



**SMart URBan
Solutions
for air quality,
disasters and city
growth**

component:

Air Quality 

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Context and motivation (1)

- Over half of the world's population lives in urban areas,
- Although in most EU cities AQ has improved over the past decades for some pollutants, air pollution is still a concern
- City administrations must find appropriate measures against air pollution
- This requires appropriate information e.g. on spatial distribution and source contribution of air pollution
- Smart technologies offer exciting possibilities

Context and motivation (2)

Contributions to

- Overarching Objective **OA1**: Empower EO-enabled informed decision making in support of the implementation of European Environmental Policy in key priority areas
- Vertical or Thematic Objective **OB1**: Enable different platform data fusion in EO based urban management of air pollution pressures and improve stakeholder and public awareness through new technologies
- ~ all Horizontal or Interoperability Objectives **OC**

Diapositiva 3

EA23

you may add or remove slides according to the quantity of information

Eleni Athanasopoulou; 14-09-2017

Approach

WP4 uses input from WP2 and WP3 to provide new services, tools, and products

- WP3 deploys different EO platforms (e.g. in situ, remote sensing, citizen observatories, UAVs, modeling) to meet the needs of the plan (input from WP2)
- WP4 transforms exploitable WP3 outputs into mature products regarding air quality issues
- Overall, increase the Technology Readiness Level (TRL) of the following components:
 - Citizens Observatories (COs)
 - In-situ UFP measurements (NRT)
 - In-situ aerosol source apportionment (NRT)
 - City scale AQ numerical modeling
 - Innovative sensor platforms

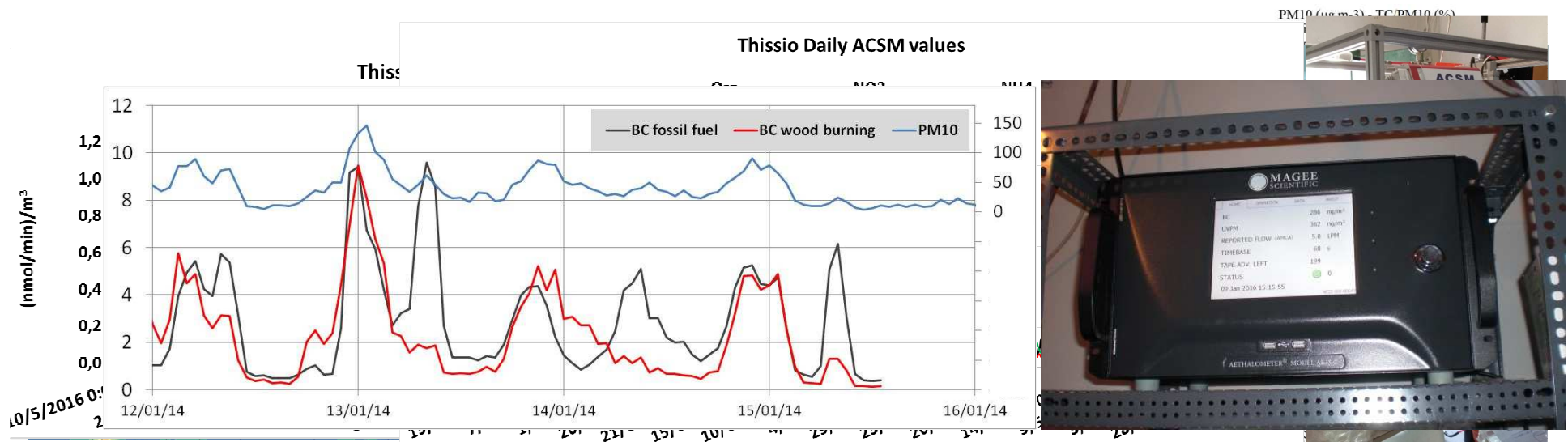
(Main) expected outcome

- OA1: Provide to relevant stakeholders robust and comprehensive Smart Urban Solutions (e.g. Decision Support Systems) and timely, open access datasets
- OB1: Integrate existing or new EO platforms for air pollution into a smart city framework
- OC1: Create smart urban solutions fusing multiple EO platforms
- OC2: Exploit the potential of EO in the Urban Essential Variables (EVs) domain
- OC7: Target a wide range of audiences and increase visibility

