

European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

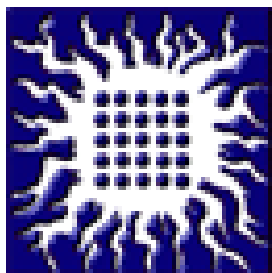
WGs and MC Meeting at LINKOPING, 3 - 5 June 2015

Action Start date: 01/07/2012 - Action End date: 30/06/2016

Year 3: 1 July 2014 - 30 June 2015 (*Ongoing Action*)

EVALUATION OF MONITORING GASES AND PM WITH LOW-COST AND REFERENCE DEVICES AT AMS(S) IN BELGRADE, SERBIA

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 COST
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY



AMBIENT AIR POLLUTION AFFECT HEALTH

Atmospheric, urban and indoor air pollution can affect citizen's health in a number of ways

Short-term effects include upper respiratory infections such as pneumonia and bronchitis

Long-term effects include lung and heart diseases and can exacerbate existing conditions such as asthma and emphysema

For such reasons it is important that both, air quality as well as meteorological data are available for citizens with high temporal and spatial resolution including online resource of near real-time and historical data



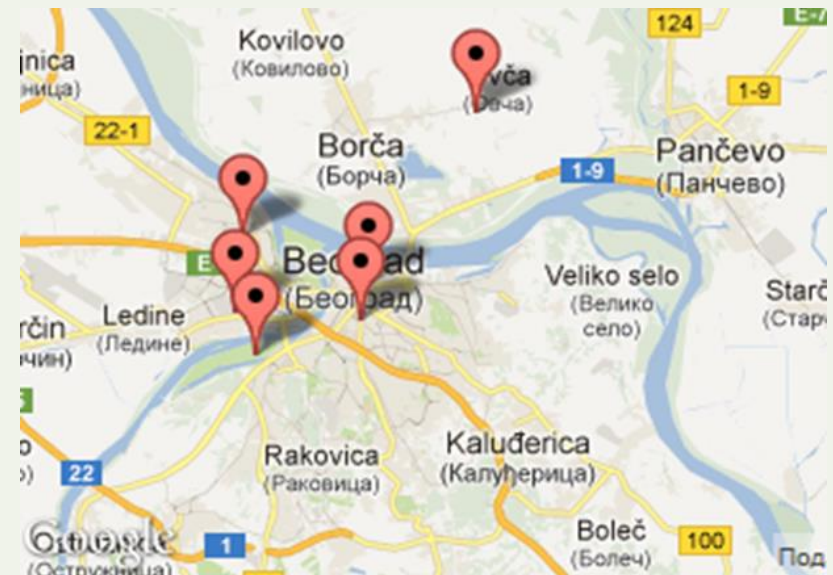
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FIXED MONITORING STATION LOCATIONS, AVAILABILITY AND USABILITY DATA AT PERSONAL LEVEL



State network of AMS in Belgrade



Municipal network of AMS in Belgrade

Few monitoring stations, located almost all in central zone of city

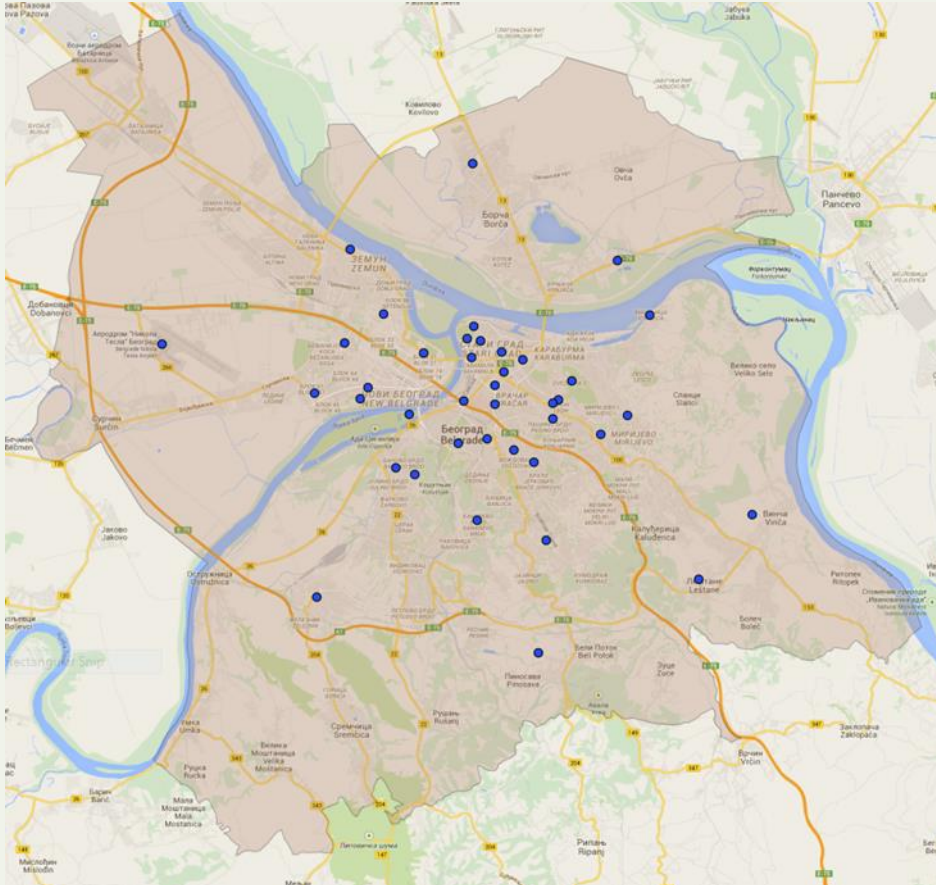
- Lack of real-time data availability for citizens
- Lack of usability data for personal exposure estimation



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LOW COST SENSORS LOCATIONS , AVAILABILITY AND USIBILITY DATA AT PERSONAL LEVEL



Draft strategy for placement of static sensor nodes in upcoming main CITI-SENSE study in Belgrade for 2015-2016

