

Project consortium SmartAQnet – Aerosol Akademie

Newsletter SmartAQnet

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Smart Air Quality Network

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Aerosol Akademie

Dissemination activities

Webpage

- Partner Aerosol Akademie is currently and ongoing working on amendments / improvements of the homepage. The improvements will be implemented continuously.
- Another upgrade will follow in January 2018: Aerosol Akademie is working on the English translation of the website. If the new English website is available, an Email will follow to keep you informed.

Publication(s)

- Preparing publication for AGIT Symposium 2018 (Salzburg, Austria)

Networking and cooperation developments

- In cooperation with Klaus Schäfer: Cooperation with pollen sampling from UNIKA-T.
- Getting in contact and discussion of cooperation with Breeze Technologies UG.

Reporting (together with the partners GRIMM and IMK-IFU, see also IMK-IFU):

- Report of an overview about monitoring air pollution by new concepts for sensors and data accumulation (in relation to existing networks)
- Report about status of application (market and technical status) of personal sensors to detect air pollution exposure and for personal health protection

GRIMM

Scientific Scout Phase 1

Since 05.10.2017: First functional testing and test of measuring mode within intercomparison at Pouch (Grimm facilities; 5 x EDM80NEPH and 1 x EDM164 as reference).

Since 25.10.2017: First functional testing and test of measuring mode within intercomparison at Augsburg (Friedberger Straße; 5 x EDM80NEPH and 1 x EDM164 as reference)

Test program

- Implementation / Installation at site (positioning, connection/supply)
- Connectivity (test of pre-configurations for Plug&Play with local WLAN-Access Point)
- Measuring mode and data-upload: Measuring data (PM-values and channels of resolution / TC of reference, meteorology, UTC/GPS) as continuous data (GRIMM-style) on ftp-server.
- Remote control system (manual change of settings, automatically software update) => Improvement and extension of functionality
- Signal analysis and algorithm => preparation for the field calibration for different PM-values.

- Robustness of measuring device (weather conditions, outdoor temperature, ...)
- Continuous operation (outdoor), failure rate and debugging
- Possible sources of errors (manufacturing or assembling or operation errors)
- Factory settings of used components => adaptations / changes

First experiences

- Good operational stability.
- Expected low concentrations of particulate matter (background concentration) head in challenges in the development of algorithm for field calibration.
- Planned initial calibration in December at the container Augsburg was delayed due to power failure (01.12.-19.12.). Devices are running with factory settings (pre-calibrated at calibration rig with specified aerosol). Therefore, no measuring data of reference device are available for that period (for planned cross-validation with other devices at the site).

High expectations set in planned comparison measuring in Asia (5 x EDM80NEPH und 1 x EDM164).

Now the preparation for the measuring cooperation at Chengdu University is ongoing. Used devices are waiting for shipping in consultation with the local distributor (assembly) and the University (Prof. Kang und Prof. Zhang). Two further monitoring stations shall be implemented beginning 2018 for 2-3 months at Malaysia and Nepal.

Outlook 2018

Requirement analysis

GRIMM is planning to finish the requirement analysis by May 2018 taking into account the data evaluation and experiences of comparison sites Pouch, Augsburg, Chengdu, Malaysia and Kathmandu, a comprehensive competitor analysis regarding measuring “devices” (low cost sensors, PM-monitors, Scientific Scouts), “smart” monitoring networks and measuring initiatives. Based on this requirement analysis specifications for Scientific Scout Phase 2 will be specified as well as requirements for a smart measurement platform for automatically calibration and integration of different measuring devices and qualities. If necessary, the 25 Scientific Scouts Phase 1 shall be re-engineered for the ongoing measuring campaign (from summer 2018) at the site in Augsburg or be adapted for their special Use (e.g. Bus, Tram)

Scientific Scout Phase 2

Based on data evaluation (measuring campaign and field calibration in Asia) specifications for Scientific Scout Phase 2 will be specified (measuring principle, signal evaluation, device setup/configuration, complete functionality, connectivity ...). Until End of 2018 (first) prototypes shall be available.

