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Ministry of Health, Welfare and Sport

Air Quality measurements during New Year's Eve 2017/2018

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Content

- RIVM / Air Quality
- Effects of Fireworks
- Idea / Equipment / Project
- Results
- And now?
- Questions

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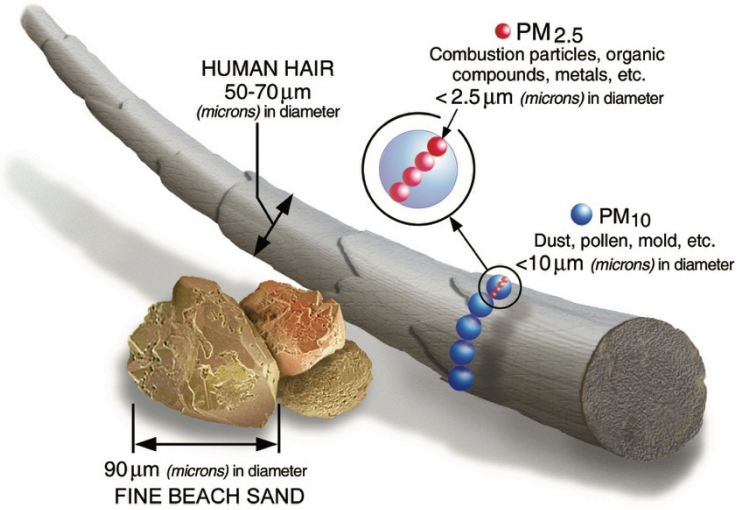
RIVM / Air Quality



National Institute for Public Health and the Environment (RIVM)

Air Quality

Gaseous pollutants

Particulate Matter (PM10/PM2.5)

"Particulate Matter (PM), …, is a complex mixture of extremely small particles and liquid droplets that get into the air. Once inhaled, these particles can affect the heart and lungs and cause serious health effects." (US EPA, 2017)

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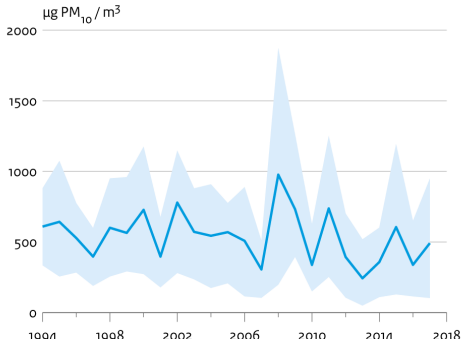
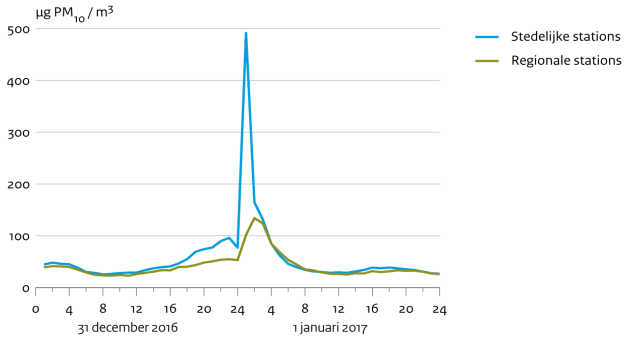
PM10 and fireworks

Urban concentrations, just after midnight



Urban concentrations, before & after midnight



Bron: RIVM/DCMR/GGD Amsterdam 2017

PBL/jan17
www.clo.nl/nl057004

- At some 40 locations in The Netherlands the hourly-averaged PM10 concentrations are routinely measured using (expensive) reference equipment.
- Average concentrations PM10 in the Netherlands are in the order of 18-24 µg/m^3.
- Fireworks temporarily creates a large amount of Particulate Matter.
- During new years evening high concentrations of particulate matter are observed.
- The high concentration levels provide a good opportunity to test cheap/simple dust sensors.

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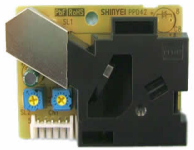
Measuring fireworks

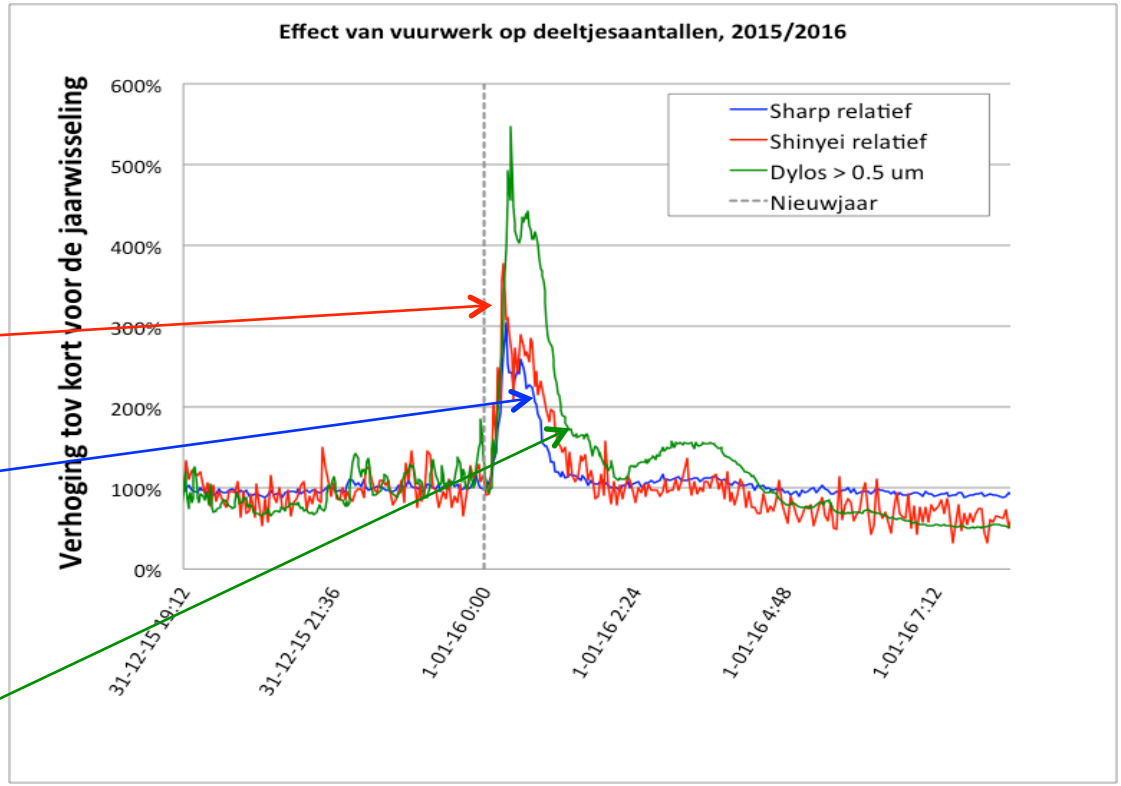
Measuring the effect of fireworks 2015/2016 using:

Shinyei (18 €)



Sharp (18 €)

Dylos (750 €)



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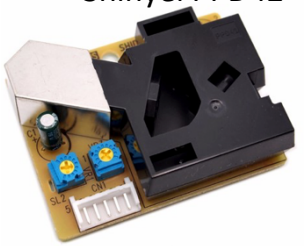
Test dust-sensors

Shinyei PPD42



Sharp GP2Y1010AU0F

Nova SDS011

- During New Year's evening of 2016/2017 some 80 simple sensors distributed by RIVM were used to measure the increase of the concentration dust.
- Very simple sensors → Are there better sensors?
- New tests in 2017/2018 → Nova SDS011.
- In 2017/2018 more input/contributions from others!
- Test sensors during several months in 2018, compare to official data.

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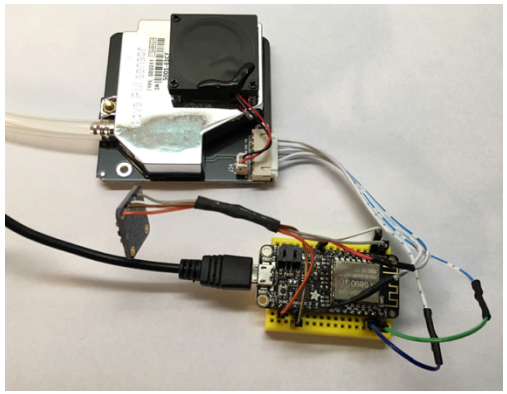
Measurements



- A number of sensor kits was prepared by RIVM for assembly by interested citizens.
- The kits were distributed during a symposium on citizen science and during workshops in the cities of Amsterdam and Amersfoort.
- Measurements were also organized by several groups of people and the data was shared with RIVM.
  - Apeldoorn
  - Venlo
  - Several individuals
- Most sensors connected to the internet using WiFi, some 25% communicated using LoRa.

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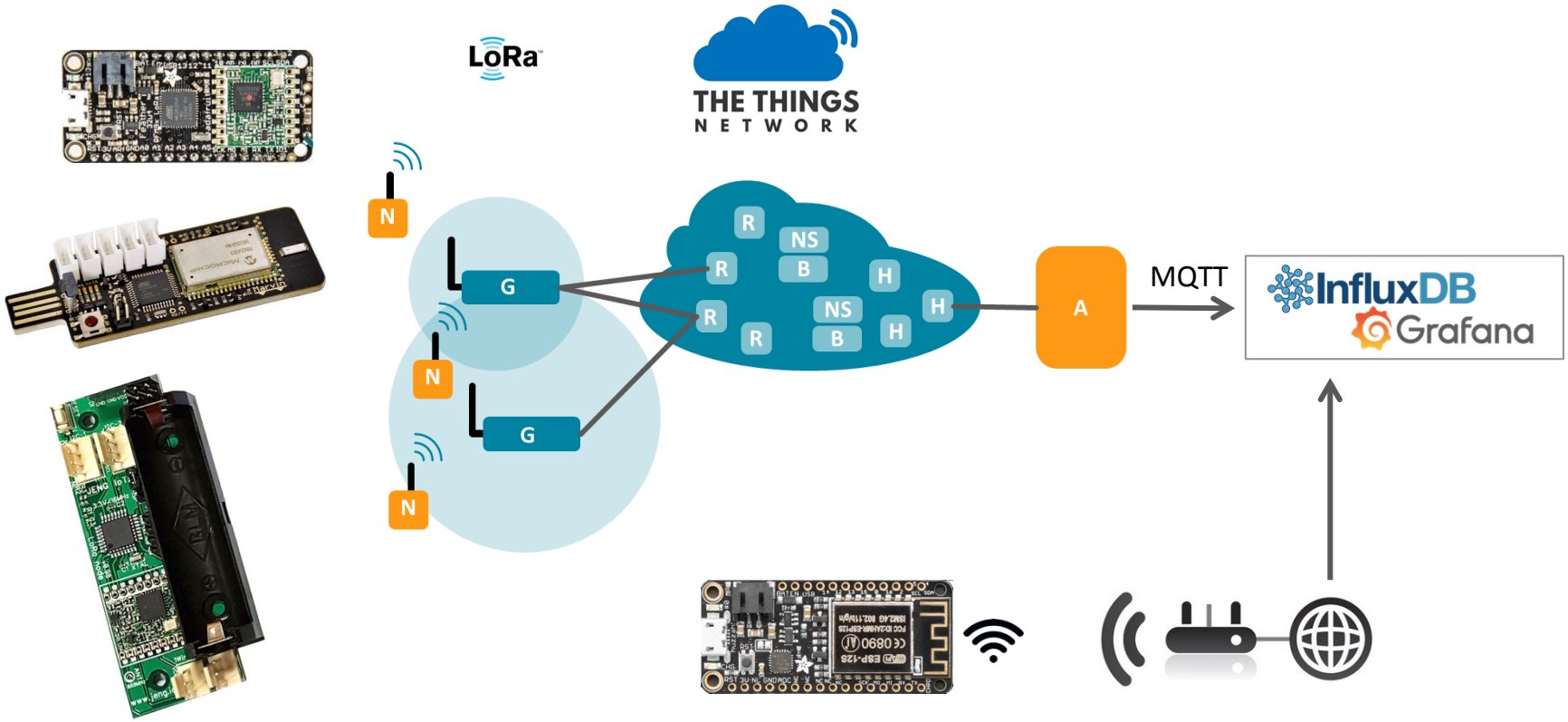
Hardware/Communication



