

Agnarmælingar í andrúmslofti á gamlárskvöld 2018

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28. nóvember 2019

Haustþing Veðurfræðifélagsins

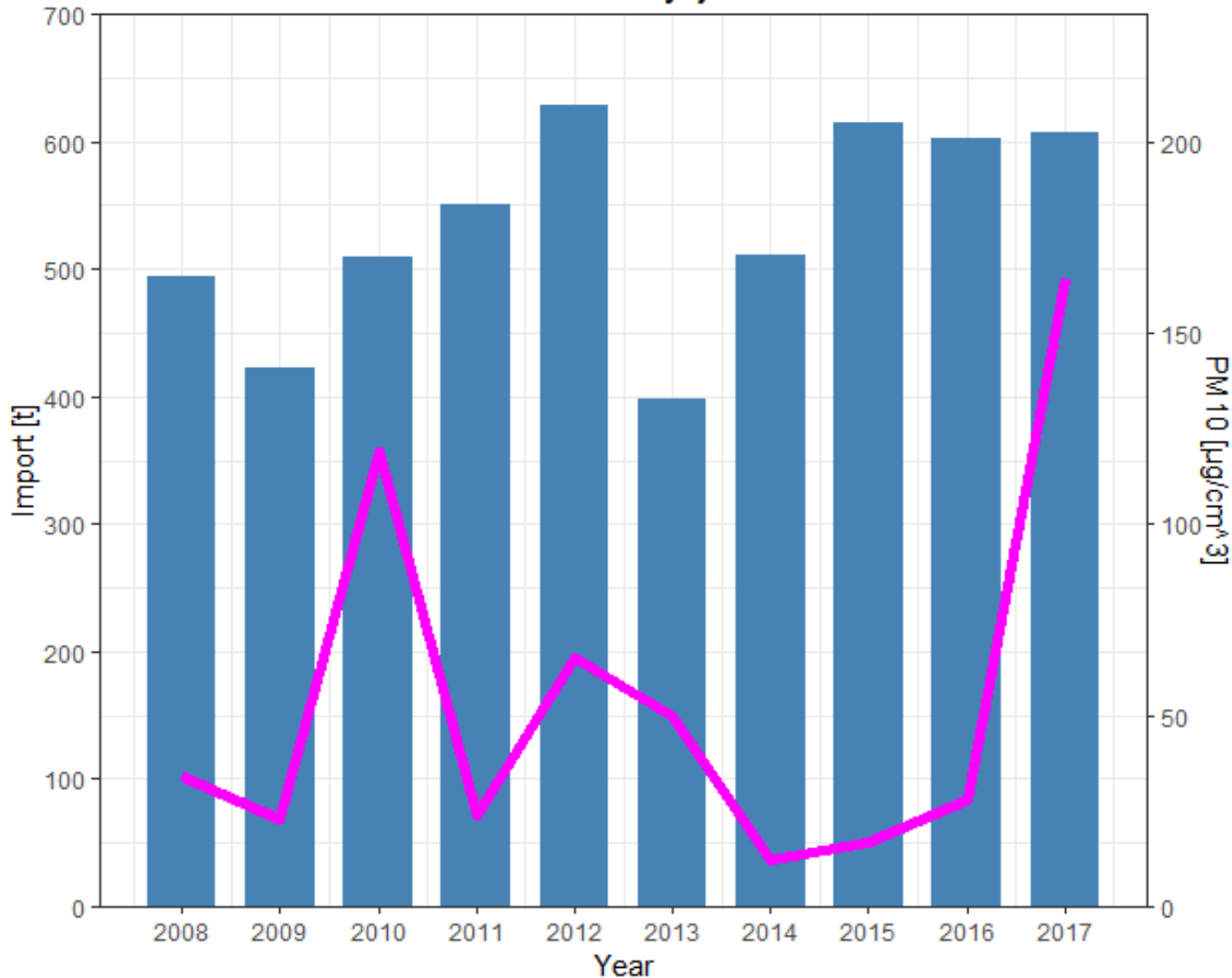


Veðurstofa
Íslands



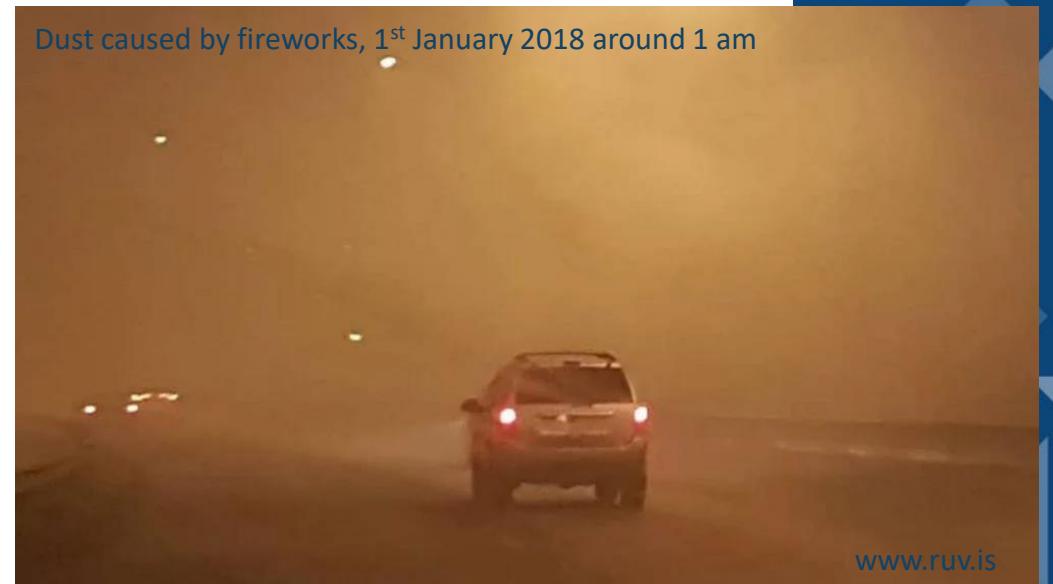
Fireworks in Iceland

Import of fireworks in Iceland vs.
PM10 concentrations on NYE in Reykjavik



- High amount of fireworks imported every year
