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Innovations for environment

Urban PM10/2.5 sensor networks in Poland – first experiments and implementations

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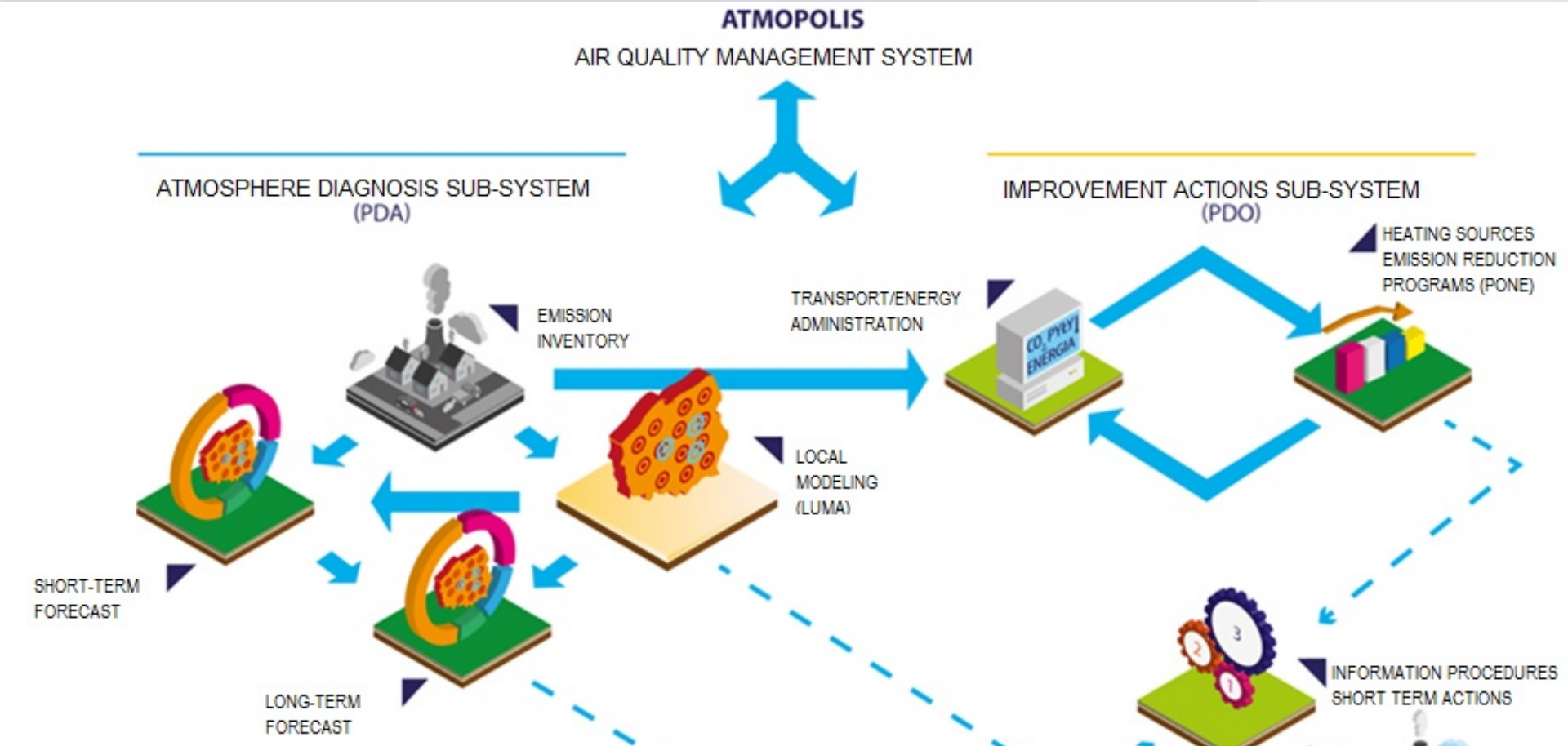
Air quality management – urban scale



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Atmopolis *– an air quality management system that allows to identify air quality risks and to optimise air quality improvement actions.*

Diagnosis of urban air quality problems

Main problem in Poland:

- high PM10/2.5 concentrations

A lot of data on AQ and emissions available:

- annual official air quality assessment reports,
- regional air quality action plans,
- local air emissions reduction programs,
- point sources databases,
- traffic sources analysis reports,
- detailed inventories of solid fuel fired domestic heating sources (SFFDH sources).