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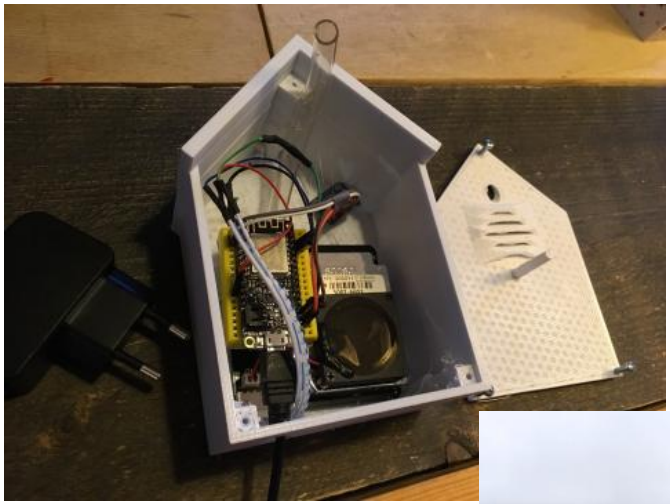
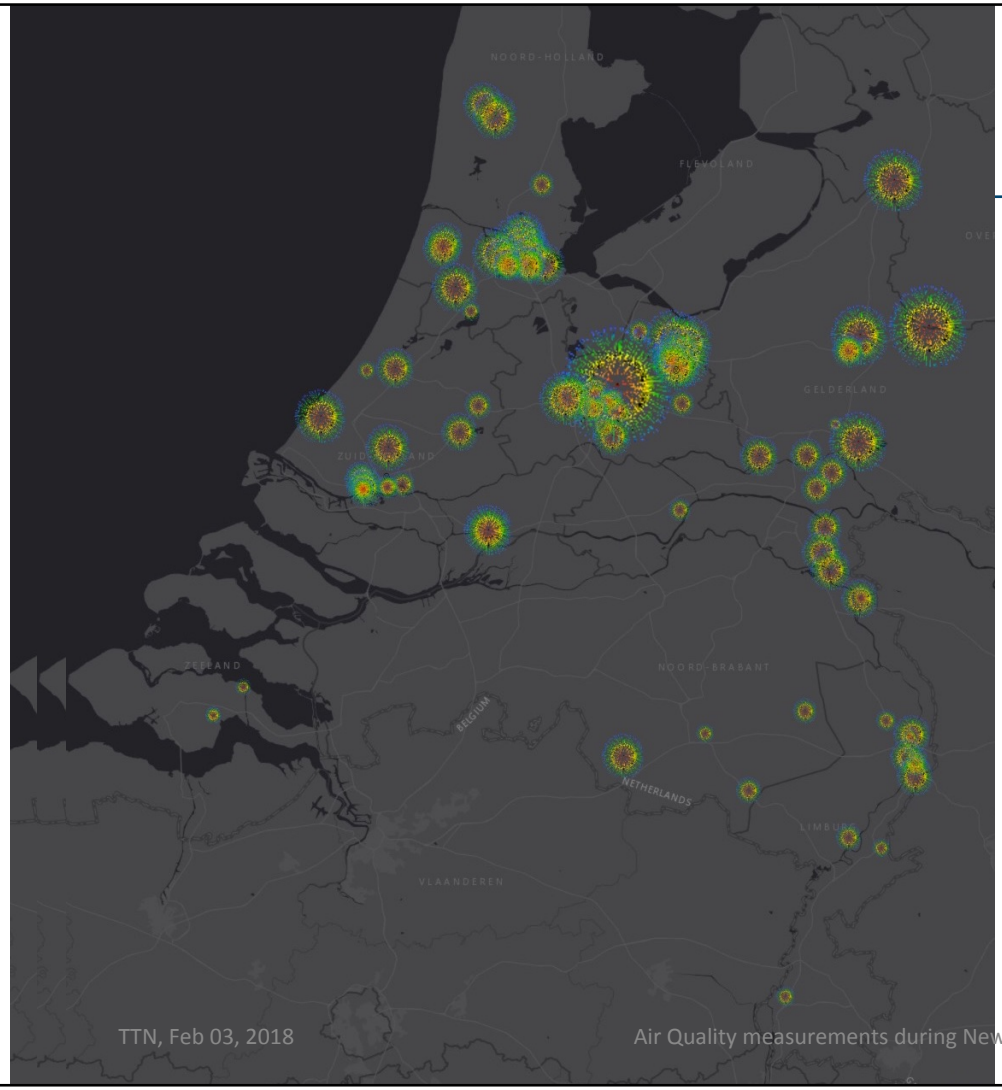
Housing



"This is not a bomb, but for measuring air quality. Please don't touch."



