JRC AQSens and modelling

European Commission

Joint Research Centre

Objectives

Contract with DG ENV, involving modelling subcontractors: NILU, VITO.

Objectives:

1. Compare performance of lower-cost air quality sensor systems to measure air pollution with conventional air quality monitoring and modelling;

3. Elaborate on a potential way to integrate lower-cost sensor systems in already existing air quality monitoring networks and air quality modelling systems

5. Establish guidance on the use of lower-cost sensor systems and their interrelationship with existing conventional monitoring and modelling systems.

Domains and available data

Available data:

- Antwerp, Oslo, Zagreb
- Both models (Atmo-street, Episode/uEMEP, Atmosys) and observations
- Summer (2020) and winter (2021) campaigns
- Hourly / 10m resolution data

Idea:

- using model results, official observations and low cost-sensors observations, to test different data fusion approaches -> guidance and Shiny-app

Guidance

MODSENS

JRCIPR2021LVP0383

Maxime Beauchamp[1], Enrico Pisoni[2], Philippe Thunis[2], Alexander De Meij[2], Bertrand Bessagnet[2], Leo Le Diouron[3], Nathalie Mavel[3], Romain Scimia[3]

European Commission

1, Scientific consultant, self employed, contact author (maxime.beauchamp76@gmail.com)
2, European Commission, Joint Research Centre (JRC), Ispra, Italy
3, Atmotrack, 1 Rue Julien Videment, 44200 Nantes

- Why do we need Data Fusion?
- Which are the existing techniques?
- Which are the suggested best practices?
- Conclusion
- Discussion: what’s next?
- Appendix A: User manual of the shiny application

Guidance: residual kriging approach

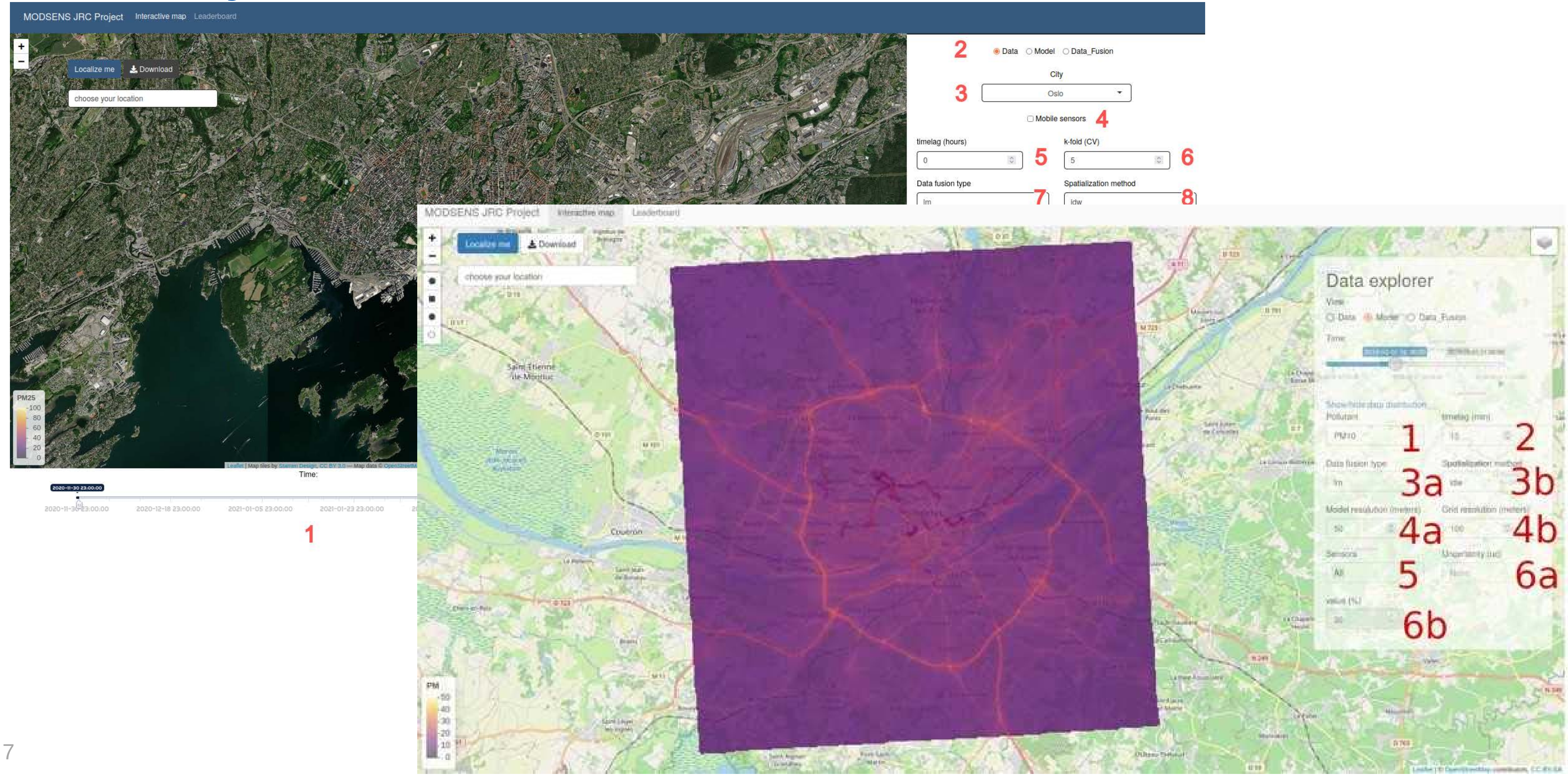
- **Step 1:** fitting a linear regression between the observations and the model:
- **Step 2:** spatial trend: applying the previous regression on entire domain
- **Step 3:** compute the residuals, i.e. the difference between observations and their estimations based on the linear regression, then optimally interpolated by kriging.
- **Step 4:** data fusion is provided, adding spatial trend and interpolation of residuals.

Guidance: description of existing techniques

3. Which are the existing techniques?

- 3.1 Spatial trend
  - 3.1.1 Ordinary Least-squares regression (OLS)
  - 3.1.2 Generalized additive model (GAM)
  - 3.1.3 Multi-Layer Perceptron (MLP)
  - 3.1.4 Random Forest (RF)
  - 3.1.5 Weaknesses and strengths
- 3.2 Residual interpolation
  - 3.2.1 Inverse distance weighting (idw)
  - 3.2.2 Optimal Interpolation (OI/kriging)
  - 3.2.3 Weaknesses and strengths
- 3.3 How to deal with outliers and uncertainties
- 3.4 How to deal with gaps in sensors time series

R-shiny



MODSENS JRC Project
Interactive map
Leaderboard
Localize me
Download
choose your location
Data
Model
Data_Fusion
City
Oslo
Mobile sensors
timelag (hours)
k-fold (CV)
Data fusion type
Spatialization method
lm
idw
PM25
Time:
2020-11-30 23:00:00
2020-12-18 23:00:00
2021-01-05 23:00:00
2021-01-23 23:00:00
1
2
3
4
5
6
7
8
Data explorer
PM
1
2
3a
3b
4a
4b
5
6a
6b

Conclusions

A dedicated repository (JRCbox, access on request) where to get:

- Data
- Guidance document
- Shiny App

Contacts: enrico.pisoni@ec.europa.eu, philippe.thunis@ec.europa.eu