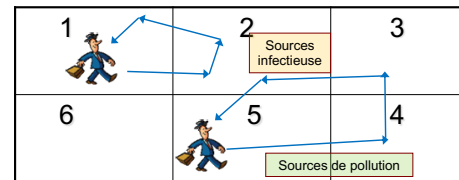# Modeling exposure to air pollutants based on daily human mobility in urban areas

Background

The transport sector is the leading emitter with more than 30% of greenhouse gas (GHG) emissions. As part of the ecological and energy transition, the Mobility Orientation Law (MOL) aims to provide mobility solutions for all by transforming the right to transport into the right to mobility. The objectives of the MOL include the following issues: • Solidary mobility: social and territorial cohesion; • Reducing GHG emissions and combating pollution; • Developing shared mobility and active mobility, including the requirement for a component relating to the continuity and security of pedestrian and cycle routes. In this context, the *EcoMobiliSim* project aims to provide local authorities with assistance with mobility policies by simulating multimodal transport plans and indices of environmental and health impacts.

From a health risk perspective, multimodal mobility generates heterogeneity in the exposure of populations to given sources. The problem of heterogeneity of exposure comes from the fact that individuals in the same population are not exposed in the same way to different sources of pollution or pathogens. This results in variability in the impacts on individuals for non-communicable and/or communicable diseases. The figure opposite illustrates the exposure trajectories of two individuals in a territory subdivided into six sectors. As can be seen, one of the individuals will only be exposed to the infectious source when passing through

sector 2 while the other individual will be exposed to both pollution and infectious sources and for different durations. As a result, individual exposures vary with the mobility of individuals and therefore become curvilinear functions of the concentration of pollutants and pathogens encountered. In such a situation, risk assessment requires: (i) - identifying and locating the sources of pollution and infection and (ii) - characterizing and describing the mobility of individuals.

Objectives

The main objectives of this work are to model (i) – daily human mobility in urban areas and (ii) – the exposure of users to atmospheric pollutants based on their daily mobility journeys.

Methods

The methodology for carrying out this project includes three phases:

(1) Develop and build a model of daily human mobility in an urban area described by a mobility network. For this, we will use public transport data from the urban area, taking into account the population structure according to socio-economic factors and daily and seasonal variability. The ultimate objective is to build a stochastic origin-destination matrix describing the daily trajectories (at the hourly scale) of individuals in the study area described by a mobility network. This mobility model will be used in modeling exposures to air pollutants and in modeling the transmission of infectious diseases.

(2) Develop an interpolation and/or extrapolation model of air pollutant concentrations (PM2.5, PM10, O3, NO2, SO2, CO) at the mobility network scale. For this work, we will use field data (mobility network) and data from the air quality agency. Measurements of atmospheric pollutant concentration data will therefore have to be carried out on the mobility network.

(3) Estimate the exposures of populations according to their mobility profiles and trajectories, and calculate the characteristic scores of mobility journeys.

Profile of the candidate and required skills

- Statistical analysis and modeling, analysis of complex networks, statistical mechanics
- Knowledge of R, Qgis, GIS software and programming ability in R and/or Python
- Rigor, autonomy, initiative, enthusiasm, curiosity
- Good writing skills
- Good level of English
- Ability to communicate and work in a team

Practical information:

- **Persons in charge:** Dominique Bicout & Christine Demeilliers, UMR 5525, TIMC-EPSP (Université Grenoble Alpes)
- **Location of the post-doc:** TIMC – Équipe EPSP, domaine de la merci, La Tronche, France
- **Collaboration:** E. Braillon-Gilet, Cognidis
- **Funding:** 18 months of post-doctorate provided by the *EcoMobiliSim* project funded by the Auvergne-Rhône-Alpes region
- **Start of the post-doc:** flexible from February 2025
- **How to apply?** : Send by email to Dominique Bicout (dominique.bicout@univ-grenoble-alpes.fr) and Christine Demeilliers (christine.demilliers@univ-grenoble-alpes.fr) a cover letter, a detailed CV with proof of the diplomas obtained and the names of two referees to contact.