State-of-the-art: tools

NOA assets

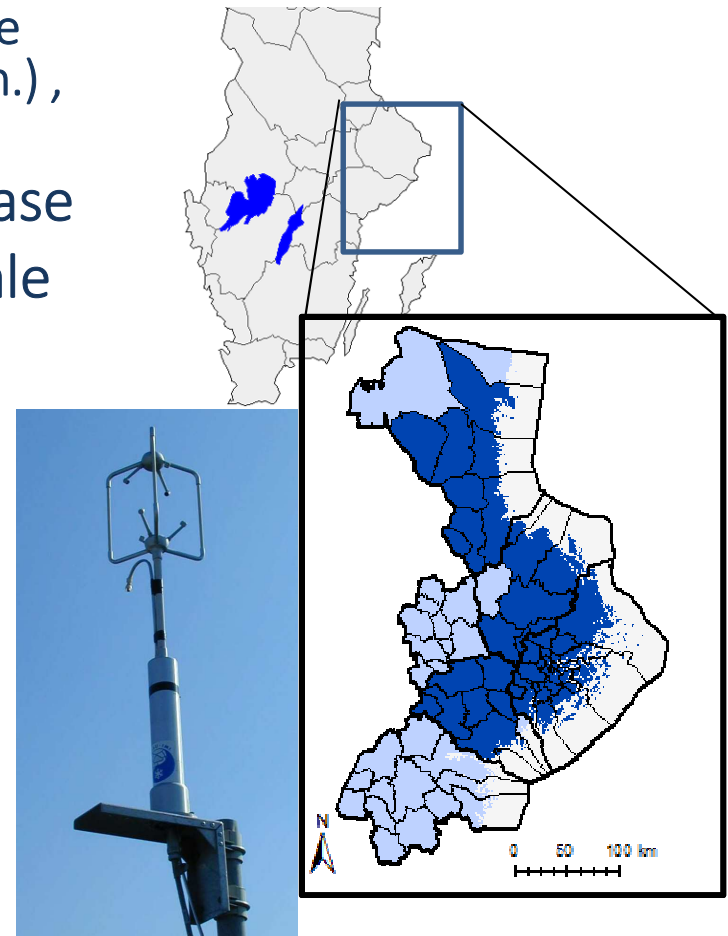
- **ACSM:** Aerosol Chemical Speciation Monitors: on-line, and long-term non-refractory aerosol fraction of PM_{10} or $PM_{2.5}$ and their main chemical components.
- **AE:** 7- λ aethalometer: information on black carbon and with appropriate algorithms contributions of biomass burning and fossil fuel combustion.
- **ROS:** innovative semi-automatic Reactive Oxygen Species analyzer (ROS) measuring the oxidative stress induced processes of aerosols on human cells.
- **COSMO-ART:** regional atmospheric model – high resolution applications
- **CAMS:** Uptake of AQ-related products