New Year's Eve ...

- Some 55 (partly) DIY sensor kits were prepared and distributed by RIVM, mostly in the cities of Amsterdam, and Amersfoort.
- Also:
  - 20 other sensor-units from RIVM.
  - Roughly 25 sensors from Dutch citizen projects.
  - Roughly 25 sensors from the German "Luftdaten" project.
- A real-time animation of all measurements was shown on the web.

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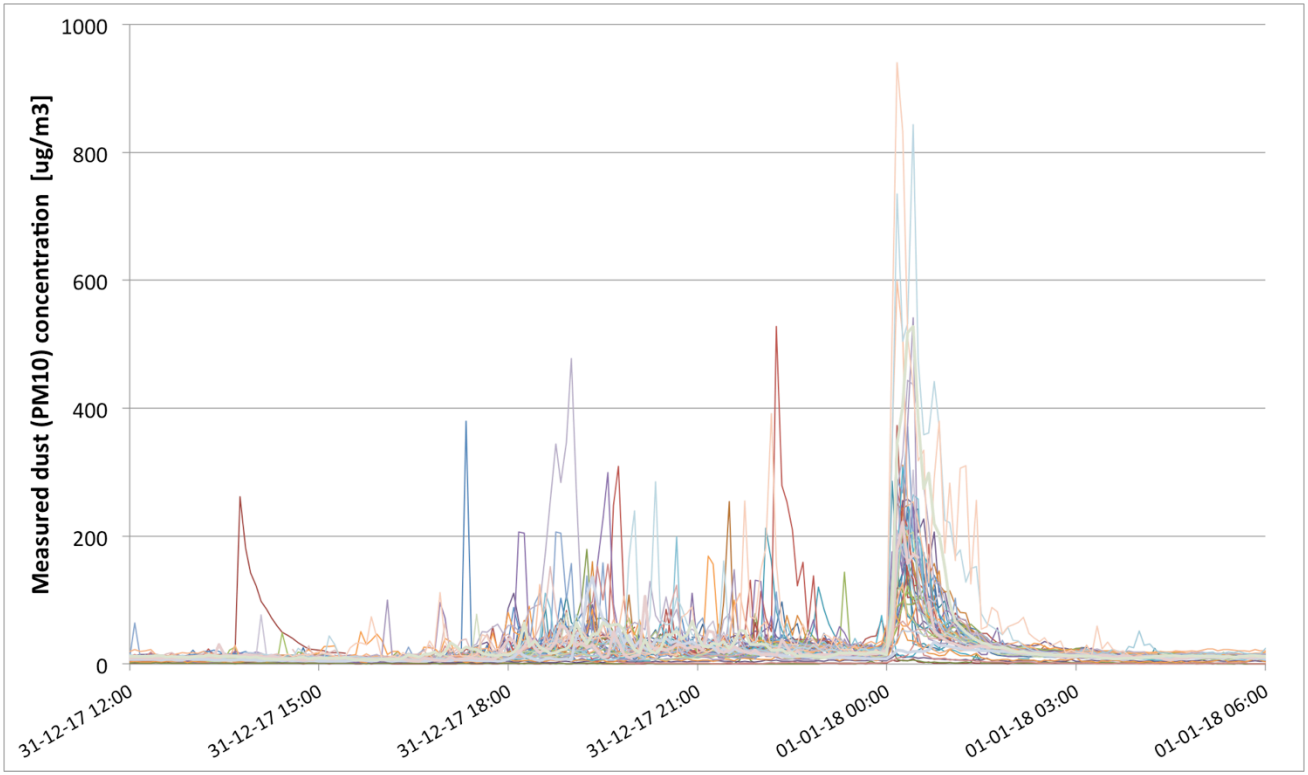
PM10 Data



- Quite high (PM10) concentrations were reported by the sensors.
- The main peak started just after midnight.
- There was a strong wind during the night.
- Concentrations decreased rapidly after 01:00 in the night.

