Air quality monitoring reinvented

Helsinki Metropolitan Air Quality Testbed HAQT





Air Pollution: Single Biggest Environmental Health Risk

Inhaling air pollution takes away at least 1-2 years of a typical human life

 More than 80% of people living in urban areas that monitor air pollution are exposed to air quality levels that exceed the World Health Organization (WHO) limits

 More than 5 million people die prematurely each year from outdoor pollution.
Without action deaths will double by 2050

 Toxic air pollution poses a greater threat to children, due to their smaller physical size and lung capacity.

 We do not yet even fully understand, what impact nanoparticles will ultimately have...



Actions for cleaner air and healthier people

Urban and regional planning

- Public transport made attractive and clean
- Green corridors and areas in city
- Location of industries and waste disposal sites

Legislation affecting pollution sources

- Clean fuels regulations
- Legislation for control measures in industry

Targeted efforts during air quality episodes

- Traffic restrictions
- Advisories for industries and construction sites
- Street dust management

Limiting exposure of people

- Up to date information on conditions
- Accurate advisories and warnings
- Modern tools for avoiding exposure (mobile apps etc)

All of these require an accurate understanding and awareness of air quality situation

- Main pollutants
- Areal distribution
- Temporal variation





Understanding air quality

Conventional network

Composition, key urban pollutants

- NO₂ indicating traffic emissions
- PM2.5 and PM10 indicating traffic, street dust and dust from natural sources
- O₃ crucial to understand photochemical reactions and smog
- CO to understand combustion sources like furnaces, stoves
- SO₂ to understand emissions from the industry and heavy machinery, ships etc

Areal distribution

- Air quality is a local phenomenon affected by weather and local emission sources
- A few high accuracy analysers will not provide an accurate picture of people exposure or pollutant dispersion

Temporal variation

- Sampling techniques give a picture of integrated exposure, but will not help in tactical decision making
- Real time monitoring will make also air quality forecasting possible

Supplementary dense network



Vaisala air quality instruments

Easy to deploy in quantities

- Compact
- Fully wireless, solar powered

Low maintenance

- Annual to biannual interval
- Easy to do locally

Near reference performance

- Measures all key urban pollutants
- Verified performance







Air quality + weather

Air Quality total solution



Helsinki Metropolitan Air Quality Testbed

A world first in operational supplementary AQ network to be constructed 2017-2018



Helsinki Metropolitan Air Quality

- Air quality is generally good in Helsinki Metropolitan region
- However, especially during spring time and on busy roads, the street dust and emissions from traffic weaken the air quality significantly
- During spring time even 40 % of Helsinki Metropolitan citizens suffer from various symptoms because of poor air quality
- EU defined annual limit for NO₂ is often exceeded in Helsinki Metropolitan area
- Estimate: 1600 premature deaths because of poor air quality in Finland annually



Helsinki Metropolitan Air Quality Testbed

New air quality monitoring infrastructure to Helsinki Metropolitan area:

- Dense network of air quality sensors to complement the existing regulatory network (15-20 new sensors in the metropolitan area)
- Real time air quality model and forecast based on the improved resolution data
- Dissemination of data to citizens through internet, public displays etc.
- Data available on an open interface for application development
- Improves the quality of life of citizens
- Creates improved services for air quality foreasting, alerting and traffic and city design
- Creates additional products and applications around Cleantech business area



Testbed Partners



FINNISH METEOROLOGICAL INSTITUTE





Vaisala

- Vaisala AQT420 air quality sensors (appr. 15 pcs) to be installed around Helsinki Metropolitan area
- Measurements of NO_2 , O_3 , CO and SO_2 gases and PM2.5 and PM10 particulates

pegasor

Pegasor

- Pegasor AQ[™] Urban sensors, (appr. 3 pcs) to be installed around Helsinki Metropolitan area
- Measurements of particulate mass and number, especially in nano size class