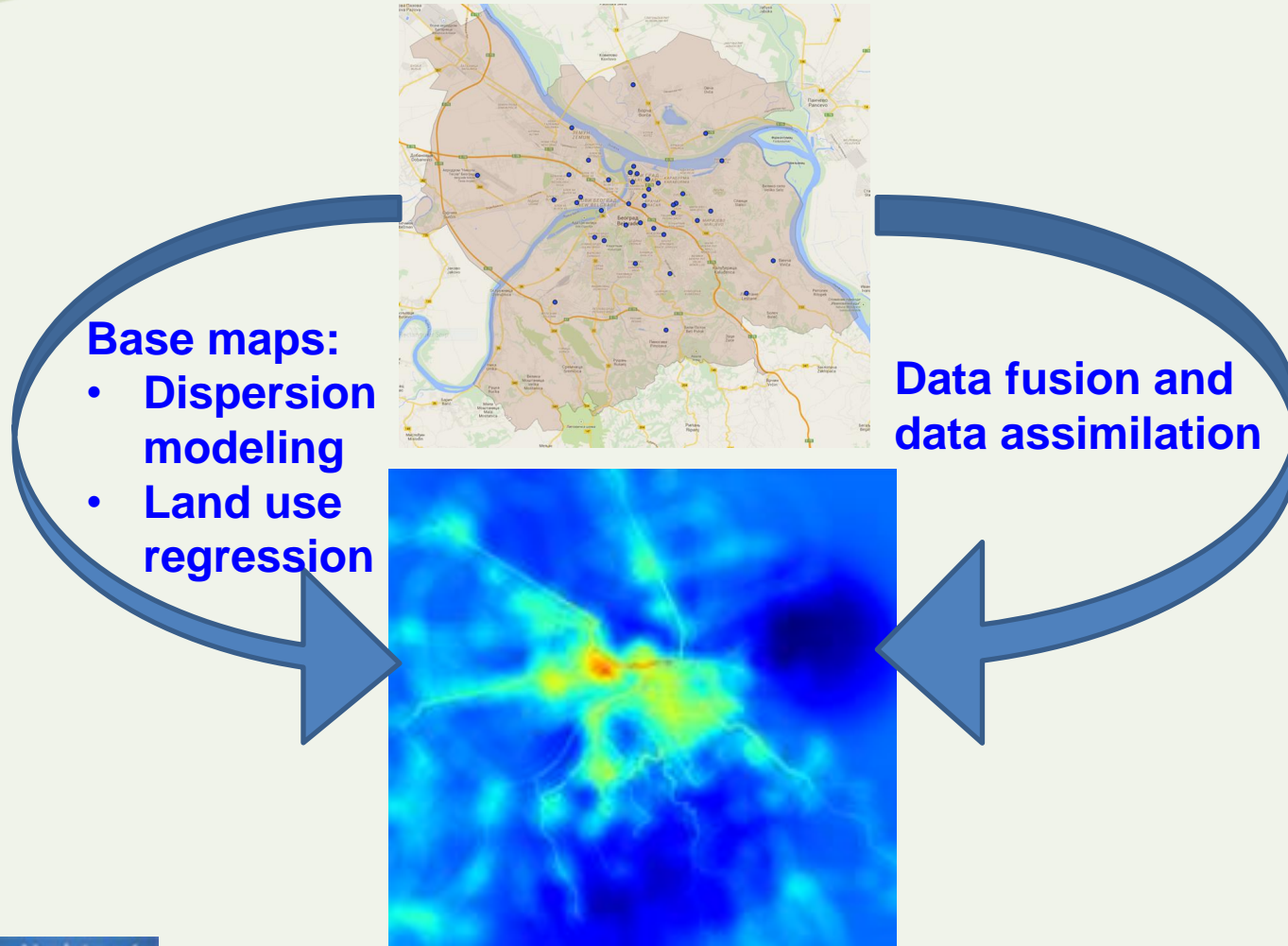
- Opportunity for adequate spatial resolution
- Opportunity for real-time data availability for citizens
- Opportunity for usability data for personal exposure estimation



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LOW COST SENSORS LOCTIONS , AVILAIBILITY AND USIBILITY DATA AT PERSONAL LEVEL



- Opportunity for adequate spatial resolution and mapping air pollution
- Opportunity for real-time data availability for citizens
- Opportunity for usability data for personal exposure estimation

Steps in creating map of air pollutants in near real-time

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LOW COST SENSORS + INFORMATION COMMUNICATION TECHNOLOGIES -CURRENT STATUS-

The question is how accurate or even realistic may the data collected by these platforms, for which period and for which purpose they could be useful



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CITI-SENSE OUTDOOR PILOT STUDY IN BELGRADE



- Low cost sensors for selected meteorological parameters (t, RH, p) and gases (NO, NO₂, CO, CO₂, O₃) has been produced by Alphasense (UK)
- Particulate matter monitor has been produced by DYLOS (USA), for PM_{0.5-2.5} and PM_{2.5-10} μm
- Integration of all parts, electronic design, data transmission and data visualization has been done by Dunavnet (Serbia)-DNET static unit



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TIMELINE OF PLATFORM COLLOCATION DURING THE CITI-SENSE PILOT STUDY

Pilot campaign	Period	Station	Platform	Testing sensors
First	28.02.2014 17.03.2014 (15 days)	Stari Grad	13 (1-13)	NO, NO ₂ , CO, CO ₂ , O ₃ , PM _{2.5} , PM ₁₀ T, RH, p
Second	17.03.2014 01.04.2014 (15 days)	Novi Beograd	12 (1-10, 12-13)	CO, CO ₂ , O ₃ , PM _{2.5} , PM ₁₀ T, RH, p
Last	23.10.2014. 02.11.2014 (10 days)	Novi Beograd	10 (2-10, 13)	NO, NO ₂ , CO, CO ₂ , O ₃ , PM _{2.5} , PM ₁₀ T, RH, p



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Automatic monitoring station Stari Grad

- Position, AMS located near strong city center, at right side of the river Sava and Danube
- Photo next to schoolyard and museum yard
- In the surrounding of AMS is street with low/medium traffic, elementary school, museum and restaurant.

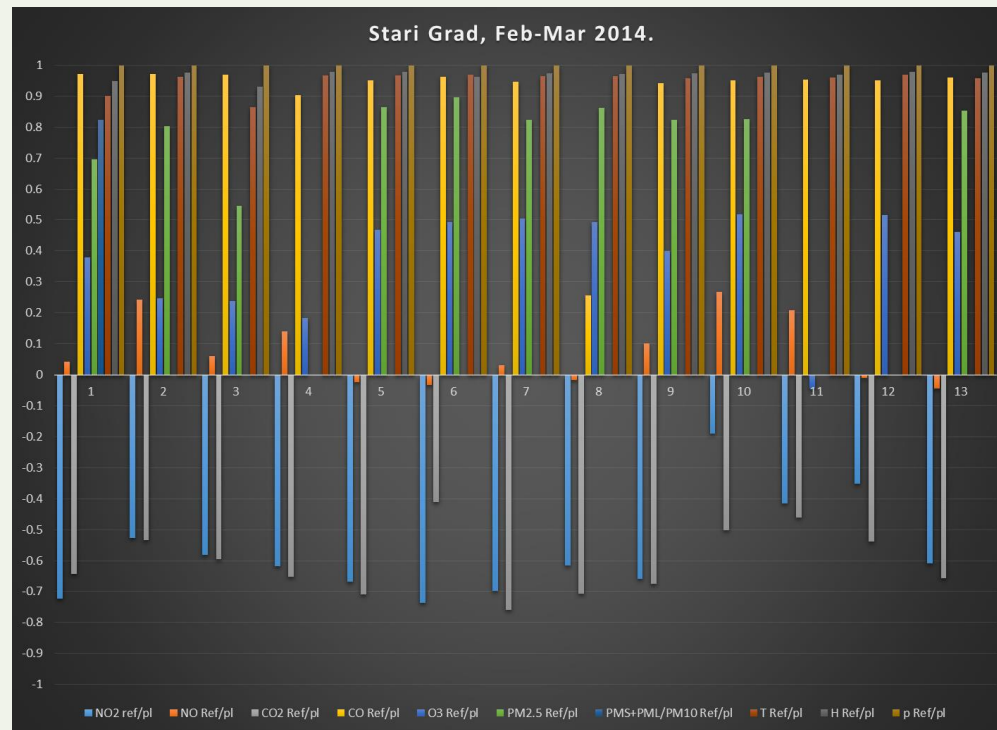


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Person coefficient correlation between low-cost sensors and reference sensors- First campaign