State-of-the-art: tools

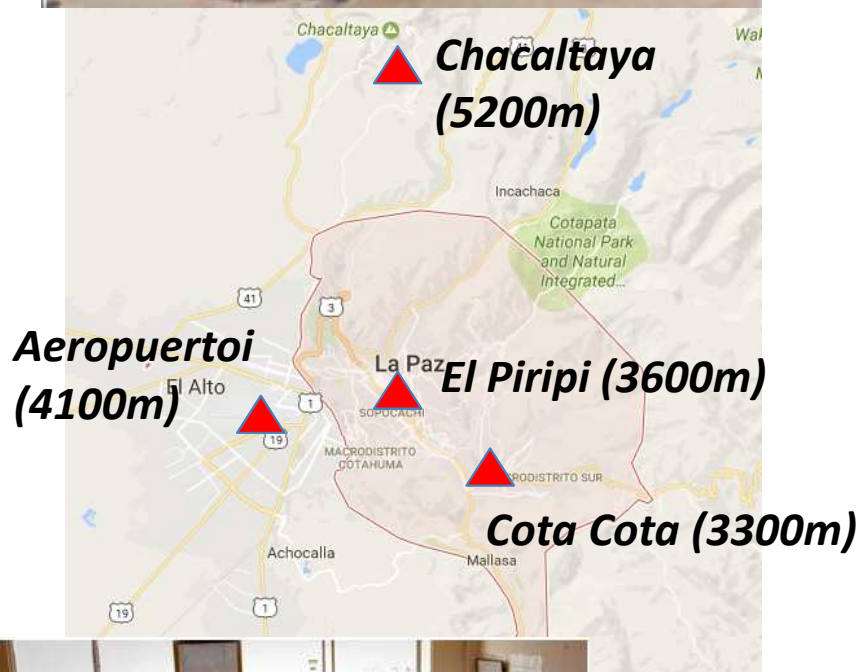
SU (Stockholm University and City of Stockholm)

- Automatic monitoring stations
PM10, PM2.5, NOx, NO2, Particle number size distribution, black carbon (7-wavelength Aeth.), Traffic counting, Meteorology
- Annually updated detailed emission database
- Dispersion models from micro- to mesoscale
- Extensive regional collaboration between authorities, stakeholders and academic institutions
- Campaigns for validation/implementation
Relaxed eddy correlation measurements
Real world emission factors



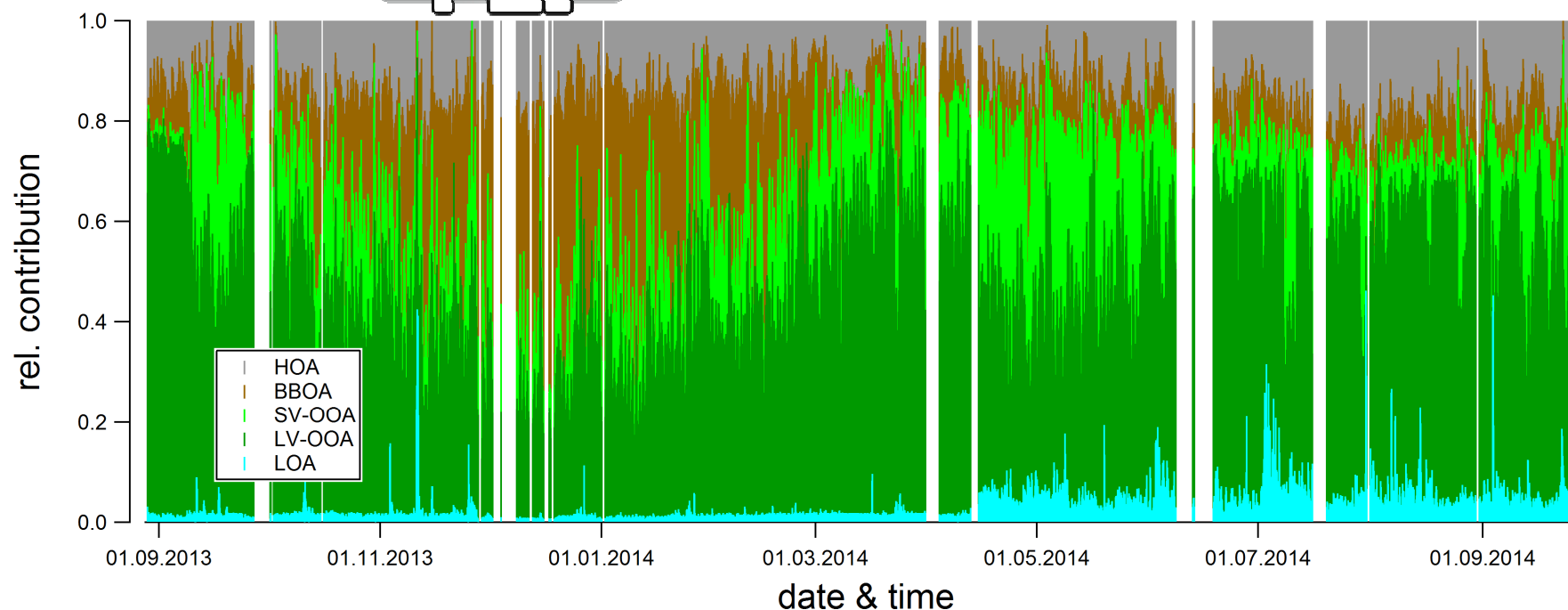
Instrumental deployment in La Paz (2016-2018)