Development of data format

Requirements to the data format shall be discussed and matched in cooperation with SAQN project partners within first quarter 2018.

Helmholtz – CMA**Helmholtz – EPI II**

A focus was set on the preparation and participation in the face2face meeting in Augsburg (Cyrus, Kusch) and the supervision of the comparative measurements at the reference measuring station in Augsburg (Kusch, Cyrus).

In the last weeks, the BC-Analyser was installed. First test measurements and a preliminary evaluation of the gained data have been performed and the results have been compared with Aethalometer (Kusch, Cyrus).

At last, Helmholtz-EPI II participated in the meeting "Augsburg Meteorological Observations Meeting" on 15.12.17.

KIT/IMK-IFUProject management (WP 0)

Weekly Jour Fix of the steering committee performed by phone (Thursday, 16:00).

Data collection (WP 2)

Reporting together with the partners GRIMM and Aerosol Akademie:

- Report of an overview about monitoring air pollution by new concepts for sensors and data accumulation (in relation to existing networks)
- Report about status of application (market and technical status) of personal sensors to detect air pollution exposure and for personal health protection

Data aggregation and analyses (WP3)

- A meeting was chaired by KIT IMK-IFU between parties in and outside the SmartAQnet project to discuss meteorological observations (met. obs.) previously and currently made in Augsburg. A working paper for the SmartAQnet network phase 1 has been drafted with the idea of a Central Activity Zone (CAZ) centred around an existing state air quality monitoring station at Königsplatz. The CAZ provides the opportunity to test deployment and calibration strategies with new and existing sensors, as well as upload and processing of data on the SmartAQnet server during an intensive observation month (IOM), perhaps September 2018.
- An additional ceilometer (observes cloud height and can derive mixing-layer height (MLH)) has been sourced and plans have been made to intercompare this unit with the University of Augsburg CL51 and existing IMK-IFU CL31 ceilometers. The aim is to deploy the new CL31 to

the north of the city centre to create a transect in order to investigate the spatial variability in MLH.

- A green paper has also been drafted on possible secondary data available in Augsburg and the possible use of infrastructure to connect the network to. Secondary data sources include crowdsourced data from mobile phones and personal weather stations, whereas possible infrastructure are existing Wi-Fi networks and municipal street lighting columns.

Data oriented dissemination and application (WP5)

Public relations by participation in conferences

- SPIE Symposium “Remote Sensing”, Remote Sensing of Clouds and the Atmosphere in Warsaw, Poland, 11 to 14 September 2017; oral presentation and proceedings paper
- 22nd International Transport and Air Pollution Conference (TAP2017) in Zürich 15 to 16 November 2017; poster presentation and proceedings paper
- Abstract accepted for 11th Air Quality conference in Barcelona, Spain, 12 - 16 March 2018; poster presentation
- 2 Abstracts accepted for GUS-Jahrestagung in Karlsruhe 21th to 23th March 2018; oral presentation

Networking and cooperation developments

- Cooperation with pollen sampling from UNIKA-T together with the development of the new air pollution monitoring network in Augsburg,
- Small-scale modelling of spatial/temporal distributions of air pollutants in Augsburg together with Aristotle University Thessaloniki,
- Installation of scientific scouts in Chengdu together with Chengdu University of Information Technology,
- Information exchange about observing infrastructure (e.g. roads, rail, electricity) using smart connected sensors University of Birmingham,
- Discussion about sensor-to-server data transfer in near real time by LPWAN (Low Powered Wide Area Networks) with a third-party provider,
- Discussion about measurements of vertical profiles and spatial surface fluxes with University of Innsbruck,
- Information exchange about smart sensor networks in China together with Institute of Atmospheric Physics of the Chinese Academy of Sciences,
- Discussion of cooperation of the development of smart sensor networks together with the project PRAISE-HK in Hongkong,
- Discussion of cooperation of the development of smart meteorological network together with the SenseBox project,
- Discussion of cooperation of small sensor development together with the Technical University Munich,
- Discussion of cooperation of small sensor operation at UAV together with Meteorological Institute of the Ludwig-Maximilians-University Munich,
- Discussion of cooperation of small sensor operation together with Vaisala GmbH.