- AMS Stari Grad (28.02-17.03.2014)

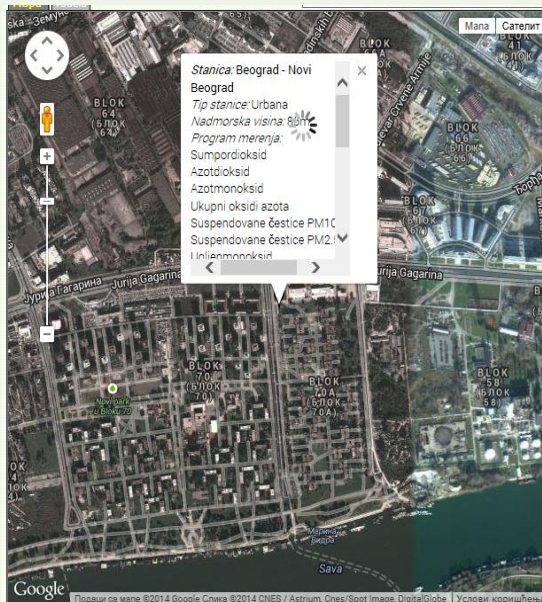


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Automatic monitoring station Novi Beograd

- Position, near left bank of the river Sava
- Photo, the view of AMS
- Photo of AMS surrounding, the station is located near the intersection roads with medium//intense traffic activity.

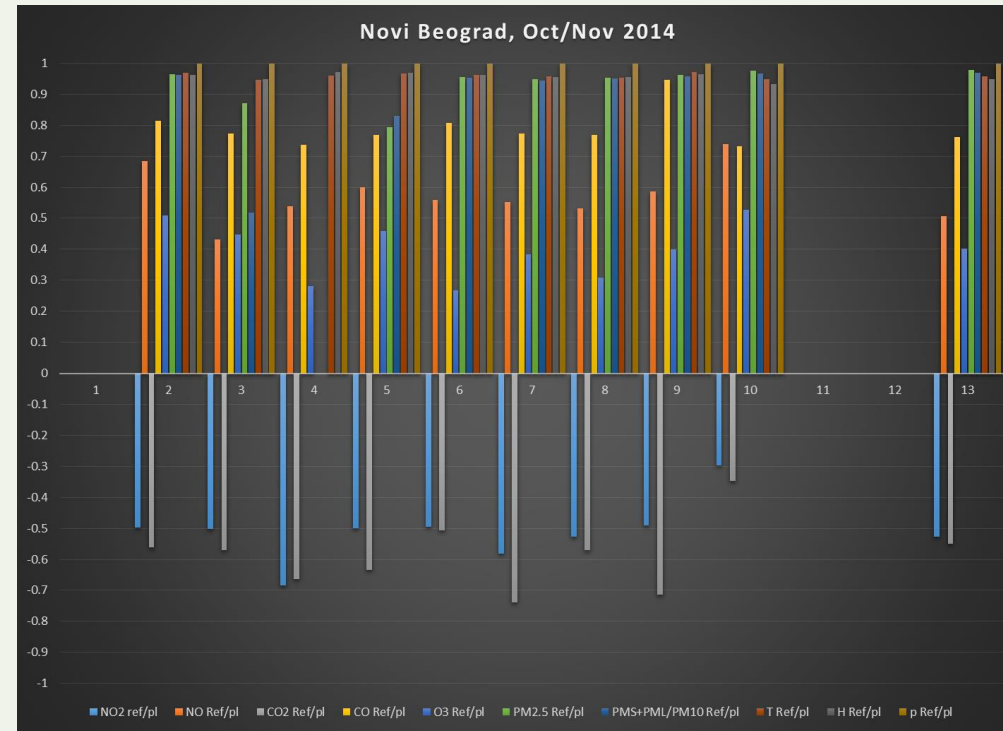
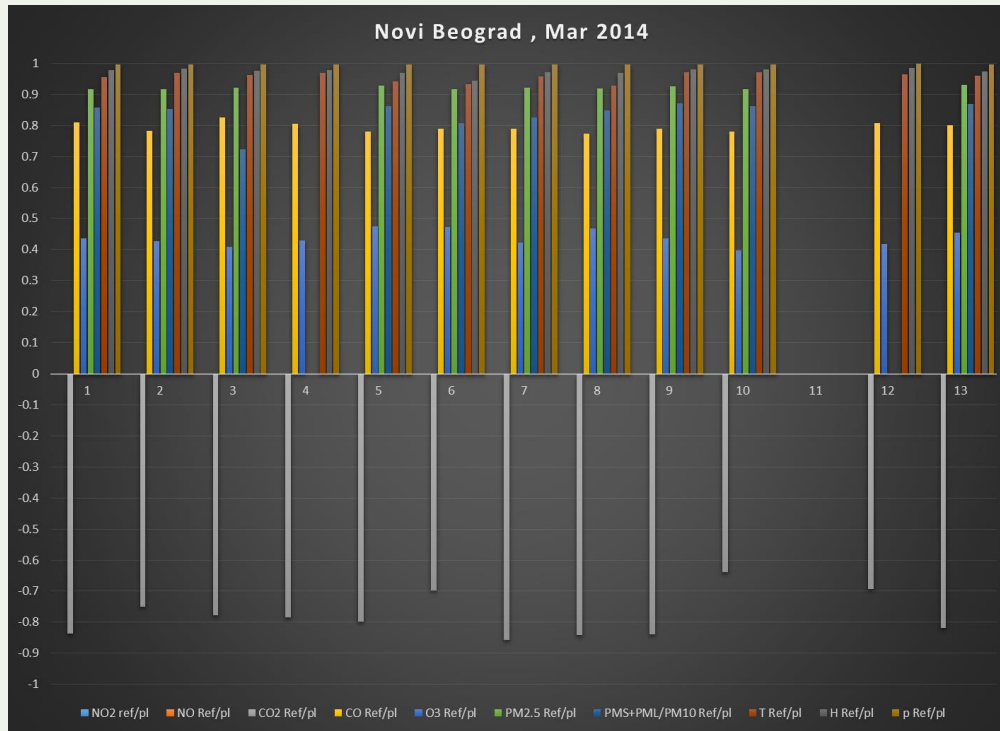


