



RESULTS OF THE INTERNATIONAL CHALLENGE 2019

MICROSENSORS: NEW TECHNOLOGIES AND CONNECTED OBJECTS

SERVING THE AIR QUALITY

Paris, January 21, 2020 - the winners of the "2019 Microsensors Challenge" were rewarded by Airlab partners at the end of the international workshop on teachings and challenges related to microsensors measuring the air quality organized by Airparif and the AFD. This new international edition has allowed willing manufacturers to have their solutions evaluated by using Airparif's know-how and an independent evaluation composed by a jury of French and international experts. It thus makes it possible to enlighten the potential users regarding the adequacy and the performances of the product with respect to the intended uses.

The rise of connected sensors for air quality monitoring

More and more experimental and innovative projects are developing around miniaturized air quality sensors, aimed at equipping cities, buildings, vehicles and citizens. However, there is currently no regulation for these technologies, which represent a market in full development and which arouse the interest of the various stakeholders: authorities, citizens, NGOs, economic actors... whatever the continents.

What are the performances of these devices according to the uses? How do their performances evolve over time? What have been the technological evolutions since the last edition of the challenge? The objective of this initiative is to highlight innovations while providing information and choice criteria for users according to their needs in relation to these new technologies.

For the AFD, these questions are omnipresent in many of the emerging and developing countries where it supports the authorities. In these countries, there are often very significant levels of pollution, an incomplete or nonexistent monitoring system, and limited technical and financial resources: the stakes are high around these measurement devices, which form the basis of public policies for the improvement of air quality.

34 Microsensors screened by the teams of Airparif for 4 months, under the aegis of an international jury

At the end of a selection phase, the **34 sensors were made available by the voluntary manufacturers, half of which were foreign companies. These evaluations covered 44 parameters on average, 15 pollutants were studied, and this during 4 months in the Paris region (in a metrology laboratory, on mobility in vehicles and on people, as well as on Airparif stations). This represents more than 50 million processed data.**

These tests were conducted under the aegis of an international jury composed of members of the first edition (Airparif, ATMO Auvergne-Rhône-Alpes, ATMO Grand Est, CSTB, EMPA, FIMEA, OQAI and VEOLIA), to which were added the French Development Agency, the World Meteorological Organization, Engie and EDF, the Network of Research Partners of the Ile-de-France Region DIM QI², the Commission for Atomic Energy and Alternative Energies and two new Air monitoring associations: ATMO Hauts-de-France and ATMO Normandie. This 2019 edition has been financially supported by the

French Development Agency, EDF, ENGIE, the Network of Research Partners of the Ile-de-France Region DIM QI² and Véolia.

Each sensor was competing for one or several uses (measurement in outdoor air or indoor air, fixed or mobile measurement, public awareness, etc.) and was evaluated according to five criteria: the accuracy of the measurement, the ergonomics, the relevance of the measured pollutants compared to the use, cost and suitability of the solution in the competing category (congestion, interoperability, handling, data management). The results are presented in the form of a star number ranging from 1 (lowest level) to 5 (highest performance).

The results of this 2019 edition: Four award-winning sensors of the 2019 Challenge

4 sensors marketed by 3 companies are at the top of the bill of this second edition and are the winners of this challenge with a result of 4.5 out of 5 stars:

- In the category "Indoor Air - Piloting (IA-P)": **The E 4000NG sensor marketed by NanoSense (France)**
- In the category "Indoor Air - Monitoring (IA-M)": **The E 5000RE sensor also marketed by NanoSense (France)**
- For all "Indoor Air" categories, whether it is monitoring, awareness or piloting: **AIRVISUAL PRO+ sensors marketed by IQAIR (Switzerland)** and **LASER EGG marketed by KAITERRA (China)**



An improvement of the proposed solutions compared to the 2018 edition

Overall, the results of the challenge reflect the differences in market maturity with fairly similar performances according to the categories of use, but with offers whose quality has increased in one year. As in 2018, the evaluation of these sensors shows that the best performing currently available solutions are for fixed indoor air sensors: both for air quality awareness uses, and for piloting and managing air quality inside a building, and this category, to which the winners of 2018 already belonged, has further progressed with the laureates getting 4.5 stars, compared to 4 stars in 2018.

Similarly, solutions intended for measuring for regulatory oversight, personal exposure assessment, or in mobility, have also improved in terms of measurement quality and the number of pollutants, but remain one level lower.