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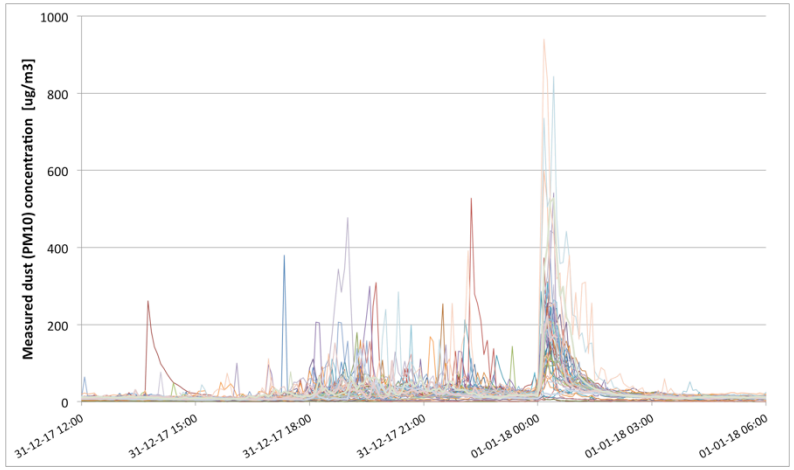
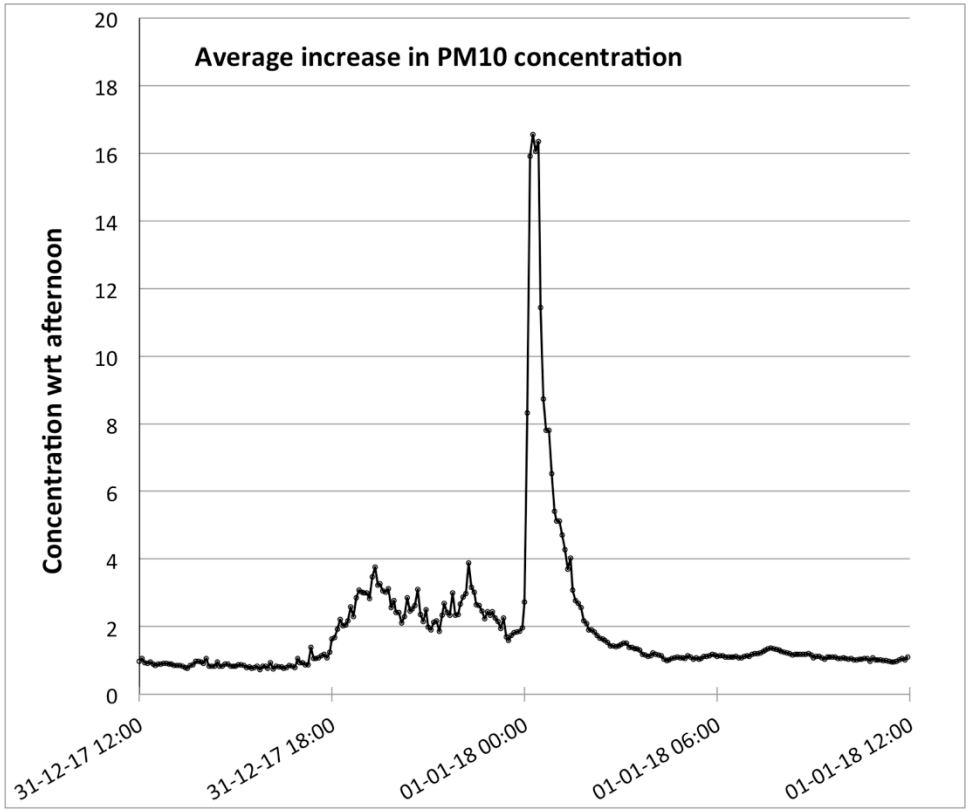
PM10 Data



The concentrations were normalized using the values of the afternoon.

On average, the PM10 concentrations increased by a factor of almost 17.



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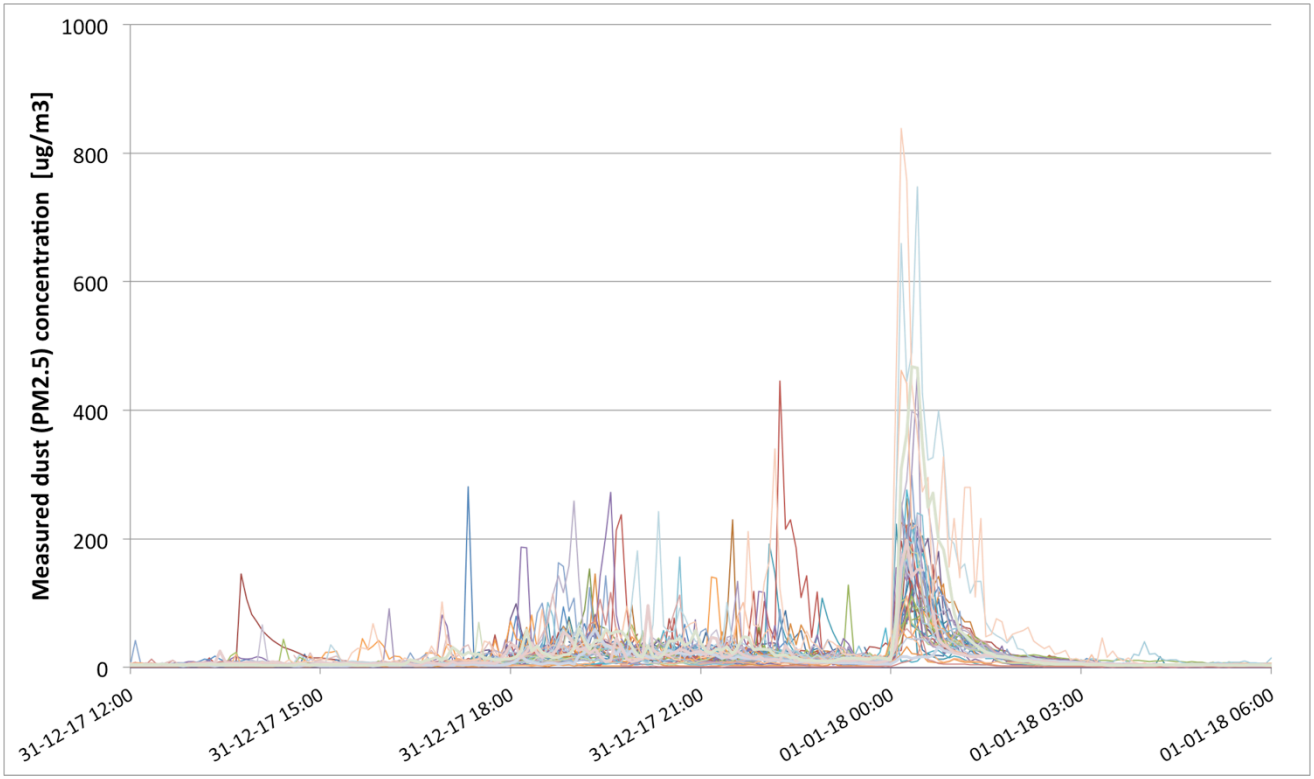
PM2.5 Data



- The concentrations of smaller dust particles (PM2.5) reported by the sensors were also quite high.
- The global pattern is quite similar to that of the larger PM10 particles.