Requirements for additional urban AQ data

- **spatial distribution** of concentration
- areas of exceedances
- number of exposed inhabitants
- based on sensor networks
- application of GIS tools
- **near on-line** picture of local air quality
- integration with the results of the state monitoring network

LUMA concept – on-line urban AQ modeling based on sensor network

Local **U**rban **M**odeling of the **A**tmosphere

LUMA uses low-cost sensors in conjunction with mathematical modeling. Nodes of a sensor network give direct information on spatial distribution of pollutants in the city. Basing on such information city administration can pay an attention to the hot-spot areas and make correct short and long-term decisions to achieve the best atmospheric pollution reduction effect.

Components:

- Local PM10/PM2.5 sensor network
- Data from the state monitoring network
- Data processing algorithms
- Dispersion modeling calculations

Main features of the sensors

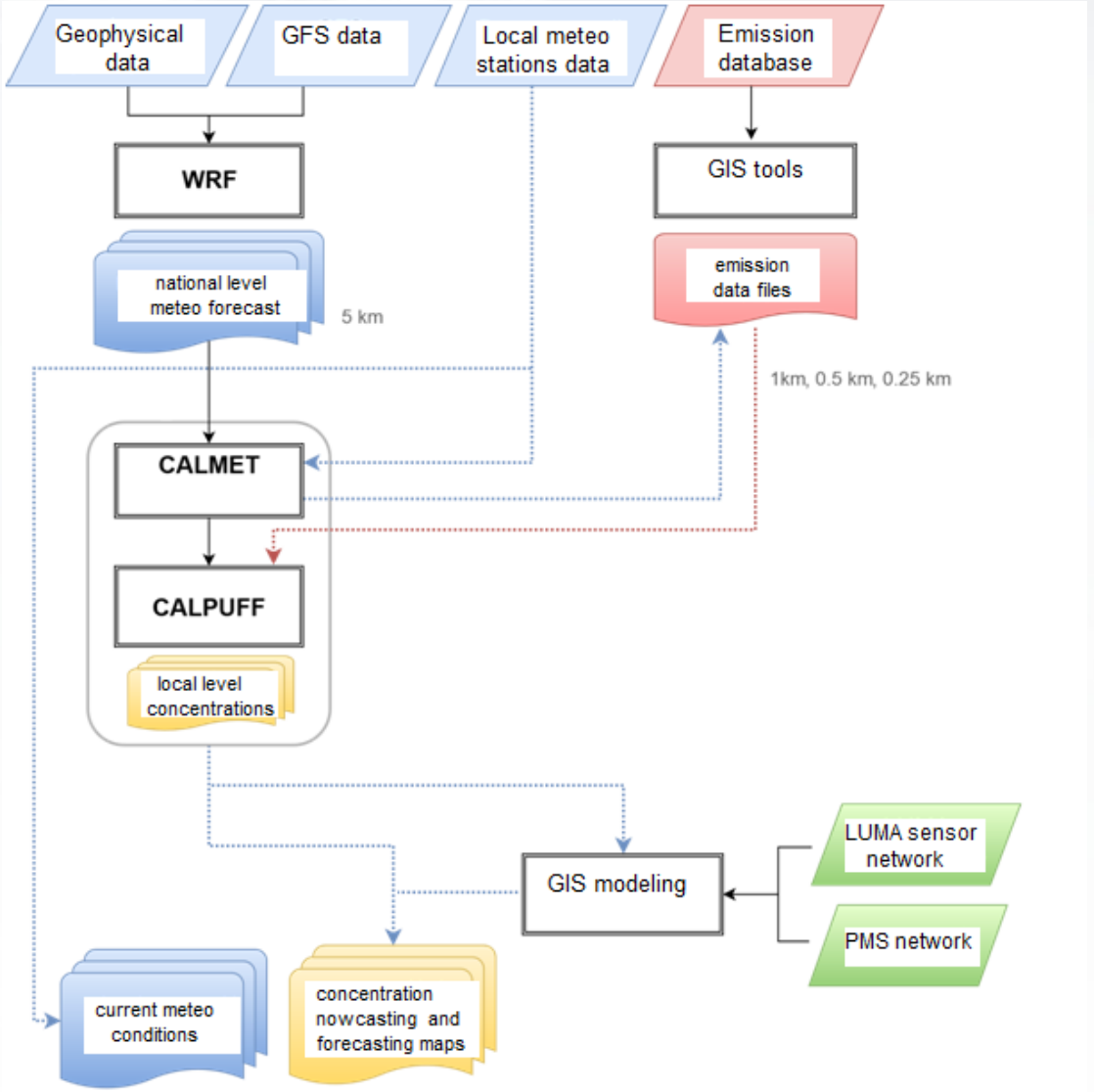
- Simple optical particle counter (6-channel)
- PM10/PM2.5 detection
- Auxiliary temperature/humidity sensor
- Low power consumption
- Wireless data transfer (GSM)
- Local data storage
- Microprocessor control
- Remote setting of parameters