KIT-TECOMeasurement node installed at Augsburg

SD011 (<http://aqicn.org/sensor/sds011/de/>) and DC1700 sensors (<http://bit.ly/2m1z6K7>) have been installed at the reference site at Augsburg. The nodes shall produce first reference measurements in the field. Before being installed at Augsburg, the sensors have been tested at the TROPOS lab in Leipzig (see Figure 1 and <https://twitter.com/JanGeorgPlavec/>).

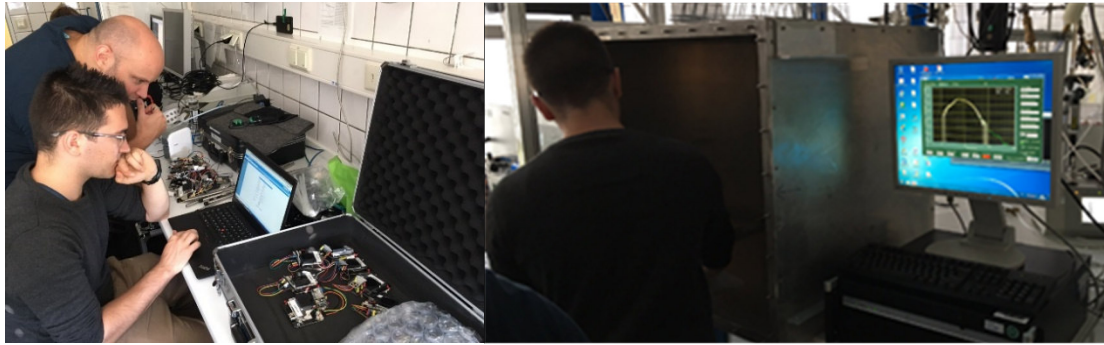


Figure 1: Matthias Budde and Dominik Kogel at the test site at TROPOS Leipzig (Source: Plavec)

Interdisciplinary value creation based on an open measuring network

Approach for interdisciplinary value creation based on an open sensor network presented at the workshop "IoT applications creating value for industry" (<http://iot-conference.org>). Till Riedel showed SmartAQnet's approach to increase the spatial and temporal measuring resolution for PM-values by various sensors in order to enable new applications. In particular, challenges of different data qualities and new business models based on the Internet of Things have been discussed.



Figure 2: Till Riedel (10th from the right) at the IoT-Conference at Linz (Austria)

SmartAQnet represented at mFUND accompanying research

The workshop has revealed several interesting potential synergies, like to the project tyrewearmapping (<http://www.bmvi.de/>) or WEKOVI (<http://www.bmvi.de/wekovi>). Based on the work at the workshop some important challenges were identified for open data projects.



Figure 3: Impressions from the mFUND workshop (Source: wik)

Master thesis on scalable interpolation and autocalibration on crowd-sourced data completed

Bowen Wang has completed his thesis at TECO about scalable interpolation of sensor values using distributed Krigings with Apache Spark. Among other things, the work takes care of using crowd-sourced sensor values from the website Wunderground (<http://www.wunderground.com>) for modelling temperature distribution by using Gaussian processes and automatically evaluating their quality (confidence). The work was performed in cooperation with the BigGIS project (<http://biggis-project.eu/>) and SDIL (www.sdil.de).