CNRS

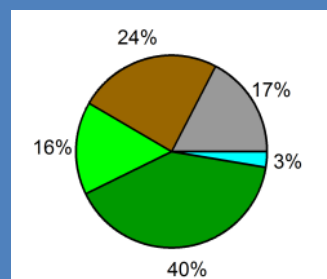


- International partnership (Bolivia, France, Spain, Germany, Slovenia, US)
- 3 sites equipped since April 2016 (+ Site Chacalataya since 2012)
- Size, BC, optical property, chemistry, lidar, chemistry
- Impact on health assessed by oxidative potential
- Local responsibilities at Laboratorio de Fisica de la Atmosfera

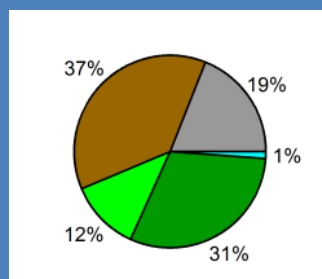




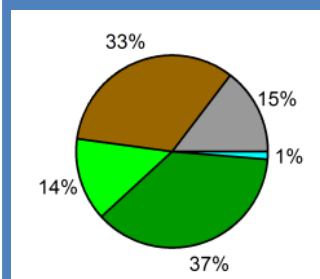
Full-year average



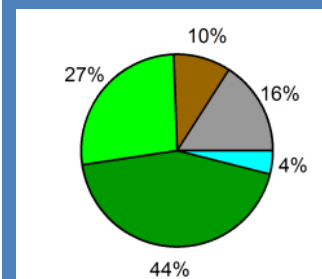
Fall 2013 (SON)



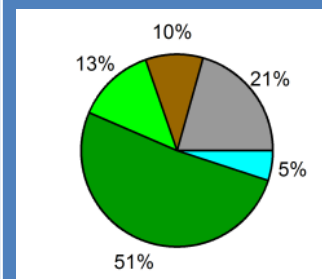
Winter 13/14 (DJF)



Spring 2014 (MAM)



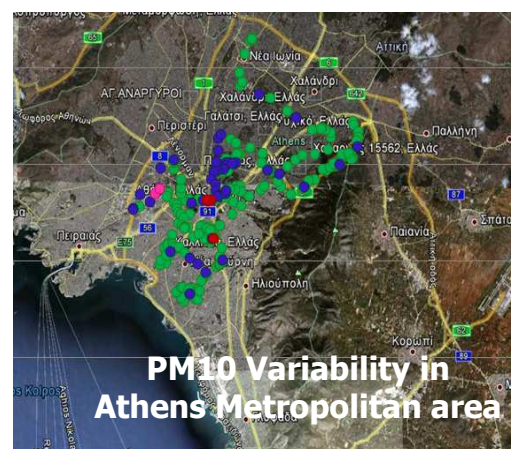
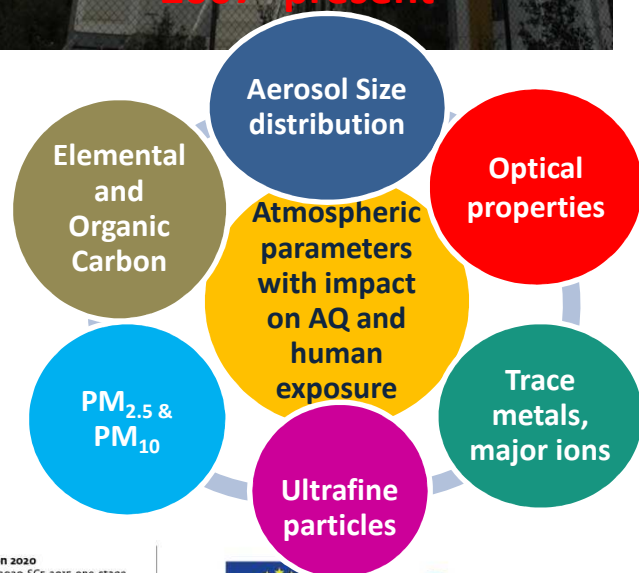
Summer 2014 (JJA)