Data processing procedures

- Normalisation of sensors - before starting detection on site
- Humidity and temperature compensation procedures to avoid influence of water droplets on optical particle detection
- Quality check algorithms
- Network calibration to the state monitoring data

Application of dispersion calculations

- Design of the network
- Missing data modeling (off-line dispersion modeling results)
- Nowcasting / forecasting (in-progress)



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Bydgoszcz project

- 8-points network of PM10/PM2.5 detection

- investigation of air quality in the areas of SFFDH sources location
- 1 sensor for comparison with state monitoring

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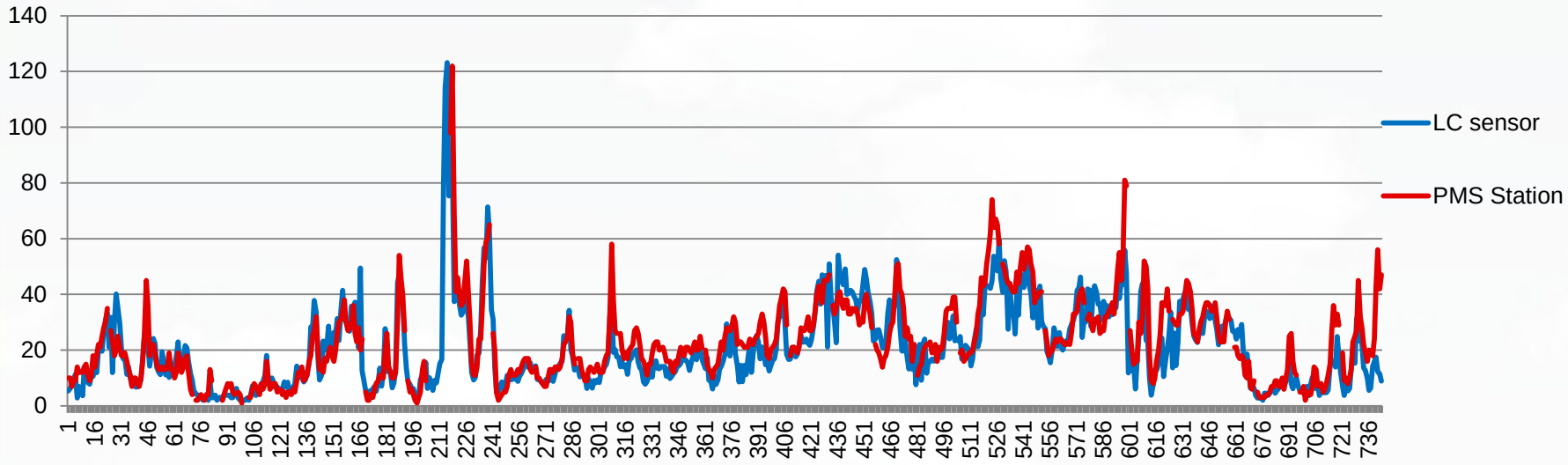
Bydgoszcz project