- PM10 observation at night NYE not correlated to dimension of import
- Weather conditions determine level of air pollution
- Calm conditions and low level inversion favours bad air quality

Dust caused by fireworks, 1st January 2018 around 1 am



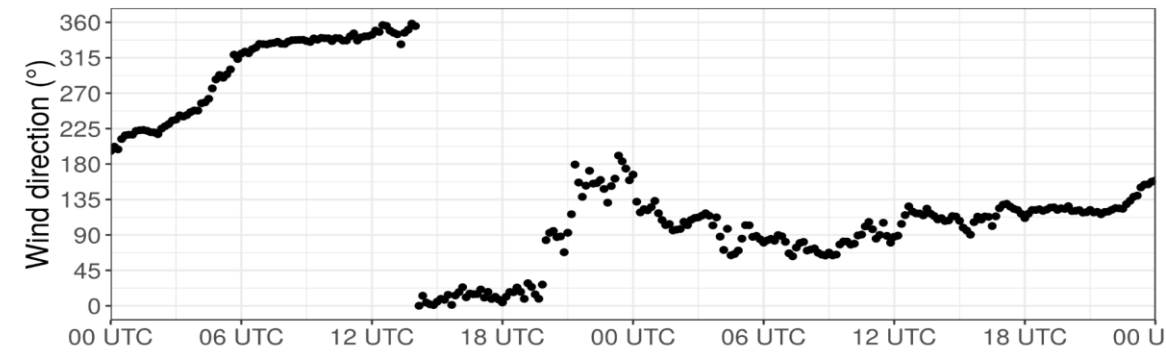
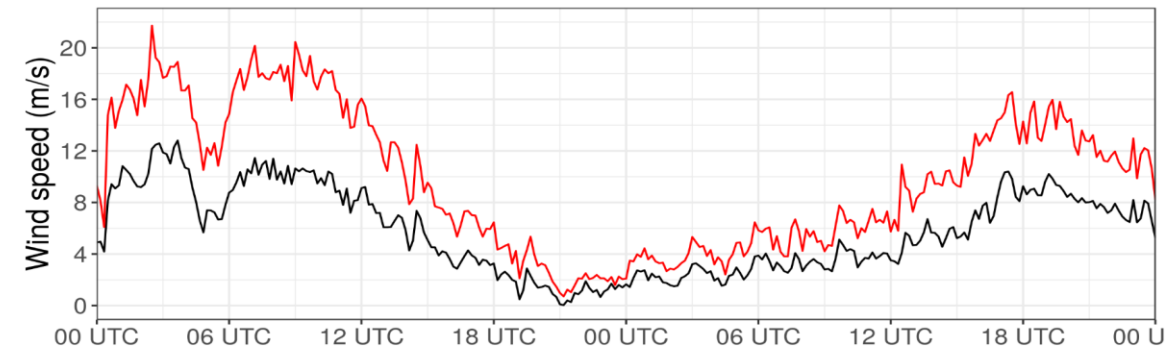
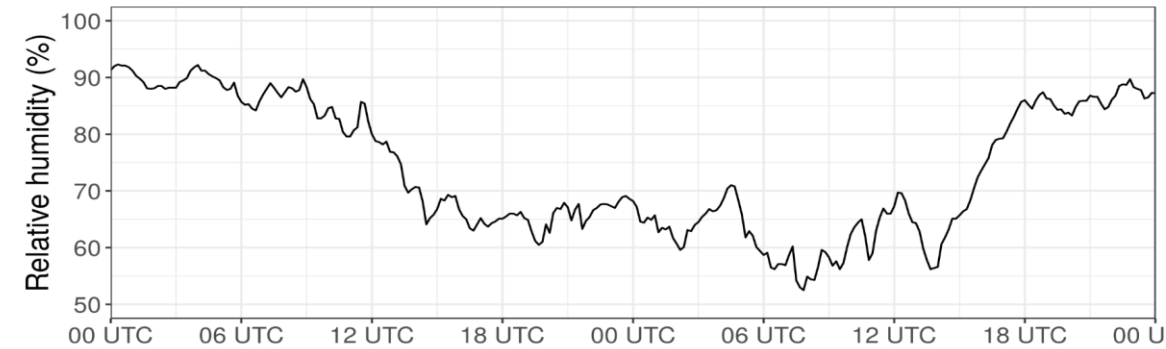
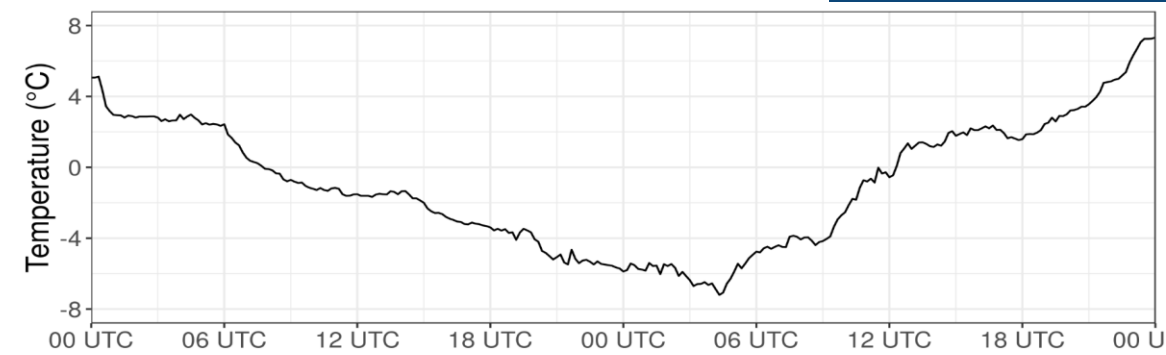
Equipment installed during the experiment

