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Dense sensor networks and satellite data to map environmental hazards in urban areas

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Background: Identifying detailed spatial and temporal patterns of harmful environmental conditions (hazards) within complex urban environments is challenging given the scarcity of official monitoring solutions. Here we demonstrate the capability and performance of dense networks of low-cost sensors coupled with satellite remote sensing, based on a deployment in Prato, Italy.

Methods and Results: in-situ air quality and meteorological measurements from a low-cost sensor network were integrated with satellite and urban morphology data to derive maps of the spatial distribution of two hazards: summer heat intensity and winter air pollution. The maps were then integrated with citizens socioeconomic data (income deciles and social deprivation index) to develop a risk assessment framework and derive the relationship between socioeconomic vulnerability and environmental hazards. Results showed how low-income areas are more exposed to summer heat intensity, while middle-income areas are found to be mostly exposed to adverse air quality.

Conclusions and Significance: This research demonstrates the potential of dense sensor networks and remote sensing to map environmental hazards and derive accurate risk assessment analyses. Such datasets should be the base to develop fine scale epidemiological models once citizens health data are also included in the framework.

Keywords: heat, air pollution, risk assessment, remote sensing, low-cost sensors