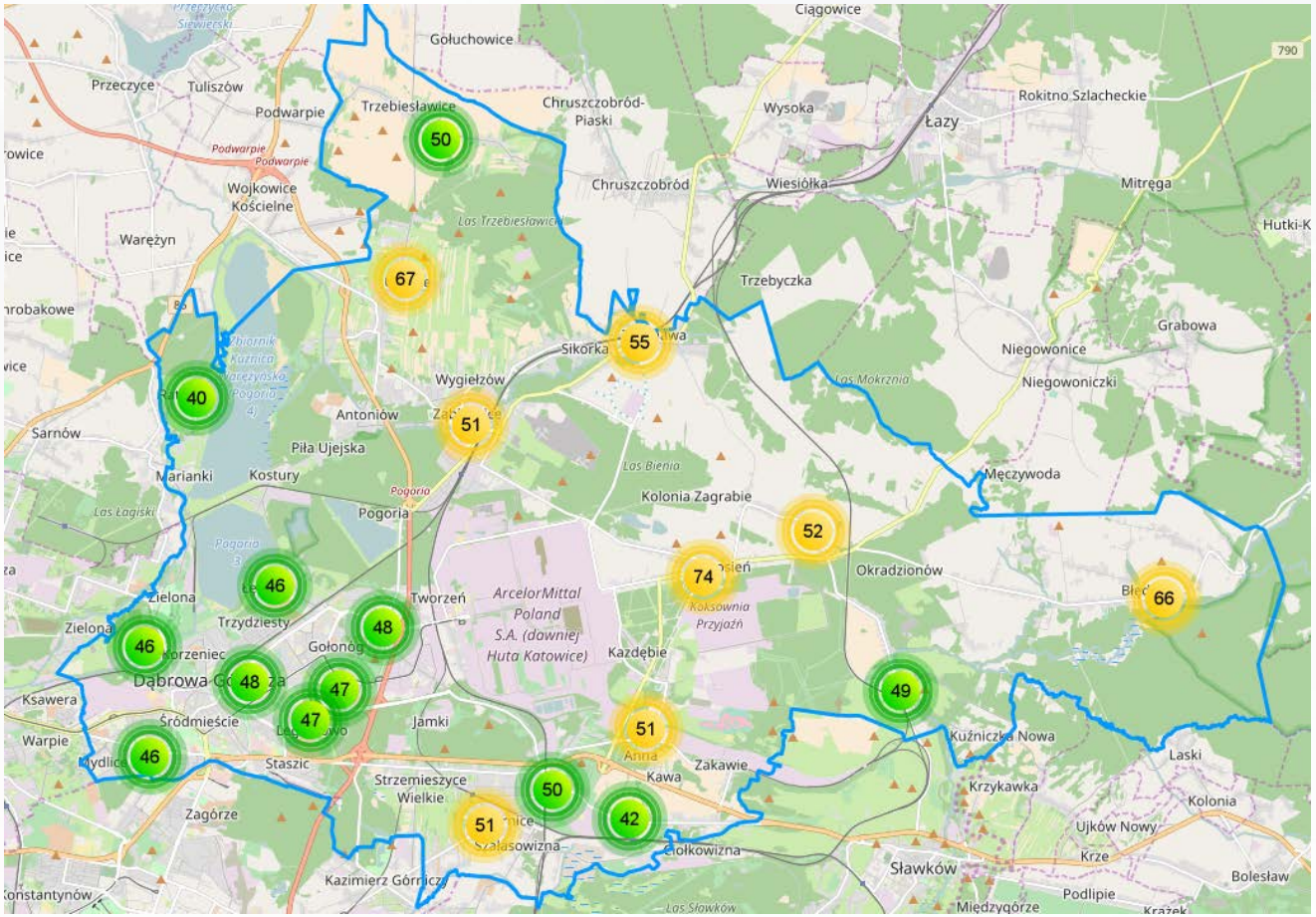
- PM2.5 concentration time series (1h average, µg/m^3)
- Low-cost (LC) sensor vs. state monitoring station (PMS)



