21th International Conference on
Harmonisation within Atmospheric Dispersion Modelling
for Regulatory Purposes
27-30 September 2022, Aveiro, Portugal

SHORT ABSTRACT

Abstract title: Understanding the impact of cruise ships emission in urban harbour using CFD modelling in CAPNAVIR project

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Abstract text *(maximum 350 words.)*

The CAPNAVIR project (CAractérisation des Particules fines issues de la NAVIgation fluviale ou maRitime) is a project funded by ADEME and aimed at characterizing the sources of fine particle emissions (PM2.5 and PM1) emitted by maritime traffic in a context of urban harbours. This project brings together CEREMA, the Grand Port Maritime de Bordeaux, the CNRS aerology laboratory in Toulouse, Particle Vision in conjunction with the University of Fribourg (Switzerland) and Fluidyn.
The objective of the CAPNAVIR project is to provide in-depth knowledge of the chemical nature of emissions from cruise ships and river vessels in real navigation conditions, as well as the corresponding concentration levels of fine particles. This subject is fundamental to evaluate the means of reducing this pollution. These results will be linked to various factors that can influence emissions: technical parameters (fuel, engine load, etc.) and operating parameters (phase of activity, etc.).
The experimental site chosen is the port of Bordeaux Center which includes on the left bank both a quay for river transport and a quay for maritime passenger transport, in a fairly restricted area.
In September 2021, during a measurement campaign led by CEREMA, particle sensors were used, supplemented by sulfur dioxide measurements, as well as mini weather stations.
Modeling of the dispersion of pollutants from ships was then carried out using the 3D-CFD software, fluidyn-PANACHE, according to two emission configurations:

1. Modeling of a stationary state for liners at berth during a stopover of several hours;
2. Modeling of transient states for ocean liners and river boats navigating in the study area.

These models will make it possible to understand the impact of these different configurations and to position the sensor network in a relevant way for recording the concentrations generated by maritime traffic during a stopover (emissions lasting

several hours with specific engine speeds) but also during the approach and departure navigation phases (emissions of a few tens of minutes with specific engine speeds).
A comparison with the experimental data is also carried out.

Motivation*

Combining the experimental and the numerical approaches to tackle air quality issues will lead to a more in-depth understanding of the mechanisms at play. In particular, besides the analysis and conclusions expected from the comparison between the experimental measurements and the simulation results, it is foreseen that the experimental results can be used in an inverse modelling approach to complement the simulation by a source determination capability.