Athens pilot (NCSR Demokritos)



Innovative observational platforms:
Installation testing (reference suburban station) and operation of a **low-cost micro-scale AQ sensors' network** and **data platform** with quality assured high-resolution, real-time air pollution data with high spatiotemporal coverage

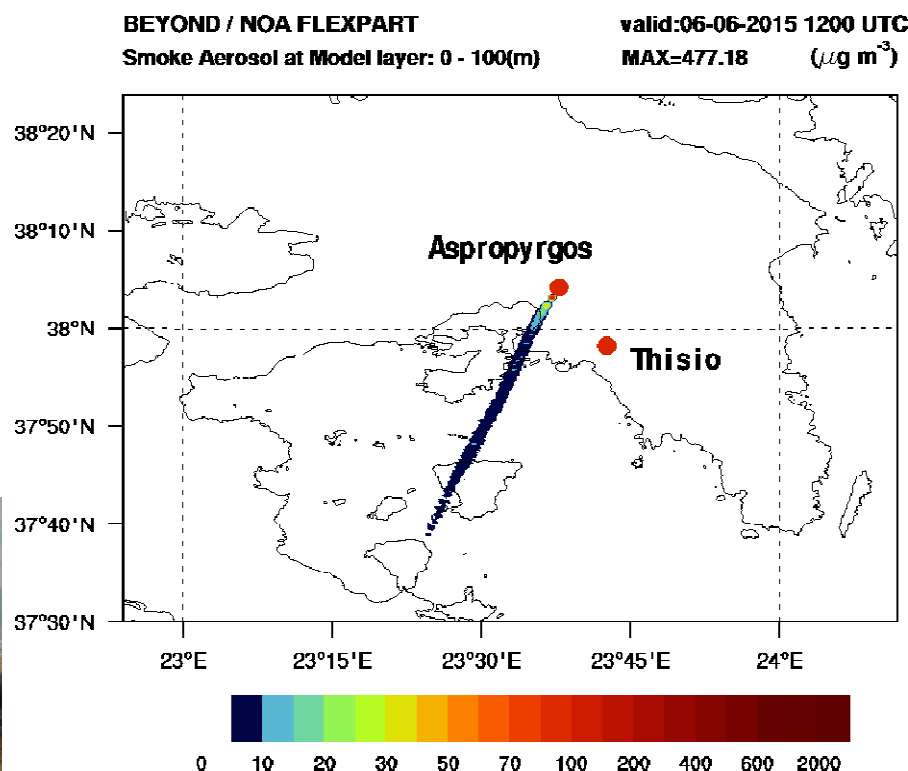


Towards ->
IoT, citizen observatories,
mobile apps

Emphasis on
replication and
transferability

Specialized measurement, model outputs and timely public information to the Region for an occasional peri-urban 'disaster' (fire accident).

NOA



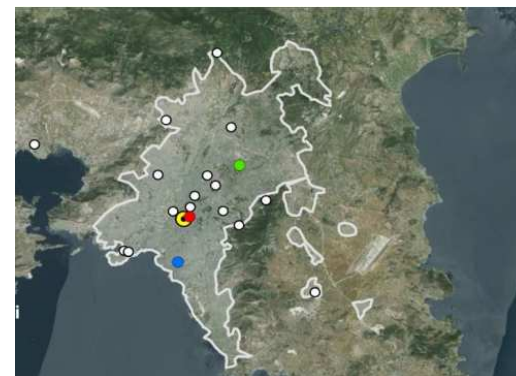
NOA systematically informs the regional /gov. authorities and the public (annual press releases) on RWB air pollution levels over Athens

