

## **First French Intercomparison Exercises for Air Quality sensors (EA $\mu$ C): results and assessment**

N. Redon (1), B. Herbin (1), F. Mathé (1), S. Crunaire (1),  
C. Marchand (2), L. Spinelle (2,\*), C. Mantelle (2), R. Aujay-Plouzeau (2)

(1) LCSQA – IMT Lille-Douai, Univ. Lille, SAGE-Département Sciences de l'Atmosphère et Génie de  
l'Environnement, F-59000 Lille, France

(2) LCSQA – INERIS, Parc technologique Alata, BP2, F-60550 Verneuil-en-Halatte, France

(\*) corresponding author: laurent.spinelle@ineris.fr

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### **1. SUMMARY:**

The increase of sensors for air quality monitoring on the market led the national agencies (Ministry in charge of the environment, the LCSQA and the authorized associations for air quality monitoring - AASQA) to study the reliability of these new devices. However, there is currently no national or European normative framework regulating their uses or giving the guideline to evaluate their performances against reference measurement systems. In this context, the LCSQA carried out the first national sensors' field evaluation for gas and particulate matter, used as fixed measurements for air quality monitoring in France (Directive EU 2008/50/CE).

This work has been carried out under real conditions on an urban site from the beginning of January until mid-February 2018. The objective was to set-up various devices in order to evaluate their abilities to measure the main pollutants of interest for ambient air: nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>) and particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>). This presentation will describe the methodology developed together with a synthesis of the results for NO<sub>2</sub> and PM<sub>2.5</sub>.

### **2. MOTIVATION and RESULTS:**

In a context of climate change, with the emergence of the Internet of Things and the plans to move towards smarter cities and a rapidly expanding market, the interest in small monitoring stations or sensors for air quality (outdoor or indoor) is growing. These sensors for gaseous and particulate pollutants, which can be deployed in large numbers at low cost, are attracting interest from the general public, associations, industry and local authorities alike.

The actors of the national system, including the Ministry in charge of the environment (MTES), the Associations Agréées de Surveillance de la Qualité de l'Air (AASQA) and the Laboratoire Central de Surveillance de la Qualité de l'Air (LCSQA), are interested in the potential offered by these new tools in addition to the reference measurement stations deployed so far. However, there is currently no national or European normative framework to evaluate the performance of these various devices on the market. Thus, after initiating work over the past two years to harmonize the metrological qualification of these devices in the laboratory, the LCSQA coordinated two national field intercomparison exercises in 2018 on gas and particle sensors ambient air quality monitoring. The first exercise was carried out for 6 weeks between January and February 2018. The second was held for 6 weeks between July and August 2018 to take into account the seasonality effect.

The objective of these tests was to place in real conditions on a fixed site of urban typology (air quality measurement station of the ITM Lille Douai on its research centre of Dorignies, Figure 1), a large number of different systems in order to evaluate their ability to monitor the main pollutants of interest to ambient air: nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>) and particles (PM<sub>2.5</sub> and PM<sub>10</sub>). These exercises involved nearly 25 participants, 23 systems of different design and origin (France, Netherlands, United Kingdom, Spain, Italy, Poland, United States), for a total of more than sixty devices in total, taking into account replicas.

The data were processed in comparison to the measurements of the reference instruments (automatic analysers). In addition to the metrological characteristics of the devices (calibration, stability (signal noise), reproducibility), a particular attention was paid to other parameters such as simplicity of implementation, autonomy, portability, reliability of communication systems (GSM, Wifi, Bluetooth, direct connection, etc.), user-friendliness of data recovery applications, quality/price ratio taking into account the initial objectives. The "assessment butterfly chart" gathering both metrological and qualitative evaluation (Figure 2) gives an overview of the performances to be considered and those with more or less significant effect based on the use the sensor is dedicated to.

FIGURES :



Figure 1: monitoring station where the sensors systems were mounted.

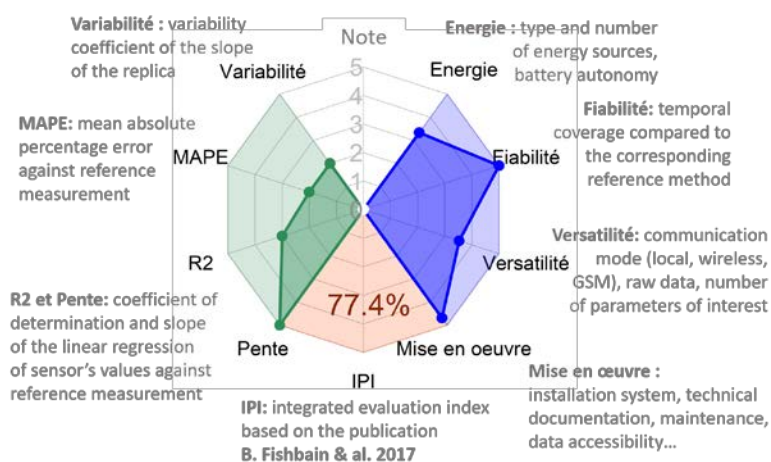


Figure 2: example of an assessment butterfly chart