CFD modeling of odor impact of a wastewater treatment plant using a tracer gas dispersion method

A. Macías, J. Vilarroig, J. Climent, J. Izquierdo, R. Martínez, S. Chiva

Due to the fast growth of cities and populations, residential areas are increasingly close to wastewater treatment plants (WWTPs), causing odor impact on neighborhood and complaints. The present study focuses on assessing the impact on residential vicinity of a WWTP in Benicasim (Spain) of different superficial odor sources using computational fluid dynamics (CFD) simulations and a tracer gas dispersion method (TDM).

CFD simulation is used as a complementary study to model pollutant dispersion. Unlike other simulation tools, CFD is bounded to smaller domains (1 or 2 km). Still, it performs more meaningful calculations and provides more detailed results, which allow obtaining a resolution at a scale below centimeter.

In this work, a CFD model has been developed. For this reason, a sufficiently large domain is simulated, to analyze the effect of WWTP odors in an urban scale scenario. The computation geometry is generated from LiDAR point clouds to obtain more urban details. Because the modeling domain was 550x600x50 m it is very important to use a coarser grid in areas with few buildings and large open spaces and a denser grid in the vicinity of the buildings and near the ground to model successful turbulent simulation.

Odor emissions from each source have been normalized proportionally to their emission in units of uoE/m3 so that they can be expressed on a "sensory scale." Also, the wind and its gust have been characterized for implementation in the model. The precise mesh generated in this work facilitates the study of the effect of the turbulence and the eddies caused by different obstacles (houses, walls, etc.). Also, for model validation tracer gas dispersion method results will be used.

Figure 1. The velocity vectors and contours in a horizontal plane in the Benicasim urban zone.