- Three webcams at the roof of IMO building
- Lidar and ceilometer installed in the trailer situated and the meteorological measurements field
- Optical Particle counter (OPS 3330, TSI inc.) within an enclosure collocated to the trailer
- Multigas instrument was not sensitiv enough
- Environment Agency (EA) of Iceland station in ~ 4 km distance to IMO

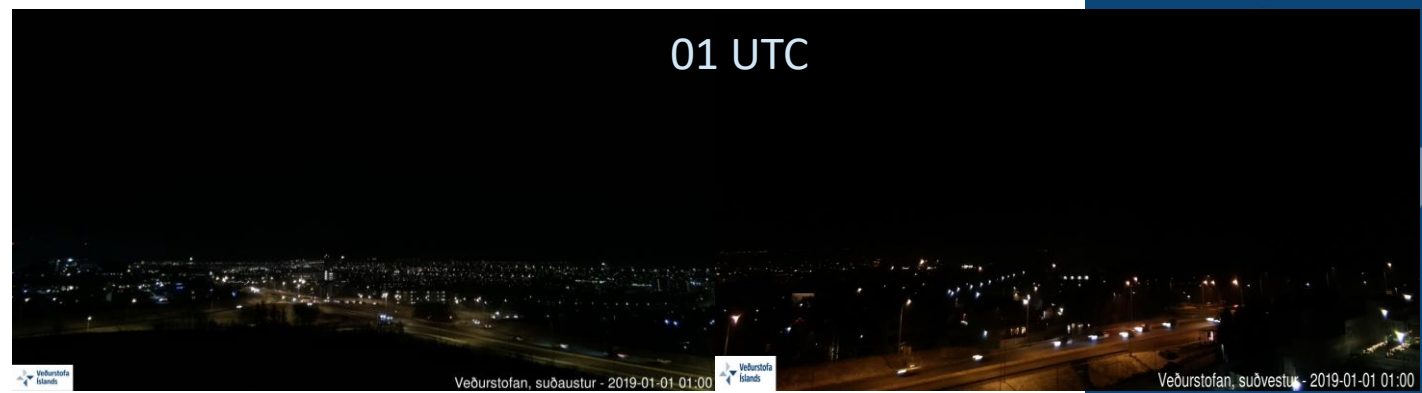
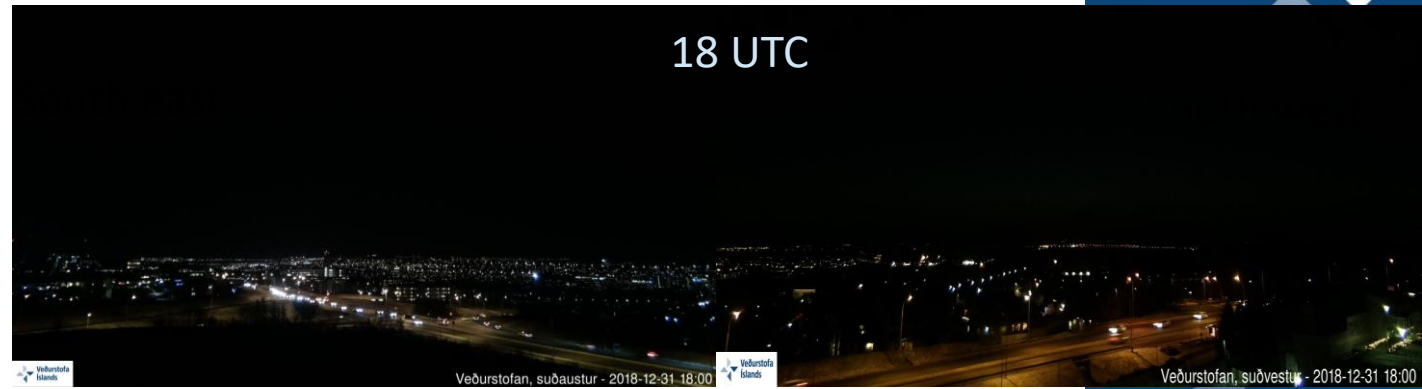
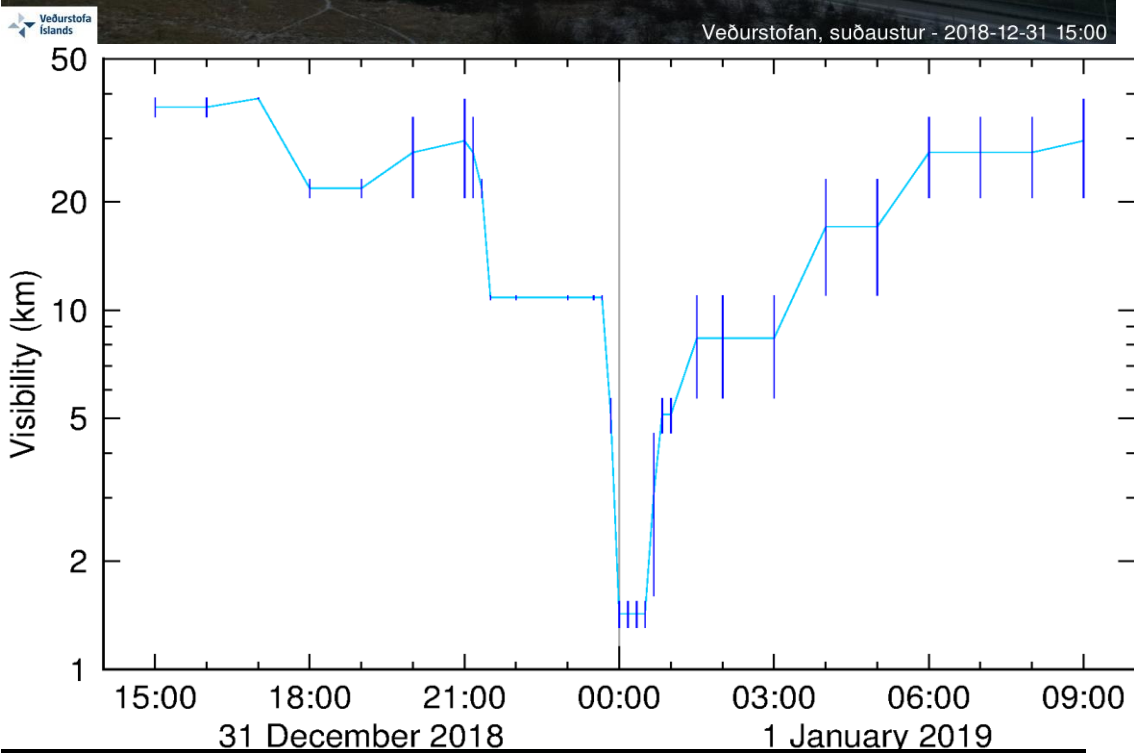