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Person coefficient correlation between low-cost sensors and reference sensors - Second and Last campaign

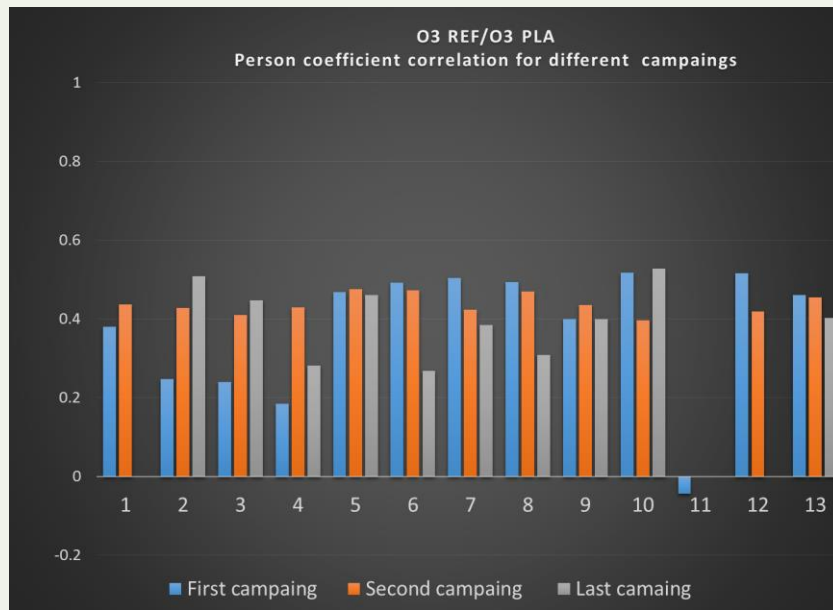
- AMS Novi Belgrade (17.03.2014-01.04.2014.)
- AMS Novi Belgrade (22.10.2014-02.11.2014.)



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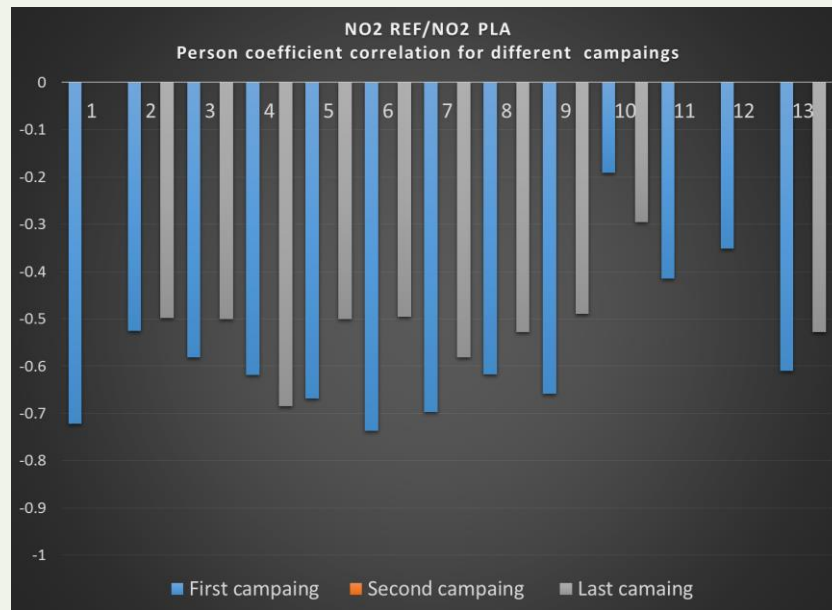
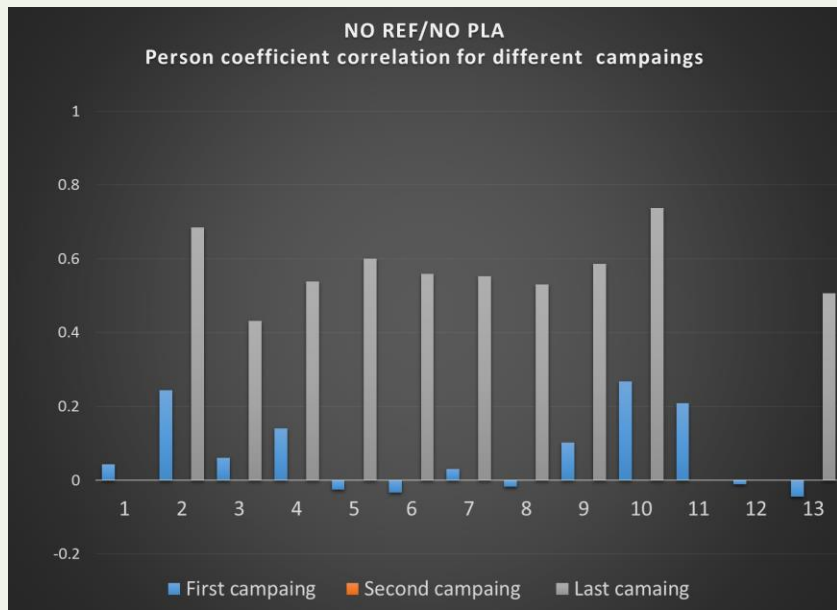
Person coefficient correlation between low-cost sensors and reference sensors for O₃ during different pilot campaigns