The 34 sensors tested during this second edition all have a satisfactory level of ergonomics and improved by more than 10% compared to the 2018 edition. Although the quality of the measurements varies from excellent (for carbon dioxide in indoor air) to unsatisfactory, with differences depending on the pollutants for the same sensor, a clear improvement has been observed in the accuracy which has increased on average by more than 30% on the 2019 edition. In addition, the jury points out that they have not observed a solution in major dysfunction this year, unlike the previous edition.

Possible improvements on measurement accuracy and the actual cost of solutions.

While the technological maturity of these sensors works well in indoor air, developments are encouraging in outdoor air, but the technology is not yet ready to meet regulatory requirements. The solutions intended to measure for the purpose of regulatory monitoring of personal exposure assessment, or in mobility, remain indeed to be improved, notably on the quality of measurements and the number of pollutants monitored. The conclusions of the challenge, on this point, are in line with the work of the World Meteorological Organization, the World Health Organization and the United Nations Environment Program, for whom low-cost sensors are not a direct substitute for reference measurements, especially for regulatory issues, but they represent a complementary source of information, provided that an appropriate device is used¹.

Moreover, regarding the cost and contrary to expectations, the calculation of the overall cost (purchase and operation) over three years shows that all these solutions are not always "low cost" products with an amount ranging from nearly 200 euros to more than 17,000 euros. And there is also the question of their environmental impact, which has not been evaluated in the context of the challenge, given their lifespan (typically 1 year to 18 months).

In addition, these results are representative of the sensors tested but cannot necessarily be extrapolated to other batches, for which performance can differ. Similarly, apart from the laboratory assessment, these results were obtained with pollution levels which are those of a large European capital and the weather conditions of Ile-de-France. In outdoor air, differences from these results may be observed in other areas of the globe with higher levels of pollution and higher temperature and humidity conditions. Before any installation of a device of this type, verification of proper operation comprising metrological tests is recommended.

Is the metrological criterion the only parameter to take into account when setting up a project based on these measurement devices? Experiments, of more or less large-scale, are developing in France and abroad and are presented within the framework of a workshop organized by the AFD and Airparif before the results of the Challenge. Beyond the individual metrological performance of the sensors (as assessed in the challenge for a given batch), these feedbacks point to other questions. The experimentation of Urban Lab, Paris&Co and the City of Paris, in partnership with AIRLAB, ADEME and the Caisse des Dépôts² highlights in particular the importance of "an evaluation of the effectiveness and sustainability of proposed solutions to move towards a responsible and sustainable purchase" and recommends arbitration according to an overall cost / benefit approach.

The evaluations freely available on www.airlab.solutions

All the sensor results are freely available on the AIRLAB website (www.airlab.solutions) in accordance with the Challenge rules so that each sensor potential user can clarify his choice according to the expected use of these technologies. These evaluations are available in English and French.

¹ Source: Low cost sensors for the measurement of atmospheric composition: overview of topic and future applications - World Meteorological Organization (WMO), World Health Organization (WHO), United Nations Environment Program (UNEP) - International Global Atmospheric Chemistry (IGAC), EMEP - May 2018.

² Program aimed at experimenting with the implementation of concrete projects to improve the quality of outdoor and indoor air, which are innovative and economically viable, mainly involving measurement with microsensors, and remediation. Results available online: <https://www.parisandco.paris/Sitepage/Synthese-de-l-evaluation-Qualite-de-l-air> - October 2019.

This Challenge is part of the activities of **AIRLAB, accelerator of technological or behavioural solutions to improve the air quality.**

The AIRLAB ecosystem brings together a community committed to improving the air quality: large companies, SMEs and start-ups, institutions and communities, research institutes, NGOs... AIRLAB aims at identifying and stimulating new levers to go further and faster in reducing pollution in Paris and in the Île-de-France Region, whatever the sources. And evaluate their performance to inform decision-makers and users.

AIRLAB was created by Airparif and its founding partners in September 2017, after a prefiguration mission funded by the Ile-de-France Region.



Press contact

Céline Delysse - (33) 1 44 59 41 06 - (33) 1 789 624 009 / celine.delysse@airparif.fr

Charlotte Songeur - (33) 1 44 59 40 15 - (33) 1 787 124 817
charlotte.songeur@airparif.fr