Weather conditions on NYE 2018/19

- Sleet and snow was observed during the morning hours but it cleared off in the afternoon
- Temperature and relative humidity decreasing towards midnight
- Inversion developed during NYE night
- Wind turned to east but almost calm conditions
- In the afternoon on New Year's Day wind speed was increasing as well as the relative humidity and temperature

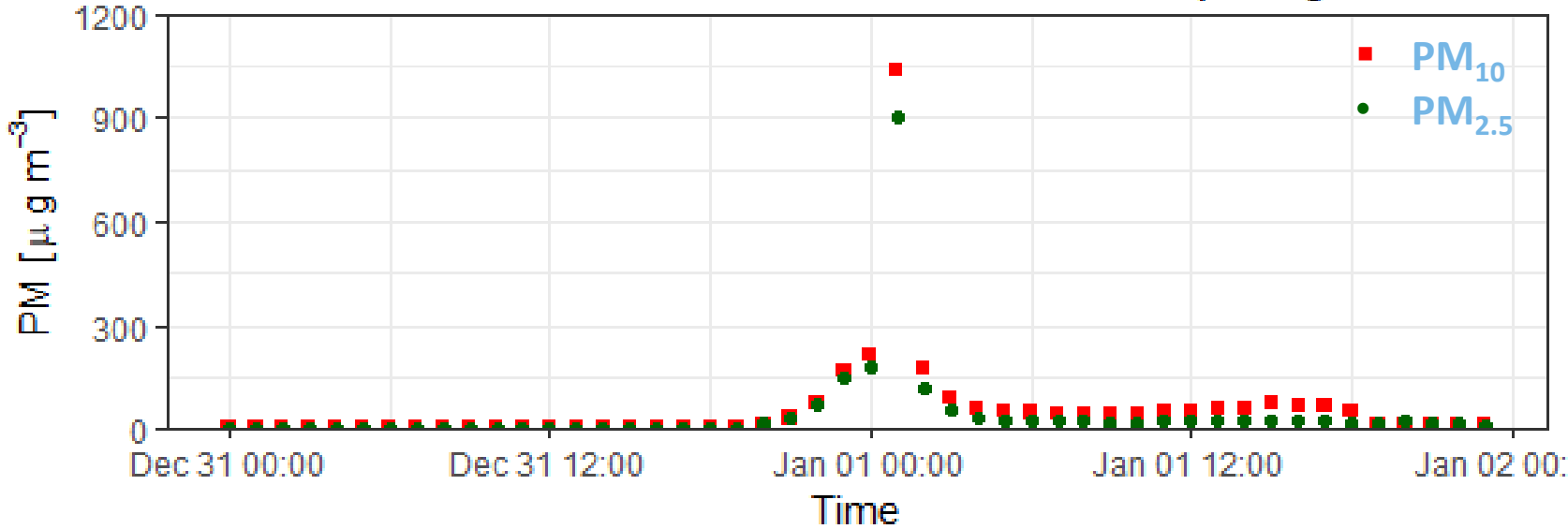


Visibility estimations

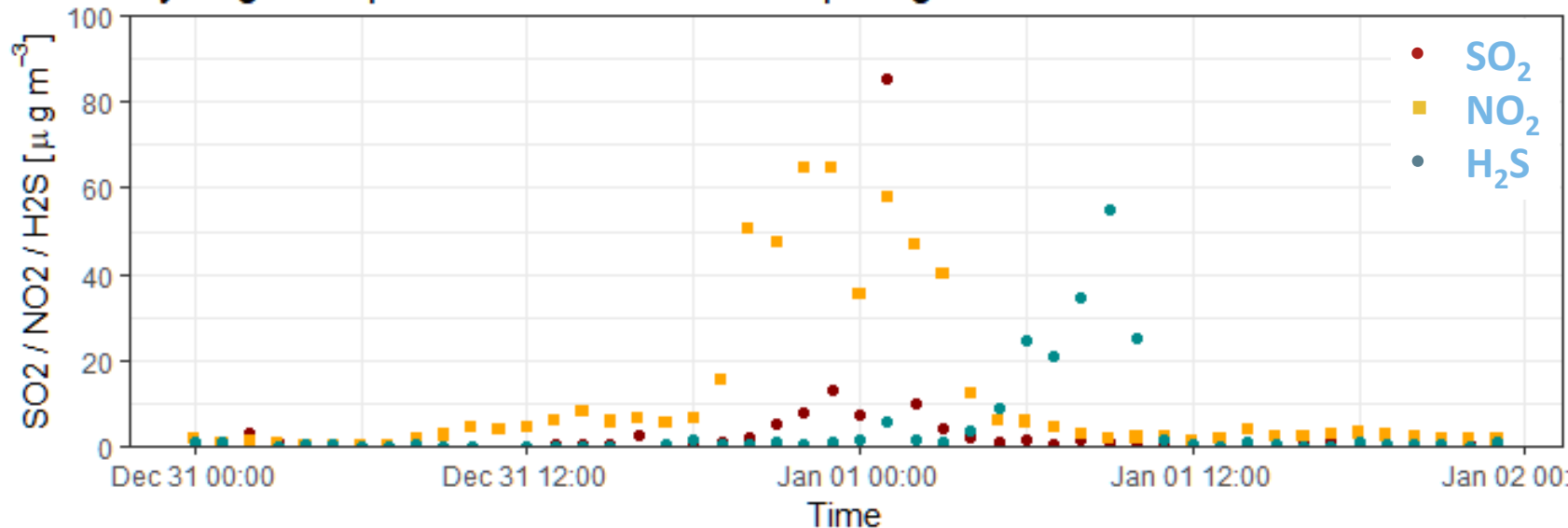


EA Iceland measurements

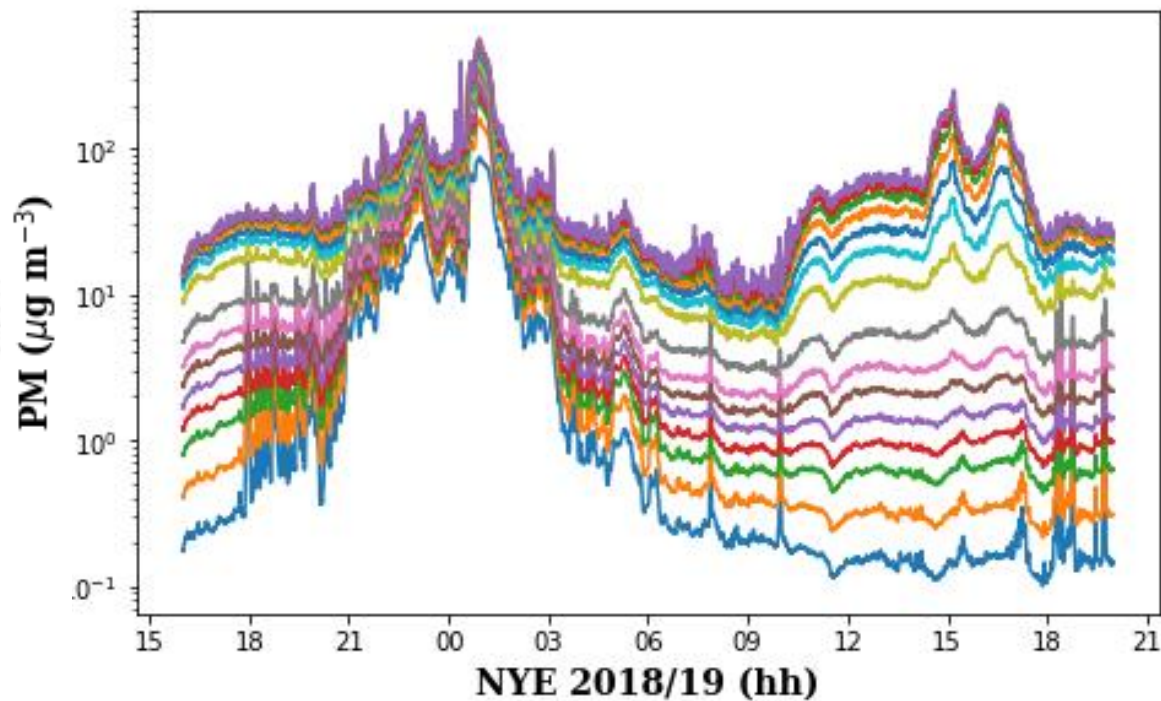
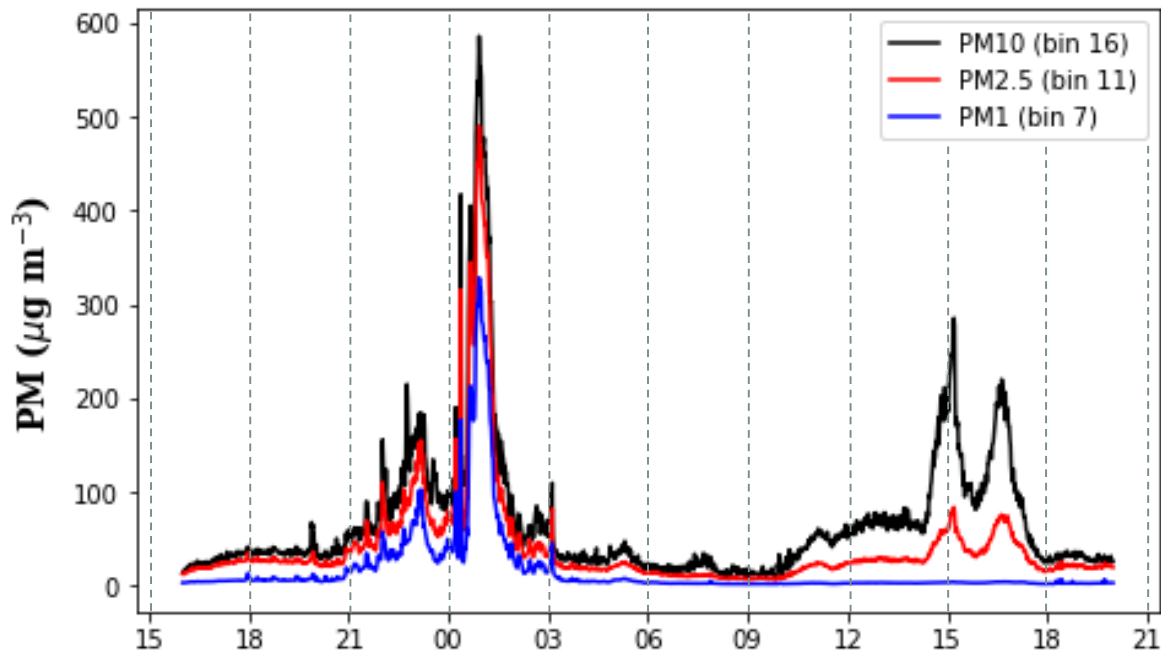
PM₁₀/PM_{2.5} concentrations on NYE 2018 in Kópavogur



Sulphate dioxide, Nitrogen dioxide and Hydrogen sulphide on NYE 2018 in Kópavogur