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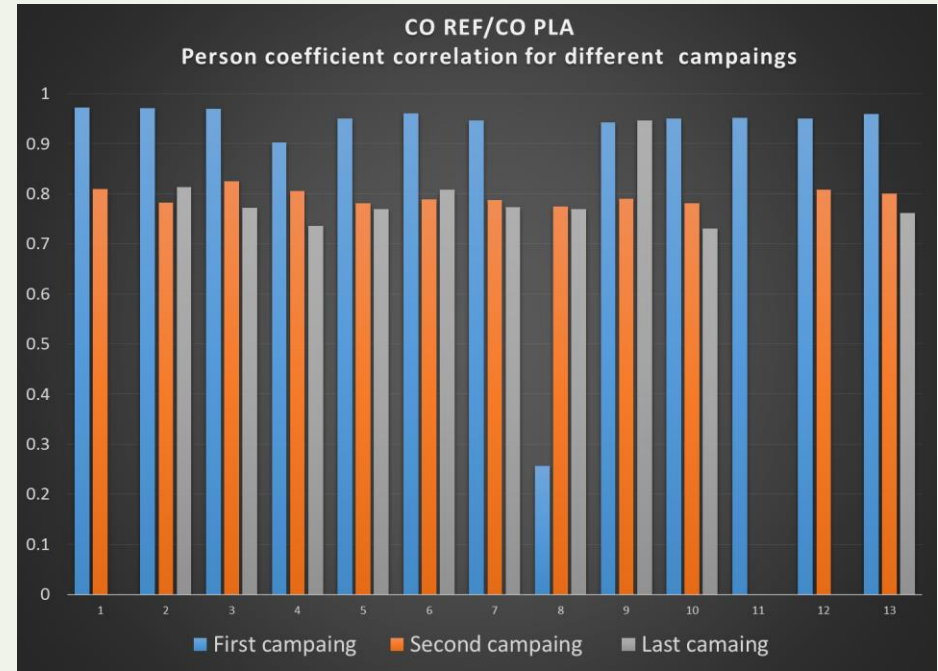
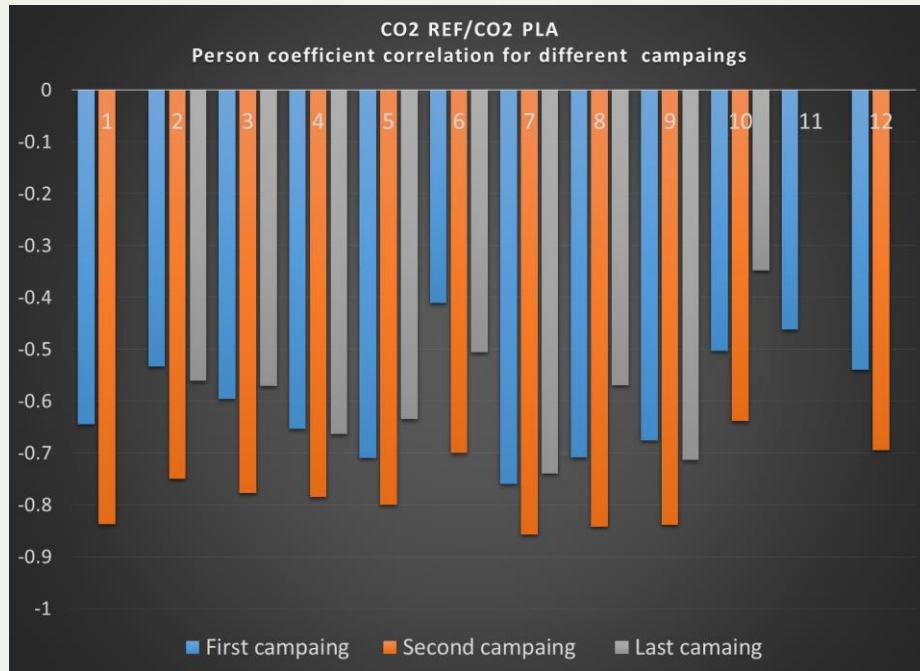
Person coefficient correlation between low-cost sensors and reference sensors for NO₂ and NO during different pilot campaigns



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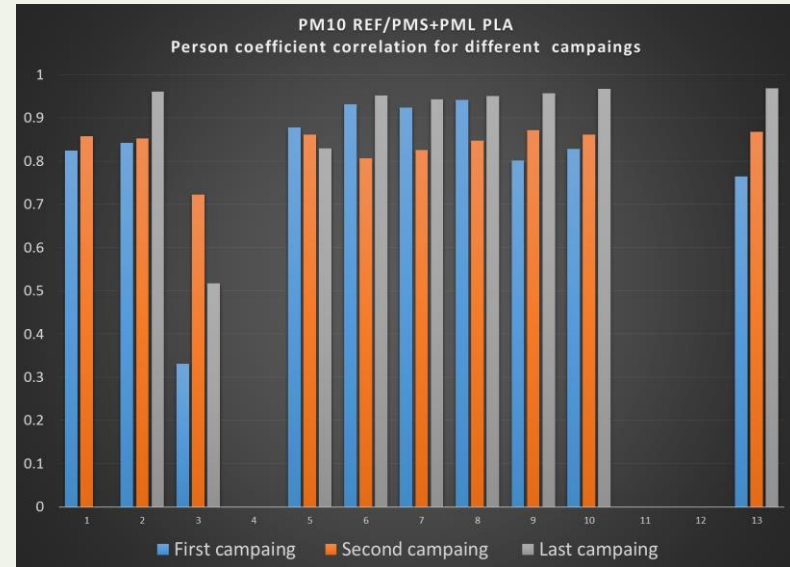
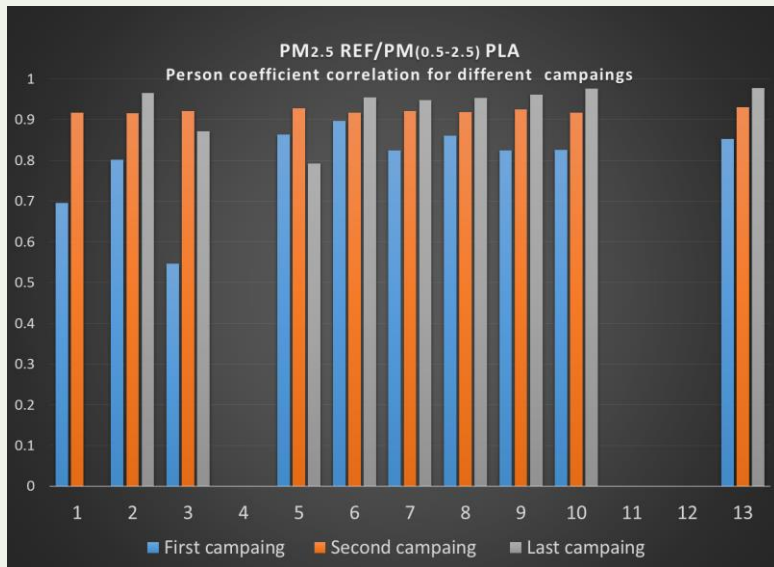
Person coefficient correlation between low-cost sensors and reference sensors for CO₂ and CO during different pilot campaigns



