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ABSTRACT

CFD MODELLING OF ODOUR IMPACT ON URBAN MICROSCALE: CASE STUDY INVESTIGATING A WASTEWATER TREATMENT PLANT

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Residential areas are increasingly close to Wastewater Treatment Plants (WWTPs) that in some specific cases this may mean an increase in the odour impact on neighbourhood and nuisance. Gaussian-based models are the most commonly used for odour dispersion modelling, but they are not intended for meteorological microscale, such in urban scale scenarios. To assess the odour impact to small domains, Computational Fluid Dynamics (CFD) models has become a practical tool for supporting modelling and simulations that require a high spatial resolution. Cases where WWTPs are very close to urban space, with complex geometries, where it is necessary to resolve the flow field at finer scales to understand the odour dispersion [1].

The present study focuses on modelling and simulating the atmospheric dispersion of odour released by the WWTP of Benicàssim (Spain), and to evaluate the impact on the vicinity area, which is composed of single-family homes, large apartment buildings, and campsites. CFD simulations are used to provide detailed results and obtaining resolutions at a scale below the centimetre. This mathematical approach provides a tool to make decisions according to some factors like meteorological conditions and emission features adapted to the urban geography specific characteristics.

The case study comprises the WWTP and the complex urban area within about a one-kilometer radius. The computational geometry is generated using LIDAR point cloud that represents realistically the urban area with more precision than using exclusively a 3D CAD from the land registry office. Reynolds Average Navier-Stokes (RANS) simulation of flow and odour transport are used to simulate conditions of high turbulence such as odour dispersion behind buildings.

Odour characterization was carried out using gas chromatography coupled with mass spectrometry (GC-MS) [2]. The study evaluates different meteorological conditions because of the complexity of the geographic position of the WWTP (mountain range behind and sea in front of it).

The CFD simulation of urban microscale facilitates the study of non-homogeneity odour dispersion due to the urban canopy configuration. It is frequently used to detect different regions of high turbulence (e.g. around buildings) which could give intensive odours.

[1] Toparlar, Y., Blocken, B., Maiheu, B., van Heijst, G.J.F. A review on the CFD analysis of urban microclimate. Renew. Sustain. Energy Rev. 80, 2017a, 1613–1640

[2] Bax, C., Sironi, S., Capelli, L. How Can Odors Be Measured? An Overview of Methods and Their Applications. Atmosphere 2020, 11, 92.

Indicate preference of kind of presentation

- ✓ Oral Communication
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Indicate topic of your work for the conference:

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- ☐ Odour/VOC perception, impact, formation and dispersion.
- ☐ GHG emissions particulate matter and industrial emissions.
- ☐ Source characterization and odour/VOC mapping.
- ☐ Odour/VOC abatement, mitigation and neutralization.
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- ☐ Air emissions and sustainable solutions for waste handling
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