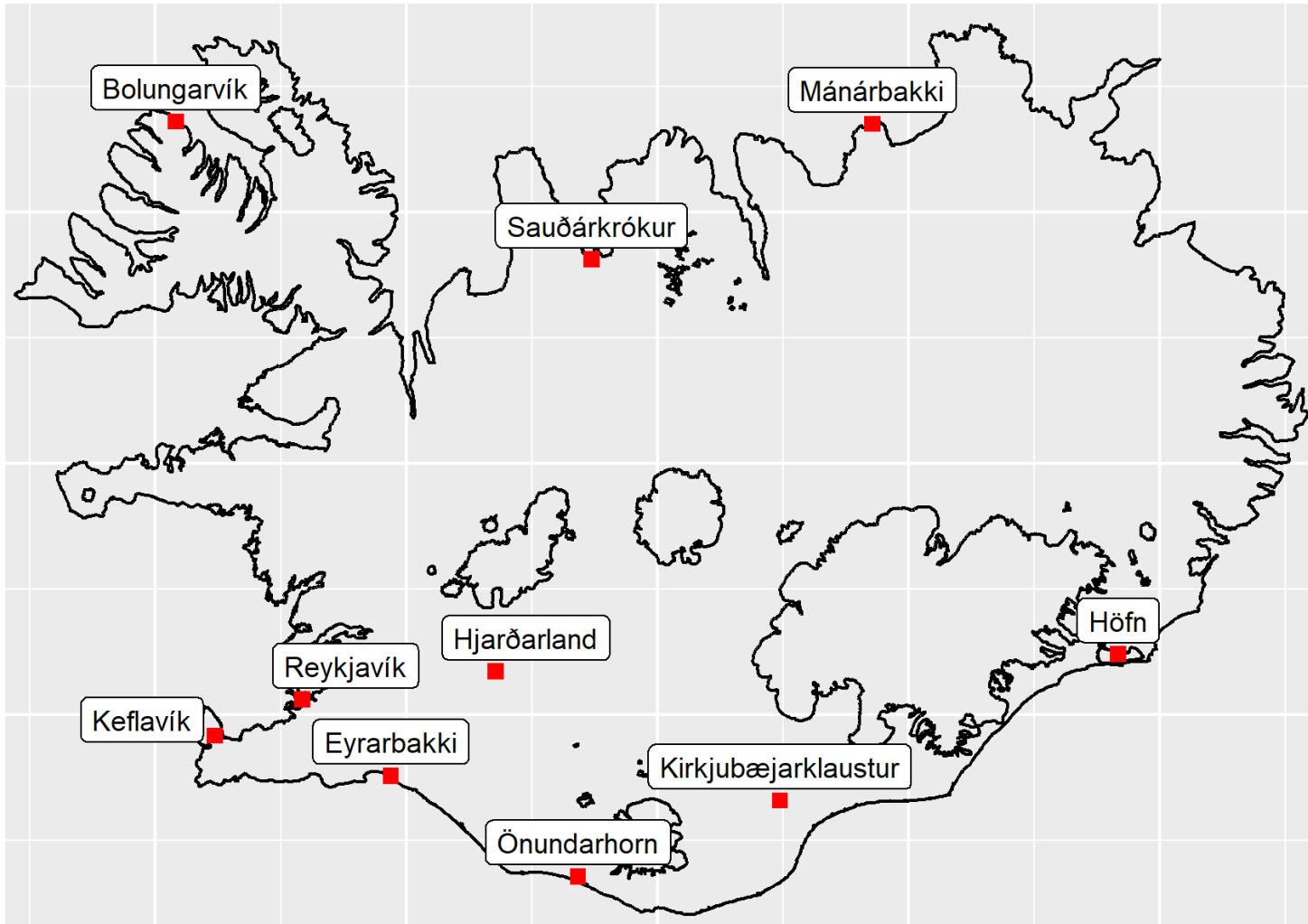
- hourly PM₁₀ and PM_{2.5} measurement in Kópavogur valley
- continuous increasing towards midnight
- PM₁₀ second maximum in afternoon
- very high level of SO₂ at midnight, but the whole evening of NO₂
- H₂S concentrations unrelated to fireworks



OPC measurements

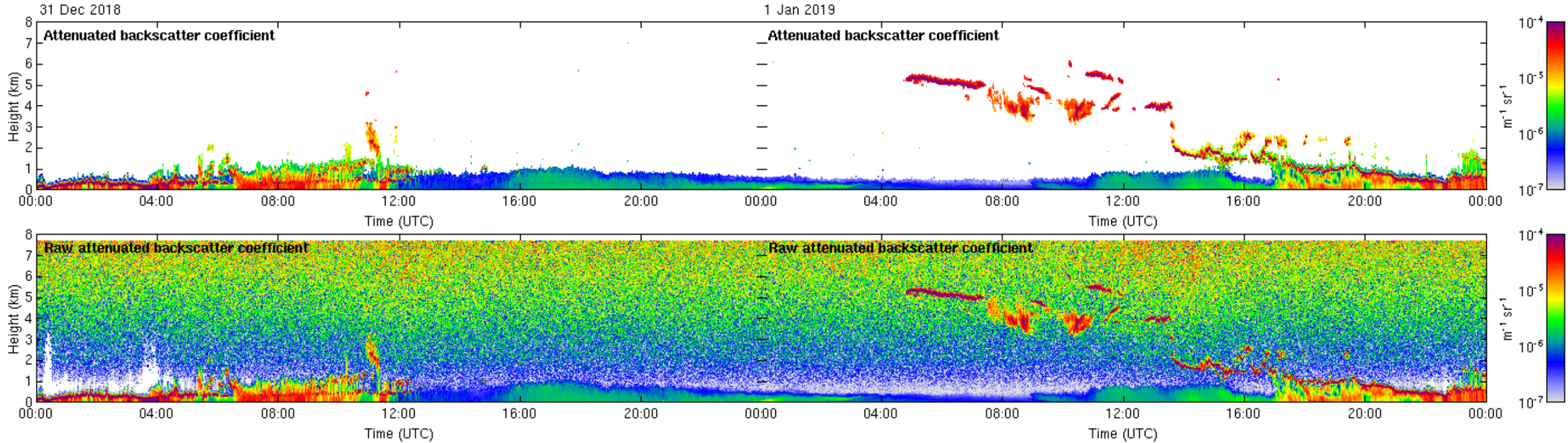
- OPC size range: 0.3 to 10 μm
- Particle number concentration measured in 16 size bins
- Particle number converted in PM1, 2.5, and 10
- PM concentration decrease 22:30 - 23:30 UTC due to very popular TV show
- Max. PM concentration one o'clock
- High number and mass concentrations of particles smaller than 1 μm around midnight
- Secondary peak probably due to resuspension in the afternoon
 - doesn't show for fine particles