Helsinki Region Environmental Services Authority

- Data from Helsinki area regulatory air quality network: comparisons and verification against reference data
- Research related to Helsinki area air quality spatial and temporal variation
- Utilization of data for HSY public services



Finnish Meteorological Institute

- ENFUSER air quality fusion model to study AQ network optimization and impact to model performance
- Comparisons and analyses with Cityzer-project



Helsinki University

- Evaluation of current and beyond state-ofthe-art Kumpula observations and their potential as part of new AQ network.
- Research related to e.g. aerosol number size distribution, aerosol chemical composition and comprehensive trace gas characterization



Testbed network





Preliminary planning courtesy Jarkko Niemi Helsinki Region Environmental Services Authority



First sensor installations in traffic sites 11/17







Modelling and forecasting



Illustration only



Helsinki Metropolitan Area – the cleanest capital in the world

Testbed Goals

- Helsinki Metropolitan citizens best served
- Combine and utilize the unique knowhow of Finnish research partners and companies in the field of Cleantech
- Helsinki Metropolitan as a Clean Tech showcase to the world
- Finnish Cleantech industry piloting and expansion globally







Thank you!

Interested in knowing more? Contact Hannamari Jaakkola (<u>hannamari jaakkola@vaisala.com</u>) Mikko Laakso (<u>mikko laakso@vaisala.com</u>)



Vaisala - 80 years of environmental observations



Professor Vilho Väisälä establishes the company on the success of the radiosonde

Subsidiaries are

established in the

UK, USA, Japan,

and Germany

1986

between 1979-



Radiosonde RS11 was displayed at World Fair in Paris where it wins a gold medal

980

The first cleanroom

is built, enabling the

manufacturing of

semiconductors in-

design and

house.



1983

A new pocket size

and light

Radiosonde

Vaisala builds it's first own manufacturing site in Ilmala. Helsinki



A radiotheollite for upper-air wind measurements is introduced

1990

Subsidiaries are

France (1990) and

established in

China (1994).



Vaisala moves to it's current location. Vantaa, Vaisala employs 60 people.

1994

Vaisala A Series

shares are listed

on the Helsinki

stock exchange.



The Vaisala Radiosonde RS13 is the world's first truly transistorized



Growth through acquisitions - eq. Lightning (2000) and Weather Radars signal and processing (2005).



Thin-film technology is developed for Vaisala HUMICAP humidity sensors. the first of its kind ...



New Radiosonde family is introduced



2007

Vaisala introdices

C-band weather

dual polarimetric

measuring and a

new concept in antenna design.

Vaisala introduces Road weather business is initiated the first automatic with the weather station and aviation weather development of the svstem. Vaisala road weather employs over 200 station.





1977

Vaisala's pressure sensing technology radars with accurate towards Mars in Mars's Rover. Curiosity.











Employs

1600 **Professionals** worldwide

EMEA 66% Americas APAC 26% 8%





41% of Vaisala people work outside Finland

countries



Serves customers in over 50 countries annually



Americas **EMEA** 41% 33%

APAC 26% 2015 R&D investments over % of net sales





anniversary in 2016

Vaisala Global Network



-56



Vaisala offering range



Information Services

Transforming weather data into decision information

Weather Information for Critical Operations Decision Support for Transportation Renewable Energy Decision Services Expert Consultation

Weather Systems

Capturing past, present, and future environmental conditions

Automated Surface Weather Observing Systems Automatic Weather Stations Observation Network Management Data Quality Control

Soundings

Assessing the state of the atmosphere from the ground up

Radiosondes Dropsondes Autosondes Ground Stations



Vaisala Project and Customer Services

- Vaisala Project and Customer Services runs ~300 delivery projects each year.
- Value of a single project varies between 20K and 20M Euros.
- Between 2010 and 2016 we delivered more than 1000 airport weather systems into 100 countries, in all continents.
- We operate in all climates and conditions; We have delivered a meteorological sounding station to Antarctica and a Weather Radar to Fiji islands.
- Our Project Management Office can manage turnkey projects, together with certified partners and subcontractors.