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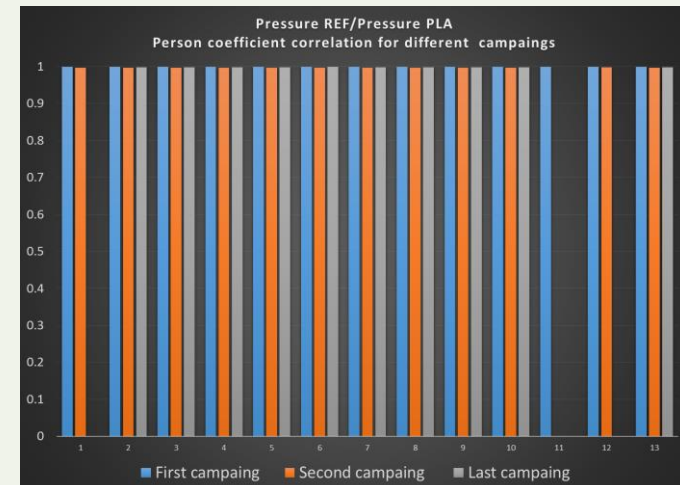
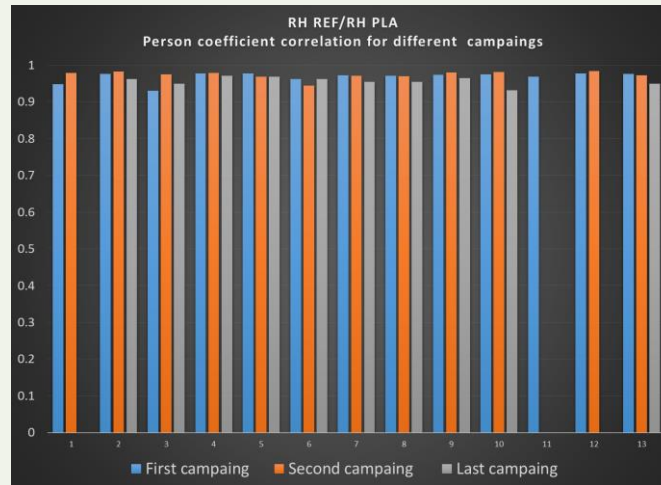
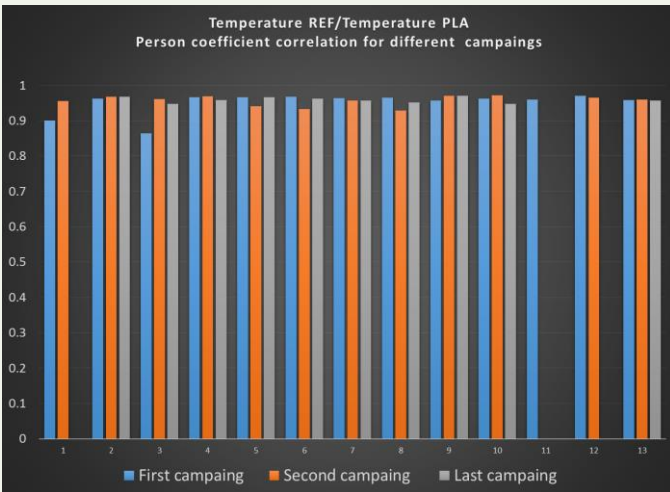
Person coefficient correlation between low-cost sensors and reference sensors for PM_{2.5} and PM₁₀ during different pilot campaigns



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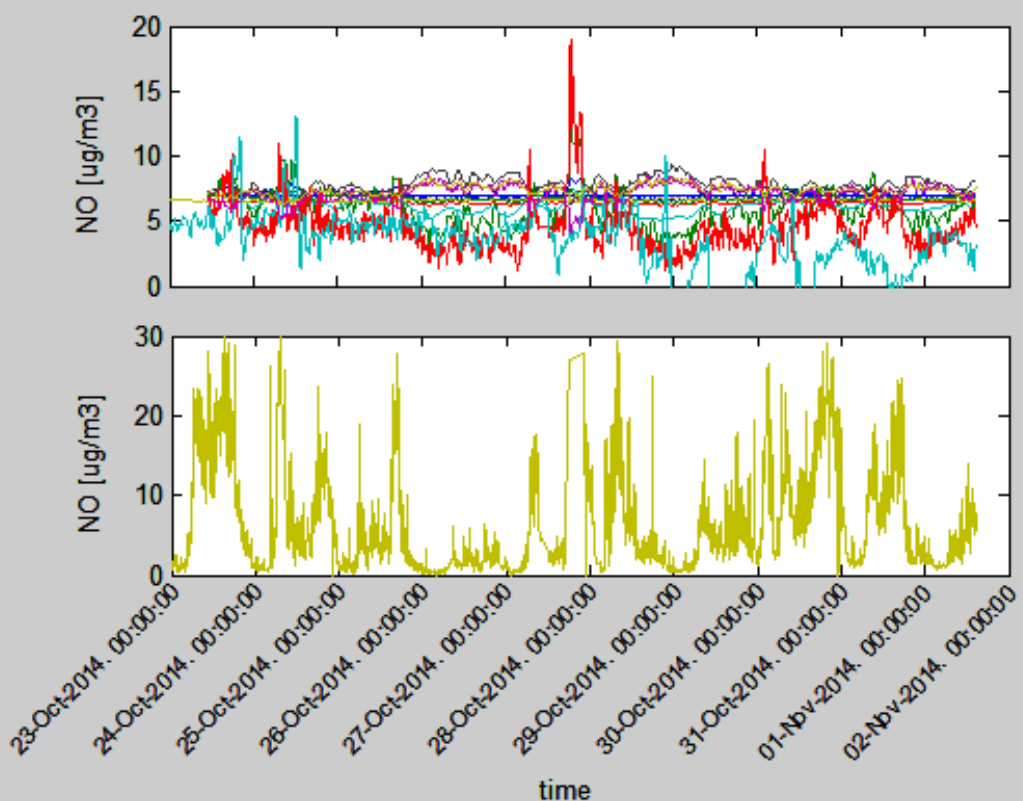
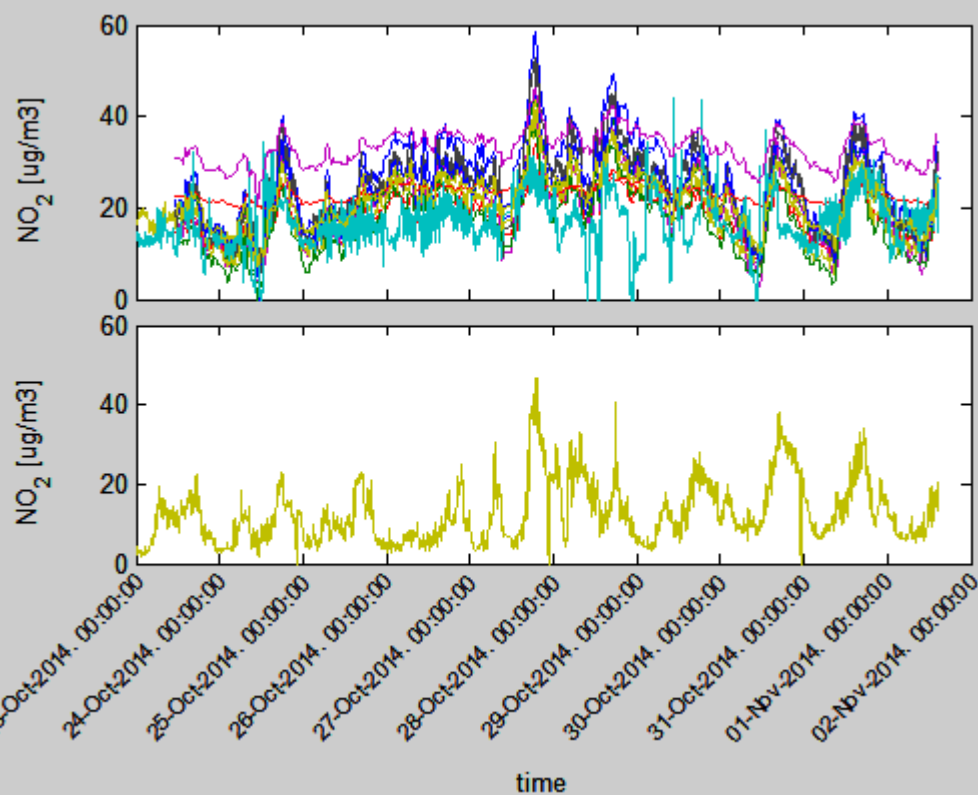
Person coefficient correlation between low-cost sensors and reference sensors for T, RH and p