Atmospheric Lidar and Ceilometer Network



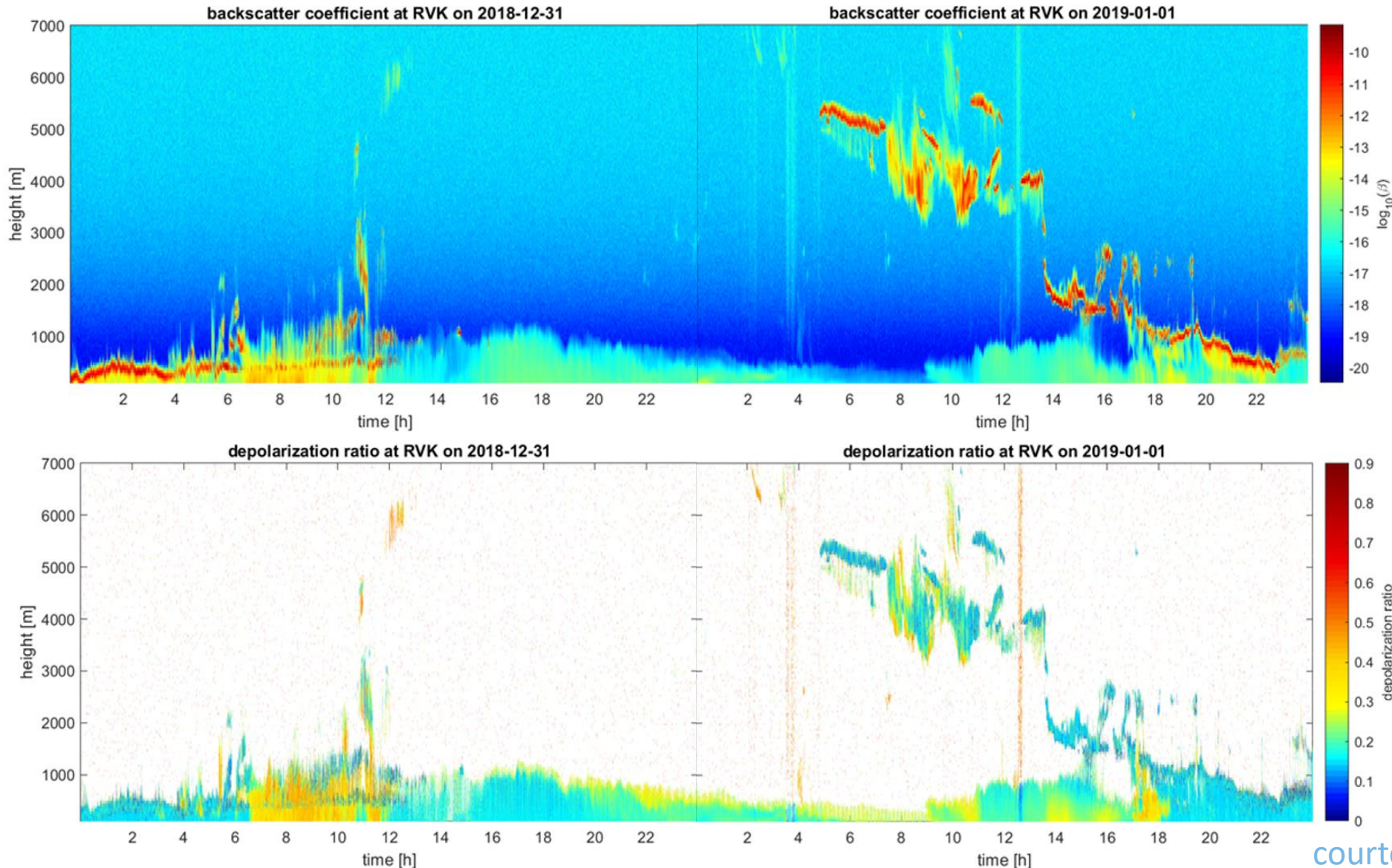
- Vaisala CL31 / CL51
- pulsed laser (Indium Gallium Arsenide); $910 \pm 10\text{nm}$
- Meas. range: 7500 / 15000 m
- Meas. resolution: 5 or 10 / 10 m
- Leosphere WINDCUBE 200S-AT
- pulsed lidar; 1543 nm
- Meas. range: 50 to 12000 m
- Range resolution: 25, 50, 75 or 100 m
- Scanning Doppler lidar ($0 \dots 360^\circ$; $-10 \dots 190^\circ$)
- Depolarization channel

Ceilometer measurements



- precipitation until noon (sleet or snow)
- clear off in early afternoon
- increase of backscatter in afternoon due to firework release
- high density around midnight
- resuspension in afternoon
- starts snowing around 17 UTC

Lidar measurements



- Backscatter coefficient shown above but depolarization ratio in bottom
- Sleet or snow before noon on NYE
- Clear off but inversion develops and level of air pollution increasing
- Firework particle seems to be non-spherical
- Re-suspended particles observed in afternoon

Summary and outlook

- **New Year's Eve fireworks produce a high level of particulate matter**
- **Air pollution in the boundary layer was observed with different instruments**
- **Ceilometer seems more sensitive to fireworks pollution than the lidar**
- **A higher resolution preferable but purpose is to monitor volcanic ash cloud**
- **Depolarization channel helps to distinguish different types and shapes of particles**
- **Data can be useful for interpretation of volcanic ash cloud**
- **Instruments moved to a dusty environment to study physical properties of particles released in a dust storm as test case for volcanic eruption**