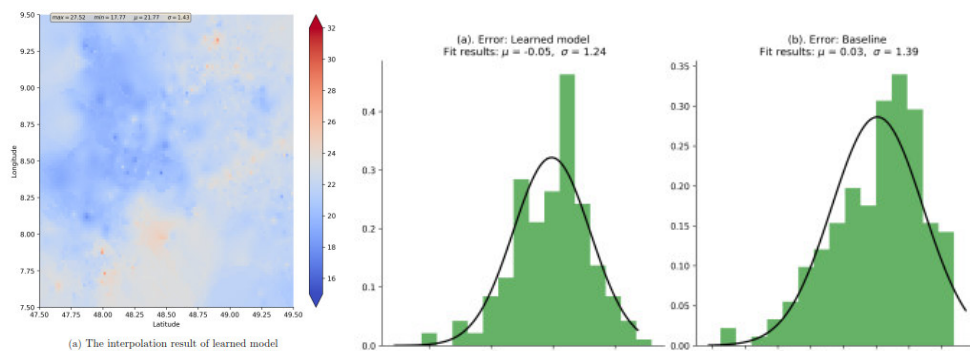


Figure 4: Selected results of Bowen Wang's Master thesis (Source: Wang)

Bachelor thesis on crowd-sensing network based on OGC SensorThings completed

Yimeng Zhu has completed his thesis on "Crowd-Sensing Bodensee Online" at TECO. In cooperation with the Fraunhofer IOSB, a measuring node was developed which consistently focuses on data fusion based on the OGC SensorThings standard. The measurement node uses intelligent compression to aggregate the water temperature data in real time from as many vessels as possible via a LoRaWAN (<https://www.lora-alliance.org/technology>). The open source code can be used in the SmartAQnet project.

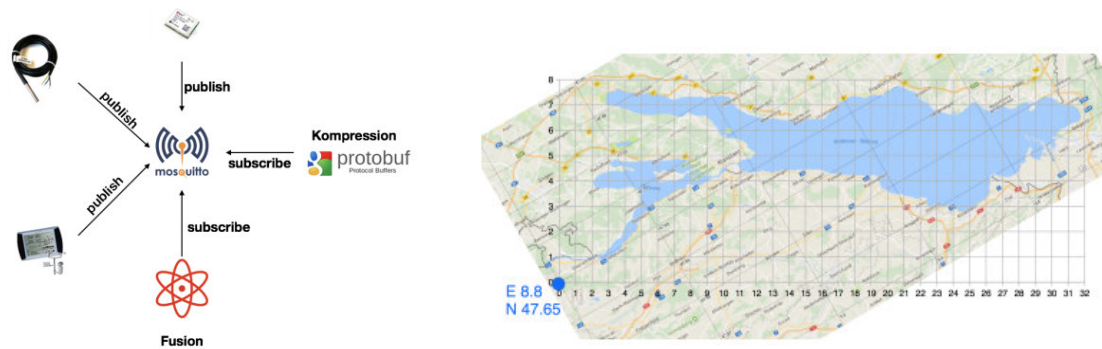


Figure 5: Approach (left) and used map of the lake Bodensee (right) of Zhu's Bachelor thesis (Source: Zhu)

Uni Augsburg

In preparation for the commencement of operational UAS-based and mobile as well as stationary measurements and the implementation of extensive intensive measurement campaigns, the development and installation of measurement technology and logistics planning was pursued until the end of 2017.

The CL51 Ceilometer, which was acquired as part of the project, was installed and put into operation at the institute's roof station and provides data on the boundary layer structure and vertical aerosol estimates on the LIDAR reflectivity since October 2017. The three Light Optical Aerosol Counters (LOAC, Meteomodem) were tested and put into operation as part of the comparative measurement at the aerosol measuring station at Augsburg University of Applied Sciences. A device had to be sent to the manufacturer and repaired, but is ready to use again.

Likewise, the development, design and programming work for the Alphasense OPC-N2 is complete. Four devices in mobile battery-powered applications now reliably deliver aerosol data with GNSS position and time data stored on SD cards. The integration into the WLAN and automatic data transmission is a next step, as well as the integration of the Alphasense and LOAC devices in the unmanned aerial systems.

Furthermore, two M600pro multicopters were procured, commissioned and tested. The fixed-wing UAS will be procured and integrated from the beginning of 2018.

For the regular mobile measurement, a network of bicycle routes has been developed, with which the regular measuring operation will start in the first quarter of 2018. The operational measurement flights at the University of Augsburg will also start in the first quarter of 2018 and the first intensive measurement campaign with parallel measurements at several locations in Augsburg will take place at the same time.