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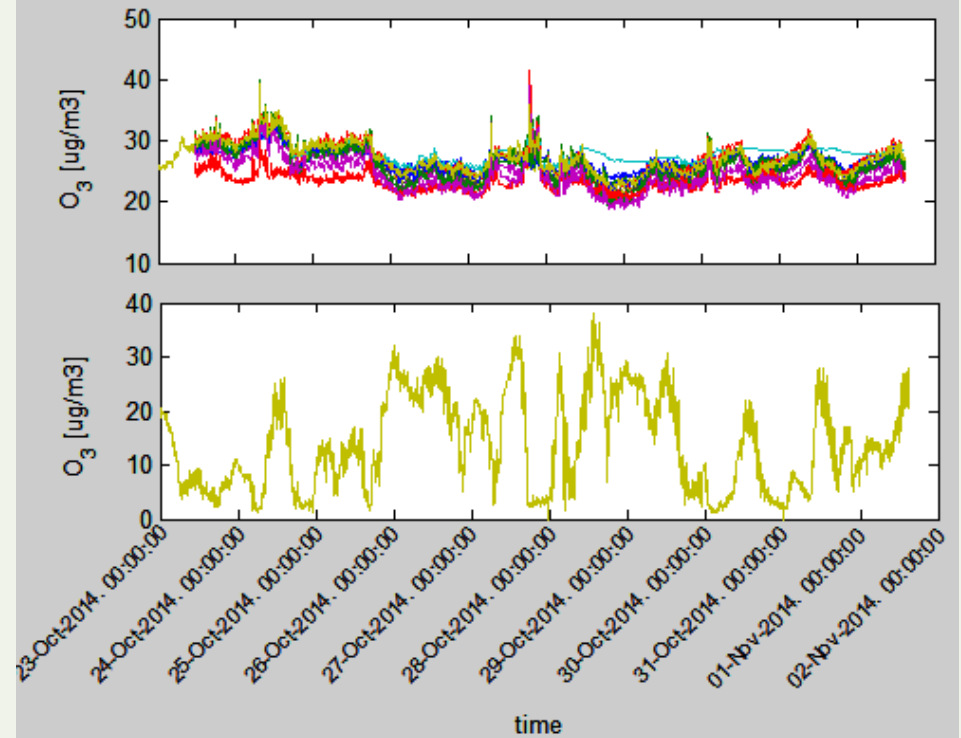
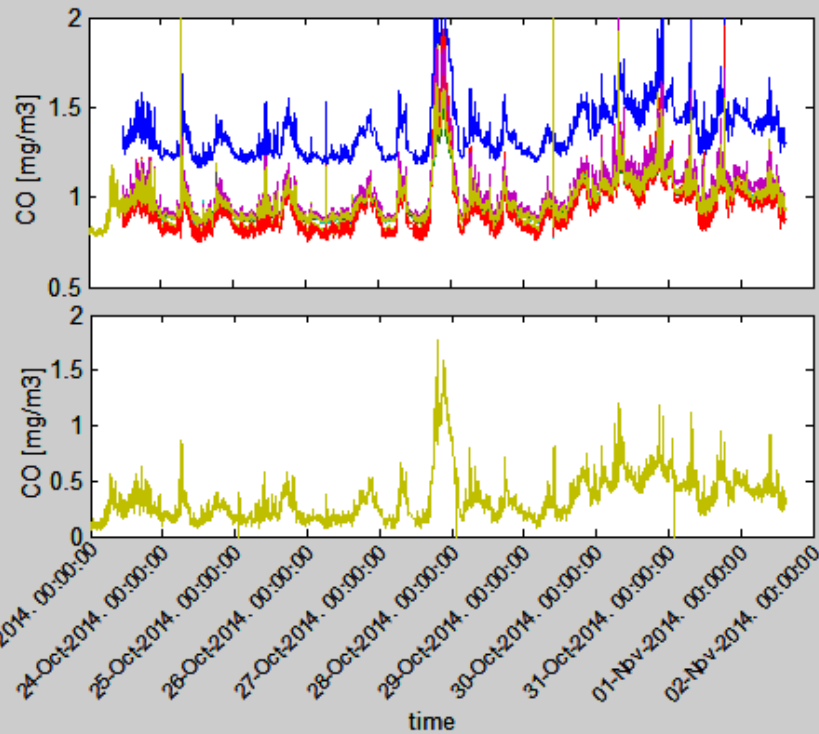
Example of concentration NO_2 and NO collected with low-cost and reference instrument in the field