PSI: Automated alert (email) in case of Saharan dust event

Progress beyond the state-of-the-art



Expansion of the present AQ network in Athens with middle cost sensors and COs, towards the production of near real time AQ added value products (based on EUV and SDGs) towards citizens, stakeholders, authorities



UHEL contributions

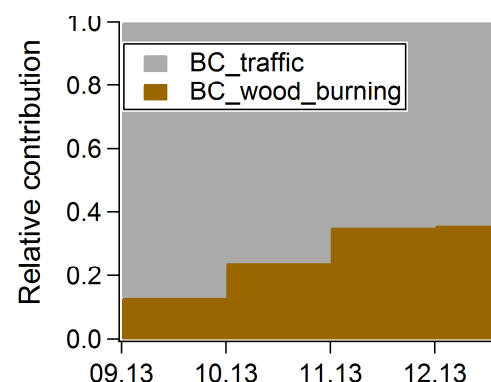
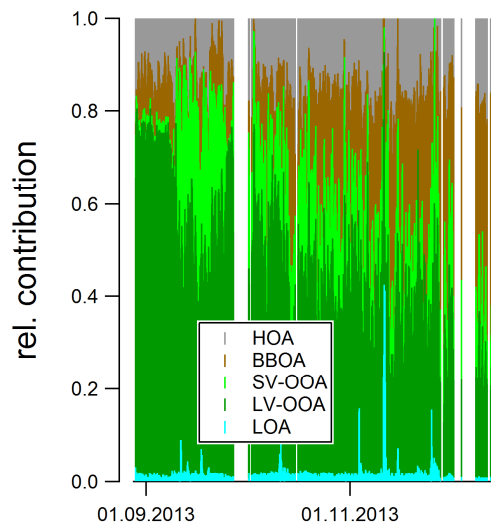
- Comprehensive air quality measurements in Helsinki, Nanjing, Beijing and La Paz
- Emission footprint area determination with back trajectories from Flexpart –model (resolutions: horizontal $0.15^{\circ} \times 0.15^{\circ}$, vertical 135 layers, temporal 1 h) for Helsinki, Nanjing, Beijing and La Paz
- Aerosol source apportionment based on aerosol mass spectrometers (AMS, ACSM) in La Paz and Beijing

SMURBS Programme 2018-2020 for La Paz

- Continuation of measurements until Sept. 2018 (incl. Oxidative potential)
- Air quality model runs in 2018
- Work with city authorities
- Capacity building



Development of SoFi RT (Source Finder Real time) for Real-time source apportionment of carbonaceous PM for Athens and Paris



Planned:

Real-Time (within one hour or less) source apportionment of

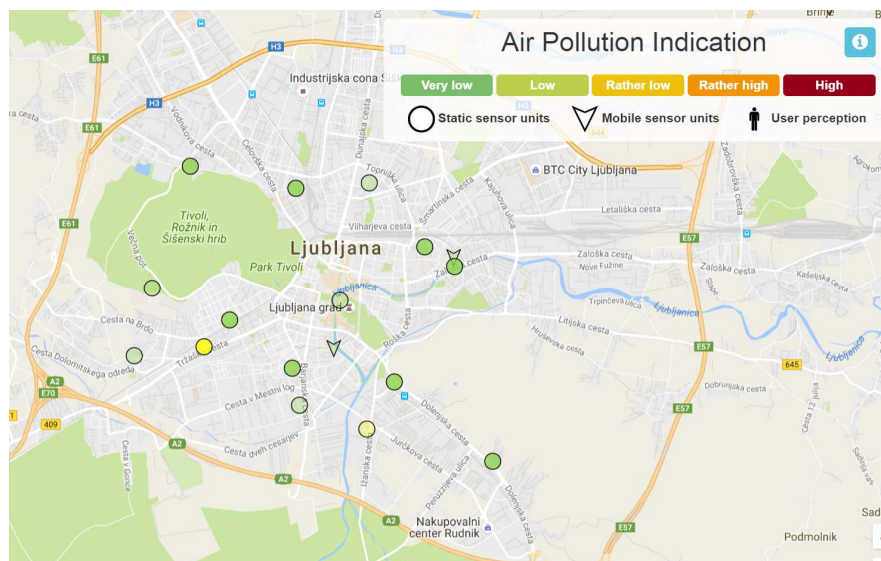
- organics: traffic, cooking, residential wood burning, secondary organics,
- Black carbon: traffic and wood burning related black carbon aerosols

