**Abstract**

Adequate monitoring of ambient air pollution is needed to prevent population exposure to hazardous concentrations of harmful materials, for regulation on industrial activity and for improved urban planning and development. The major challenge in these tasks is producing high resolution pollution concentration maps, using the current monitoring methods – standard air quality monitoring (AQM) and short-term measurements campaigns. The two methods have complementary benefits - AQM stations provide consistent but sparse high-quality data while short-term measurement campaigns achieve higher spatial resolution, but for limited time only. An alternative or complementary solution is to use Wireless Distributed Environmental Sensor Network (WDESN), usually comprised of portable and relatively low-cost Micro Sensing Units (MSUs), that can measure, process and transmit data to some base station. The use of a WDESN enables covering larger areas and obtaining finer spatial and temporal resolution of measurements than the standard methodology, but certainly poses a new challenge – finding the optimal way to deploy it while keeping operational costs low. The optimal deployment problem becomes even more challenging when the time varying weather and emission conditions are considered, and the optimal layout varies accordingly. The following proposal offers a multi-objective optimization model, coupled with an air pollution model, for studying the deployment of WDESN in a site with a complex source term and changing weather conditions. The basic model aims at finding a protocol for placing MSUs, under a set of fiscal and geographical constraints, that will allow decision-makers to discover tradeoffs between performance criteria and to consider alternative modes of action according to the prevailing circumstances. It considers the time varying meteorological conditions (wind velocity and atmospheric stability) and uses as the main objective a quantitative measure of the complexity of the given set of sources/sensors geometries: the pairwise Euclidean distance (PED) between the sensor network potential readings of different number of active sources. Three modules are suggested: i) a *spatial* optimization model that computes sensors’ deployment, which minimizes the cost of the deployment while maximizing the sensitivity of the network to changes in emissions, ii) a *temporal* optimization model that computes sensors’ redeployment, which minimizes the transfer effort from the previous deployment, considering a change in weather or emission conditions, and iii) a *spatial-temporal* optimization model comprised of the findings of the two previous models, considering the probability of change in weather conditions and emission patterns. An initial simulation set was constructed to test the first suggested model. Optimal solutions for placing up to 300 homogeneous MSUs in a 1000x1000 m flat area were retrieved for various PED-related objective functions, showing promising results. More simulations will be conducted for each of the modules, and the potential improvement achieved by the deployment of a heterogenous network, comprised of different types of sensors with different characteristics (sensitivity, dynamic range, cost), will be examined. Other extensions will be considered as well, including the use of other more sophisticated dispersion models, other forms of objective functions related to the maximization of the PED values, and real-world test cases.