**CONTEXT**

- The OpenSense Project is looking into enabling an air quality monitoring using mobile sensing platform anchored on buses provided by the public transports of Lausanne.
- An environmental field layer is needed for the integrated simulation framework.

**OBJECTIVE**

Using concentration measurements together with additional available sources of information (e.g. vehicle mobility data, weather data), the goal of this Design Project is to derive a simple data driven, statistical model for the pollution field in the central area of Lausanne.

**METHODOLOGY**

- **Raw Data**
  - Environmental Filtering
    - wind speed < 2 km/h
    - solar radiation < 500 W/m²
  - Filtered Data
    - Large scale analysis
      - Daily mean interpolation based on seasonal variations
    - Daily average modelling
      - Seasonal variations removal from filtered data by subtraction of the daily average concentration
    - Local scale analysis
      - Spatial selection algorithm and statistical analysis of daily variation
    - Spatial variations modelling
  - Combination of both models

**DATA DESCRIPTION**

- **SOURCE** - Climaps platform - mobile station 1057
- **VALIDATION** - Statistical comparison with reference station
- **SELECTION** - CO as main parameter for the model building
- **SPATIAL SCOPE** - Public Transport Bus Network
- **TEMPORAL SCOPE** - About one year of measurements

**MODEL BUILDING**

- **Daily average model**
  - Large scale model building
    - Seasonal trend interpolation
    - Aim: Remove the variability at a large time scale
    - Method: Sinusoidal interpolation of CO monthly means
  - Result: Dntrended concentration measurements
    - Variations around the daily mean of carbon monoxide concentration
    - Aim: Study these variations locally in order to build a spatio-temporal model
    - Localized variations around the daily average are modelled and added to the large scale model in order to set-up the environmental field layer

**OUTPUT EXAMPLE – LE FLON**

- A. Predicted local variation with a resolution of 2 hours
  - Hourly interpolation
  - Note that concentrations are generally above the daily mean.

- B. Comparison between the hourly interpolation and the filtered measurements \([•]\) at Le Flon, bars are observed hourly means
  - A good fit of the detrended data by the daily variation model is observed.

- C. Combination of the large scale model & the hourly CO variations at (Le Flon)
  - This graph represents the final CO concentration prediction tool for one location.

- D. One week zoom-in on graph C
  - Daily variations between 6am and 10pm as it appears in the model.

**LIMITS & PERSPECTIVES**

- The model is: - build on data covering a limited period of time
  - only valid for the specified weather conditions
  - better fitted for daytime
- Interactions of carbon monoxide with other particles and secondary phenomena taking place in the atmosphere have been omitted in the present attempt to build the model
- CO concentration general trend is significantly correlated with seasonal temperature variations and could therefore be incorporated into the daily average model.

**CONCLUSION**

Statistical analysis is necessary in order to support further improvements of the model. Generalization of the model would also need longer period of measurements in order to improve the prediction tool for certain specific locations and time intervals.

**Supervisors:** Alcherio Martinoli & Adrian Arfite (DISAL – EPFL), Davis Daidié (Sensorscope Sàrl)

**Contact:** laurent.hafiz@epfl.ch, kim.ehrensperger@epfl.ch