using aerosol chemical speciation monitors (ACSM) and Aethalometers (AE33)

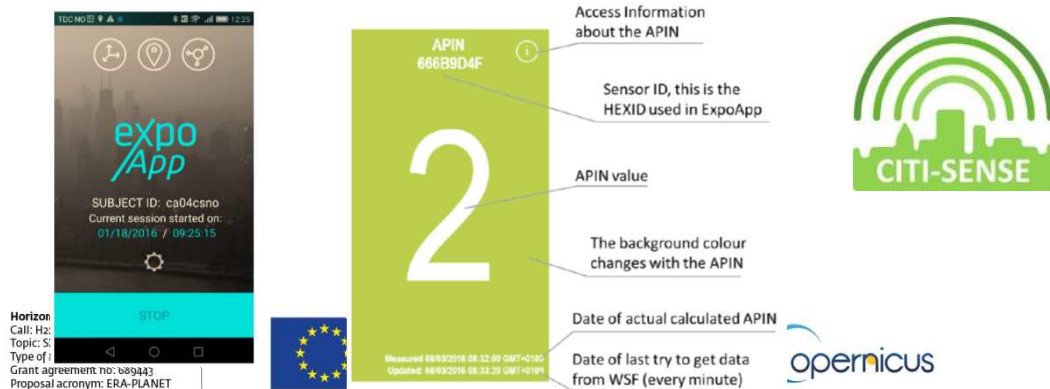
Comprehensive aerosol chemistry measurements and source apportionment in Beijing and Delhi using the latest state of the art mass spectrometers



