **quantiAGREMI** WP2, IMTelecom will optimize an autonomous  $NH_3$  gas sensor (CONIAC) based on a sensitive conducting polymer layer for various types of measurements, i.e. inside vs. outside and emission vs. immission. CONIAC is a validated sensor able to measure  $NH_3$  in the range 10 nmol/mol to 10  $\mu$ mol/mol. Development work will focus on the autonomy by reducing energy consumption, reinforce the stability and improve several aspects, i.e. drift and humidity influence. At least three functional systems will be optimized and deployed in the project. The IMTelecom sensor will then be used throughout the rest of WP2.

### Senseair

Senseair is a leading global provider of gas sensing technology. Senseair develops and produces the smallest and most cost-efficient high-precision, low power sensors for high-volume production for a wide range of applications such as indoor and outdoor air quality monitoring and GHG control. With over 30 years of experience, and about 200 employees, Senseair has become the centre of excellence in the field of non-dispersive infrared (NDIR) technology. Senseair holds around 40 patents relating to its proprietary measurement technique. Around a third of the Senseair manpower is dedicated to highly scientific R&D as well as advanced production techniques, always aiming to apply the newest technologies on the market to their products.



Sensair has also a long tradition of collaboration with both academic and industrial partners and is always aiming to apply the newest technologies to its products. They have already succeeded in providing  $CO_2$  sensors, which fit the needs for a deployment within urban networks to monitor the  $CO_2$  emissions at urban scales. They are on the way to introduce to the market a new compact mid-precision 3-channel NDIR sensor, which will open new doors in the field of environmental monitoring. This new sensor platform, so called K96, will allow to measurement simultaneously  $CO_2$ ,  $CH_4$  and  $N_2O$  concentrations with sub- $\mu\text{mol/mol}$  resolution making it suitable for applications like leak detection and emission monitoring in industrial facilities. With a small size, low power consumption and rugged design, the K96 sensors can be easily deployed in large number in dense networks around industrial facilities.

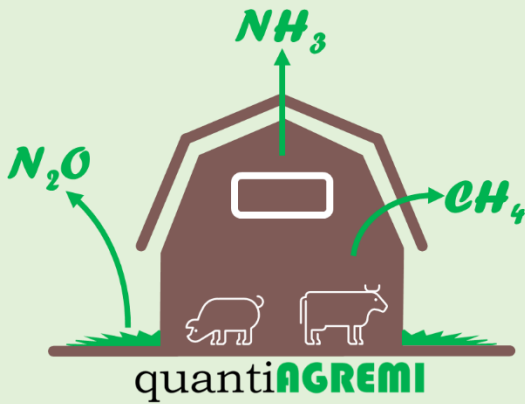
Sensair also contributes extensively to **quantiAGREMI** WP2 with further developments of the K96 sensor including packaging it in a thermo-regulated enclosure to improve overall performances, i.e. drift and accuracy, for measurements in farms. Additional components for wireless communication and power supply management will be included to end up with an easy to deploy solution for field measurements in farms.

## Gasera Ltd

Gasera's patented cantilever photoacoustic sensors are the global state-of-the art photoacoustic sensors on the market. GSR has been leading the way in developing portable, accurate, highly sensitive and selective PAS-based measuring devices for extreme conditions. The patented MEMS fabricated cantilever pressure sensor with an optical readout interferometer has brought a major advance to photoacoustic spectroscopy, by overcoming the electrical noise limitation of conventional microphone technology thereby improving the sensitivity in photoacoustics by more than a factor of 100, which is ultimately limited by the Brownian noise, i.e. random motion of gas molecules.

Gasera's units are used in various research, industrial and environmental applications in all regions of the world. GSR's main product lines are multi-gas sensors based on filtered blackbody radiators and more recent laser-based sensors for sensing one or several gases often below 1 nmol/mol sensitivity. GSR's sensor platform can be combined with multiple different light sources (DFB, QCL, OPO, EC-QCL, LED) ranging from visible range all the way to mid-infrared due to the unique wavelength-independent hyperspectral property of photoacoustic detection principle. Gasera is selling filter-based and laser-based products for GHG and livestock measurements.

Within **quantiAGREMI**, Gasera will develop a new laser-based and field-deployable instrument for detecting  $CH_4$ ,  $NH_3$ ,  $N_2O$  and  $H_2O$  simultaneously using only one Mid-IR laser. Target sensitivity ( $2\sigma$ , 60-sec) of the analyser for  $N_2O$  and  $NH_3$  is 10 nmol/mol and the estimated sensitivity for  $CH_4$  is 50 nmol/mol in order to fulfil expected requirements



## Vaisala Oyj

Vaisala is a global leader in the field of industrial humidity measurements with more than 80 years of experience in manufacturing humidity sensors. In addition to humidity products, Vaisala also offers products e.g. for  $CO_2$  and  $CH_4$  measurements. The Vaisala brand is typically seen in the most demanding measurement applications including e.g. Mars rovers. Vaisala also has in-house ISO/IEC 17025 accredited calibration laboratory.

Within the **quantiAGREMI** project, Vaisala's low-cost  $CO_2$  and  $CH_4$  sensors will be tested and evaluated within WP2 and then used in field measurements during WP3

## Wageningen University & Research

WR has a long tradition with emission measurements from animal housing systems (including end-of-pipe solutions), manure storages and manure processing. It operates a dedicated Air Quality Lab to calibrate equipment and carry out both reference and automated measurements. These also include novel techniques for continuous monitoring using sensors ( $NH_3$  and  $CH_4$ , together with supporting parameters like  $CO_2$ , temperature and relative humidity).

Within the **quantiAGREMI** project, WUR will facilitate a field test for measurements both inside and outside an animal house, including reference measurements.

## TNO

The Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO) is the Dutch research organization for applied scientific research. The team within the EMSA research group at TNO (formerly at ECN) has a long track record on the determination of emissions from complex and diffuse sources of varying nature, such as oil and gas platforms, landfills and livestock housing. TNO has unique expertise in the field of remote measurement techniques, which it will contribute to this project.

Within WP1 of the **quantiAGREMI** project, TNO will test the use of a dispersion model based on previous data to calculate emission factors from mobile and stationary concentration measurements outside the farm buildings. They will also provide a low-cost sensor for testing and evaluation within WP2