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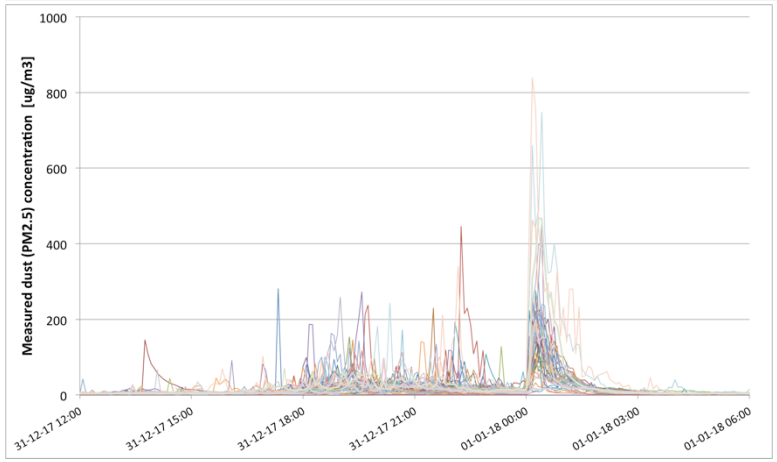
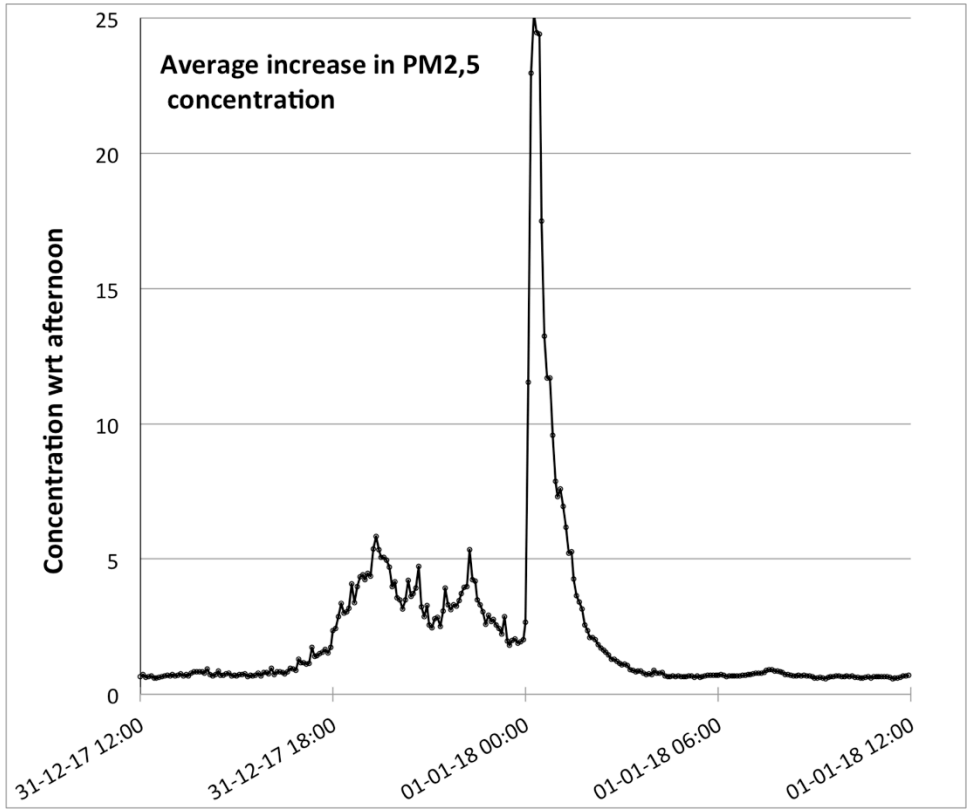
PM2.5 Data



The concentrations were normalized using the values of the afternoon.

On average, the PM2.5 concentrations increased by a factor of almost 25.



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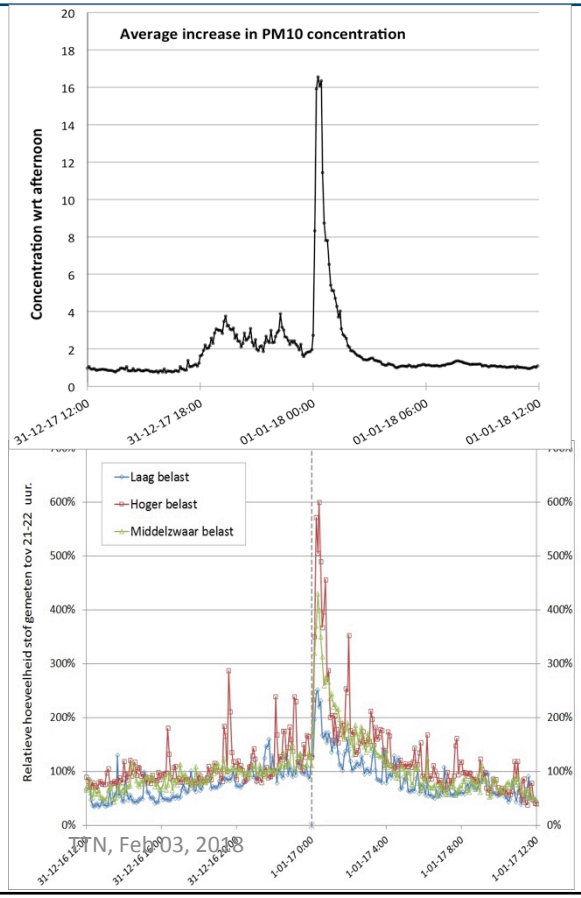
Comparison to 2016/2017