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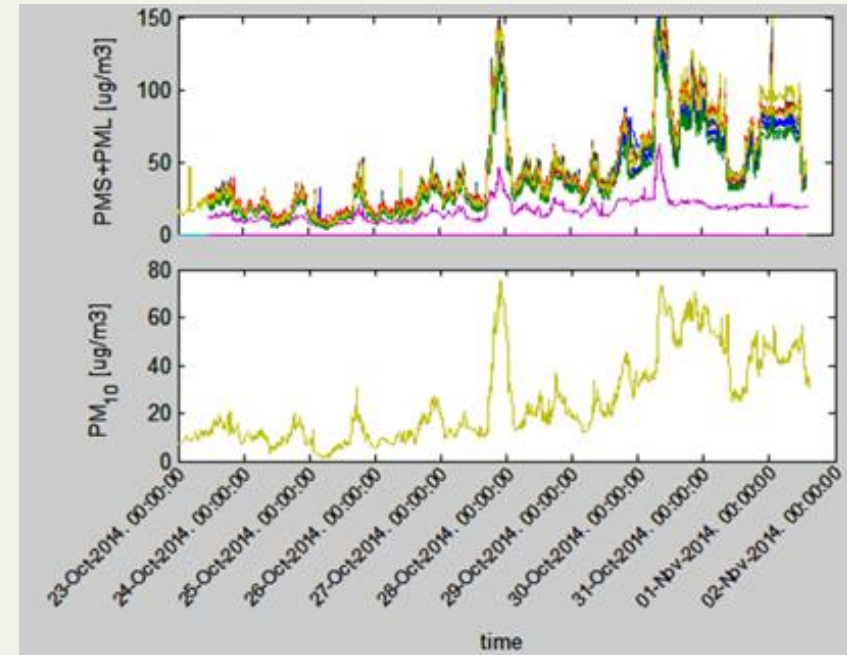
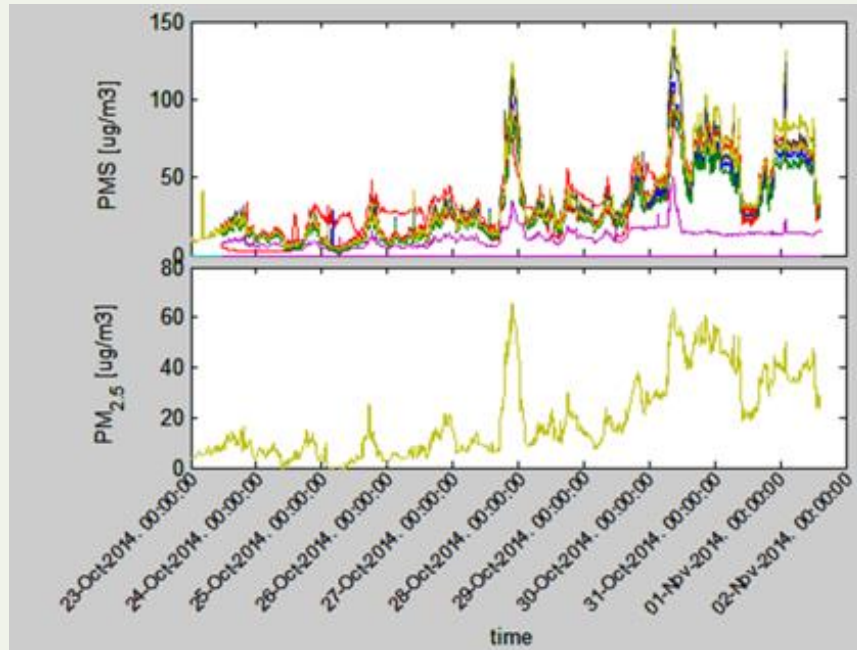
Example of concentration CO and O₃ collected with low-cost and reference instrument in the field



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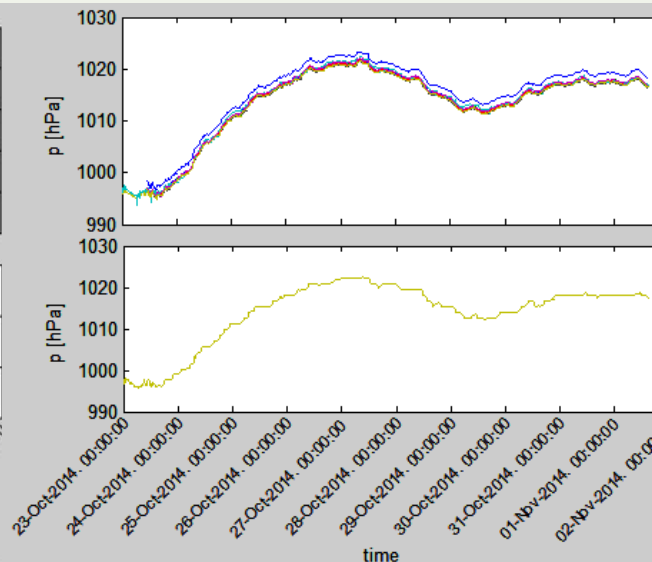
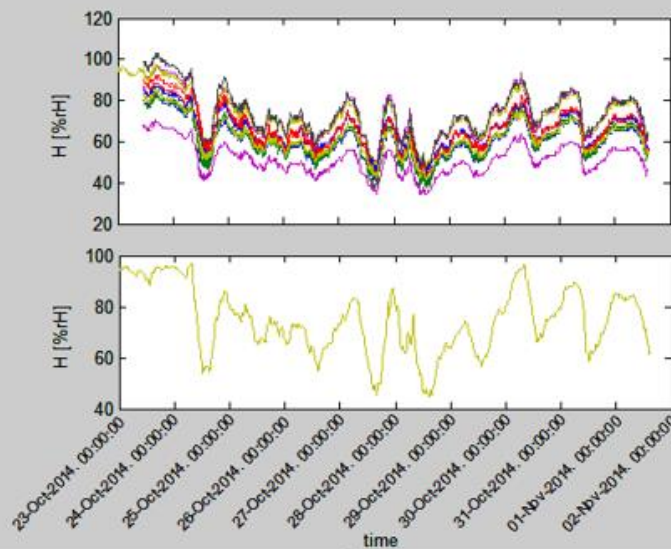
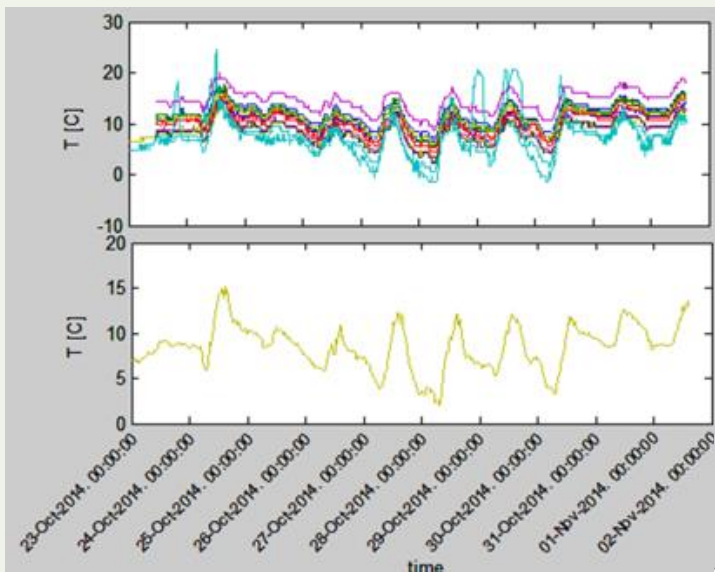
Example of concentration of PM_{2.5} and PM₁₀ collected with low-cost and reference instrument in the field



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Example of level of meteorological data collected with low-cost and reference instrument in the field



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CONCLUSIONS AND FURTHER ACTIVITIES

- To use low-cost devices with improved sensors that eliminated influence of O_3
- To update methodology of calibration in the field:
 - apply correction function for meteorological data
 - determine frequency of calibration and life time of sensors
- To compare results from different available units in the aim of finding optimal solution for analyzing and presenting indicative levels of selected pollutants and meteorological data that may be usable for citizens



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