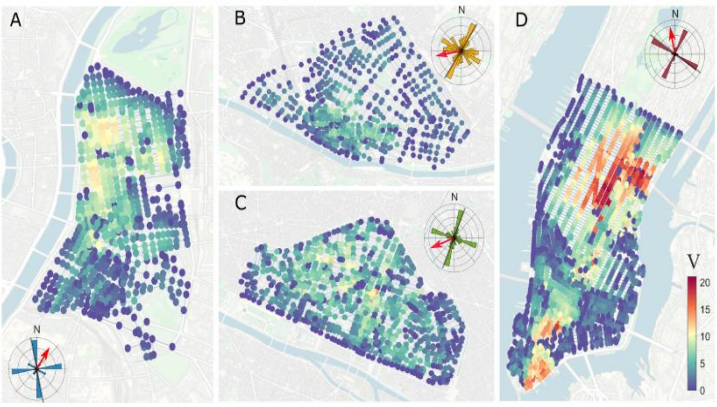
Cities are extremely vulnerable to **air pollution** as they exhibit both a large number of pollution sources and a high density of people exposed. Despite recent efforts in environmental policies, urban air pollution still represents the **greatest environmental risk to health** and a crucial challenge for city administrations. The purpose of the theses proposed below is to contribute to the understanding of dispersion mechanisms in the built environment and to the development of operational models for urban air pollution. Both **wind tunnel experiments** and **numerical** techniques are proposed.

POLITECNICO DI TORINO

ÉCOLE CENTRALE LYON

THE EFFECT OF TREES ON STREET CANYON VENTILATION

Tree planting in streets is often used as a pollution mitigation strategy, due to the filtering effect of vegetation on pollutants. However, from the aerodynamic point of view, trees can obstruct the wind flow thus reducing street ventilation and leading to higher pollutant concentrations. By means of **experiments in the wind tunnel of the Ecole Centrale de Lyon**, this thesis aims at evaluating how tree planting influences the flow and concentration fields within a street.

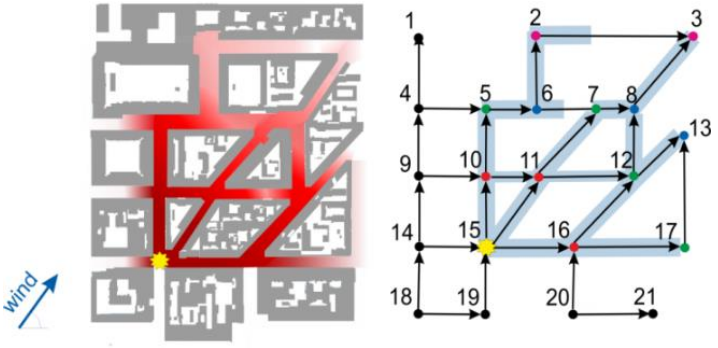


COMPLEX NETWORK MODELS FOR POLLUTANT DISPERSION IN URBAN AREAS

The aim of this thesis is to evaluate the **vulnerability** of a dense city to the release of airborne pollutants by means of the modern techniques provided by the **theory of complex networks**. The urban tissue is represented as a network of links and nodes, and propagation phenomena are modelled as transport processes on networks. In this way, it is possible to rapidly assess the consequences of interventions in the urban fabric or the effect of climate changes on the vulnerability of cities to gaseous releases.

INVERSE PROBLEMS FOR URBAN AIR POLLUTION

This thesis deals with the solution of **inverse problems** related to urban air pollution. Given the measurement of pollutant concentration in one or more locations in the city, the goal is to find the position and the size of the toxic source. An interesting application of this study is the optimal positioning of **sensors for air monitoring** to maximize the probability of intercepting dangerous gas releases.



CROWD DYNAMICS IN URBAN ENVIRONMENTS

Crowd dynamics studies the behaviour and interaction of a large number of entities in movement. In city centres, the high density of people and the compact urban structure make these dynamics relevant for the safe management of urban events. This thesis aims to study the motion of a crowd in an urban centre by exploiting the innovative tools of the theory of complex networks and the laws of fluid dynamics. For this purpose, the crowd of individuals is assimilated to a fluid flowing in a network.