- The average value of the increase in dust concentrations is larger with the Nova SDS011 sensor than with the Shinyei PPD42.
- Last New Year there were higher wind speeds, so concentrations should be lower.
- The normalization of the two data sets is slightly different.
- Probably the Nova SDS011 is more sensitive than the Shinyei PPD42.
- The Nova also shows much more fluctuations in “normal” periods.

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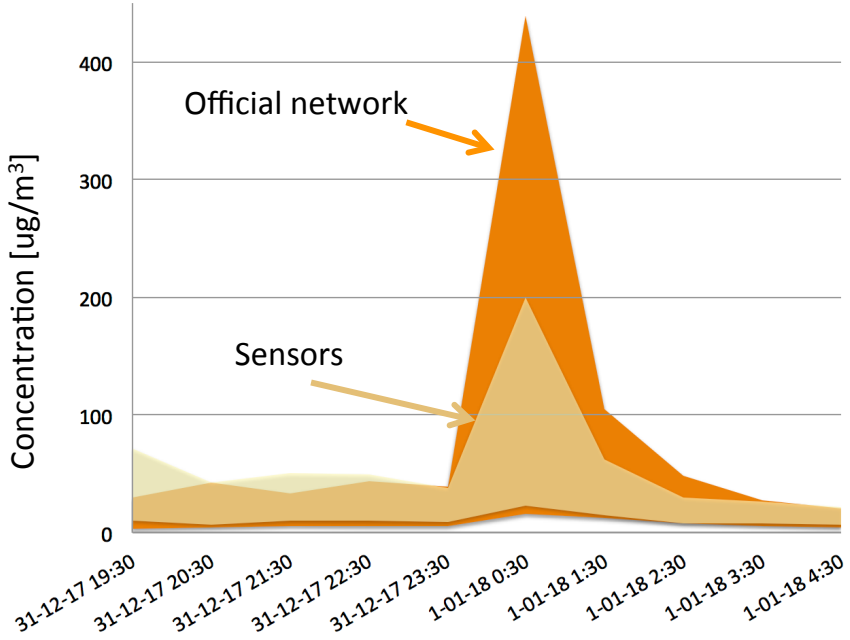
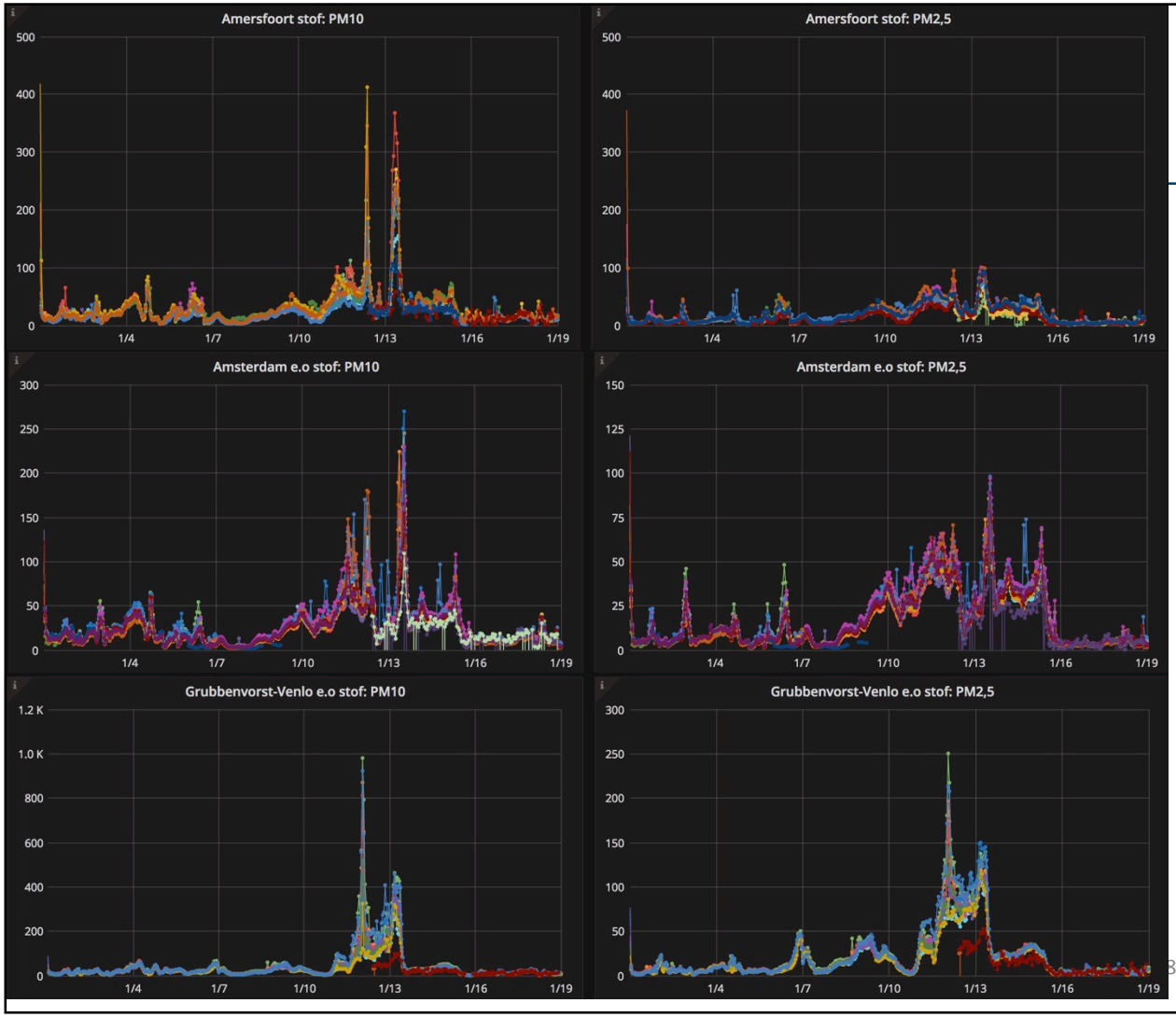
Comparison to official data