Static AQ network



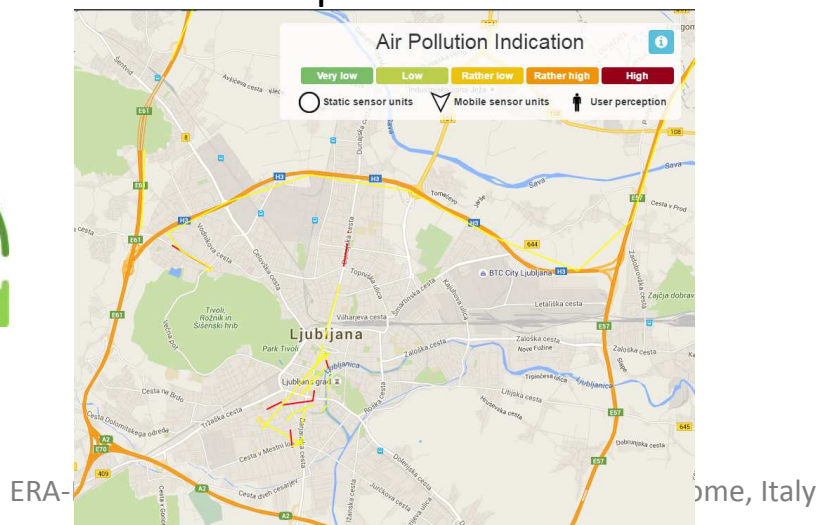
Smartphone App for portable monitor



Portable AQ monitor



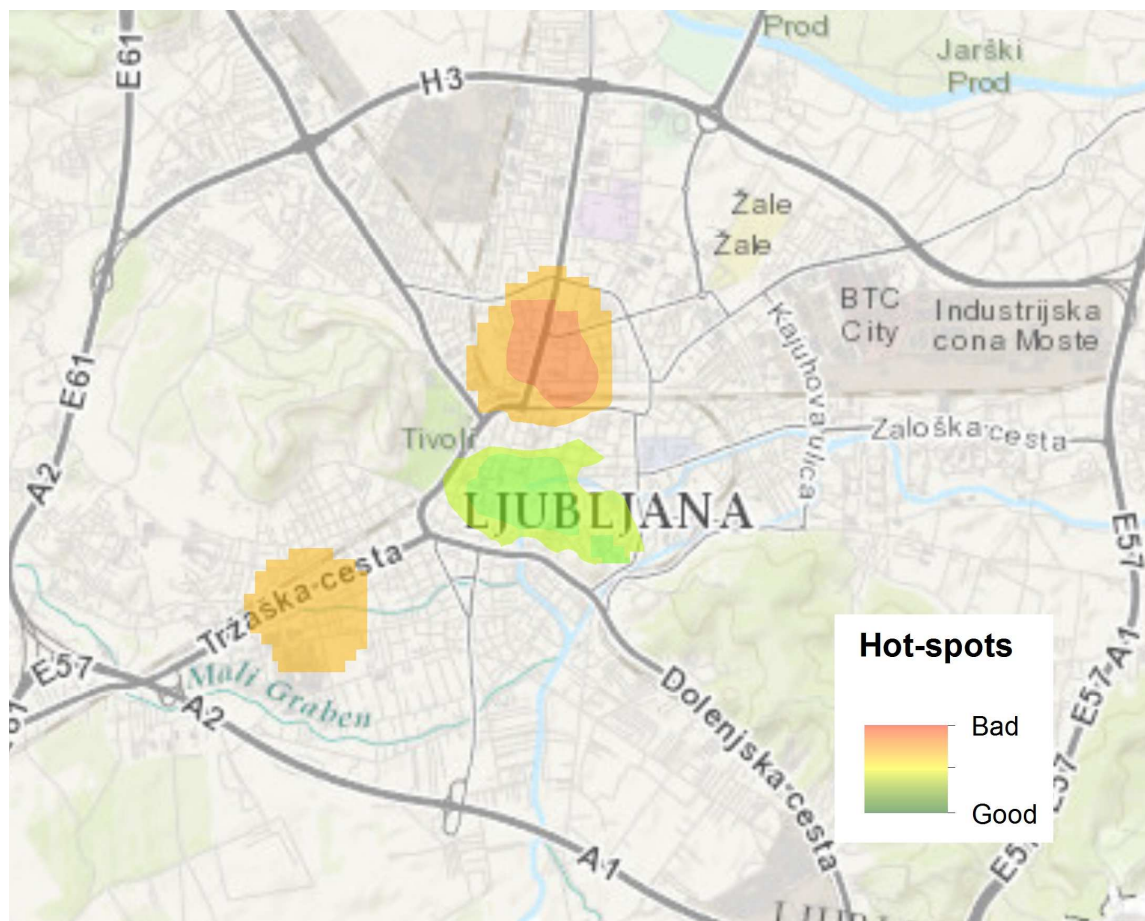
Personal exposure visualisation



Community-based environmental monitoring: subjective perception



CityAir App for reporting of AQ perception



- Public maps for sensitive persons presenting 4 day prognoses of an Air Quality and Health Index
 - Considers exposure to PM10, NOx, O3 and pollen
 - Index based on health risk factors from local epidemiological studies
 - Utilises Copernicus CAMS European wide prognoses for non-local sources
 - Local emissions and modelling for local sources
- Validation exercises
 - Panel study including asthmatics to assess usefulness of information
 - Comparison between model calculations and measurements (rural, urban, hotspots)
- Plan is also to make apps (if local funds becomes available)

SMURBS Air Quality will provide

- Expansion of networks , consolidated / improved infrastructure
- Link of in situ, remote sensing and satellite data with modelling activities
- Development of Apps for smart city solutions
- Real time source apportionment readily available for decision makers
- (Exploratory) extension of source apportionment to new variables
- ‘New’, automized, customized, standardized, online , open data