October 2016 – *moderate concentrations*

Dabrowa Gornicza project (on-going)

- 20-points network of PM2.5/PM10 detection



- investigation of air quality in different areas (SFFDH, industrial, traffic sources)
- 1 sensor for comparison with state monitoring

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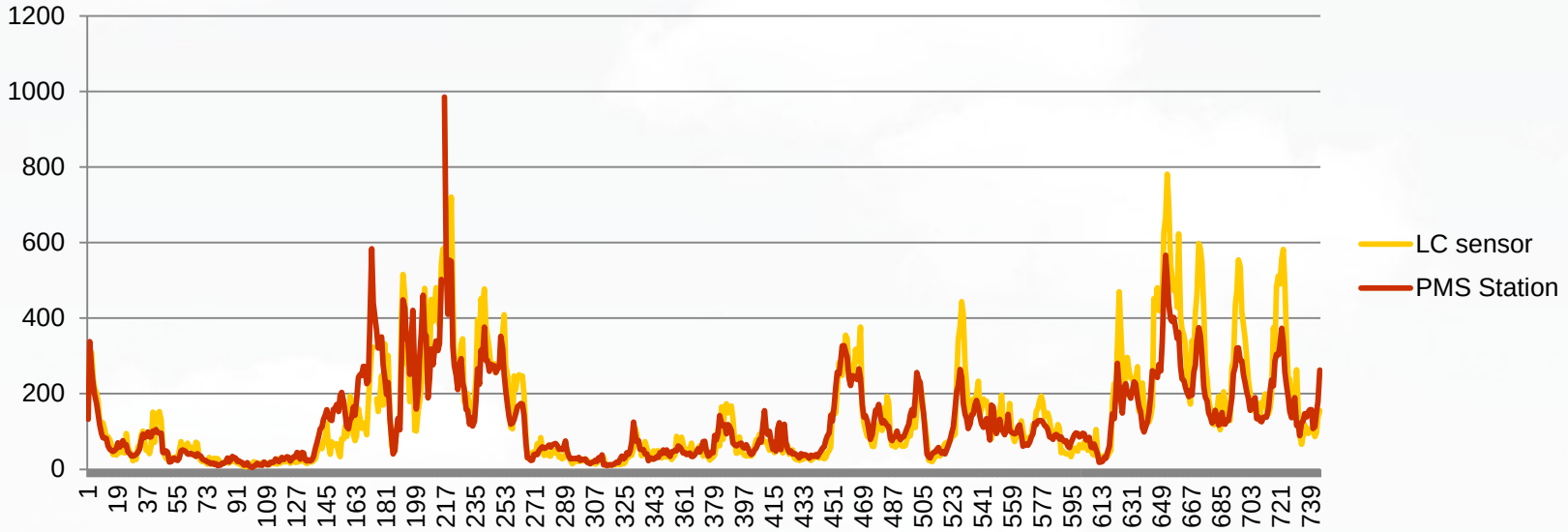
Dabrowa Gornicza project

- PM10 concentration time series (1h average, µg/m^3)
- Low-cost (LC) sensor vs. official monitoring station (PMS)



January 2017 – *high concentrations*

Further research and development

- new project supported by NCBR (national R&D agency)
- fully wireless detectors
- on-line integration with dispersion modeling
- advanced data processing methods and software
- gaseous pollutants including NO_2 and VOCs

- *Thank you for your attention!*

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