- The official data is only available on hourly-average basis.
- Sensors report on minute basis.
- Compare the concentration ranges between the 10- and 90-percentiles, i.e. the range where 80% of the data is located.
- The hourly-averaged values of the official measurements are higher.



And now …

- The aim is to keep as many sensors running for as long as possible.
- Grouped in several regions / cities they are compared to official data.
- We are looking for a general calibration of the sensors: results look promising.
- Effects over time?

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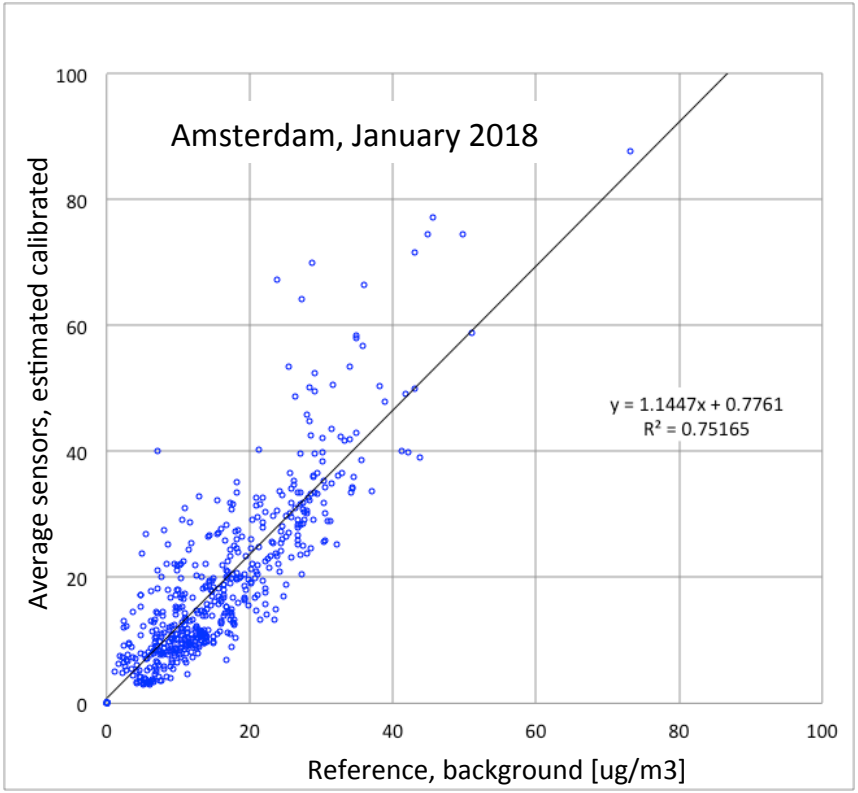
Amsterdam PM10 Data



- The average PM10 values of the sensors located in Amsterdam have been compared to official reference measurements.
- A calibration factor was estimated from the data available in January.
- The simple calibration results in a reasonable agreement between the average of the sensors and the reference data.
- More locations will be analysed in the near future.

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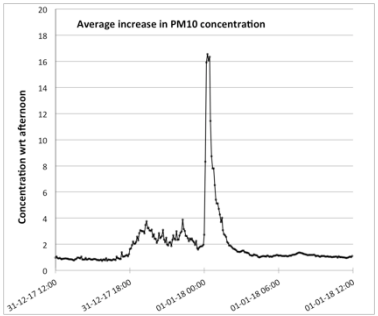
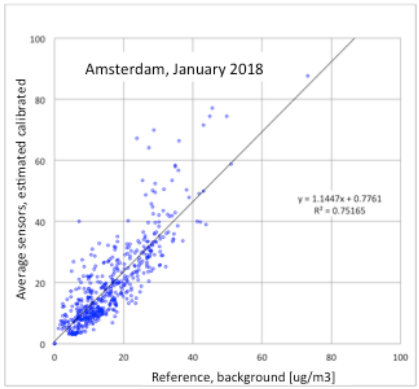
Conclusions





- During New Year's evening of 2016/2017, dust concentrations were successfully monitored using cheap and simple sensors (Nova SDS011).
- Data from different organisations/groups of people were combined.
- For the first time LoRa was used by RIVM, tastes for more
- Test sensors during several months in 2018, compare to official data. First results are promising.

Questions ?