

Ambient Measurements of Amines by PTR-QiTOF-MS

Instrument Performance Assessment and Results from Field Measurements in the Vicinity of TCM, Mongstad

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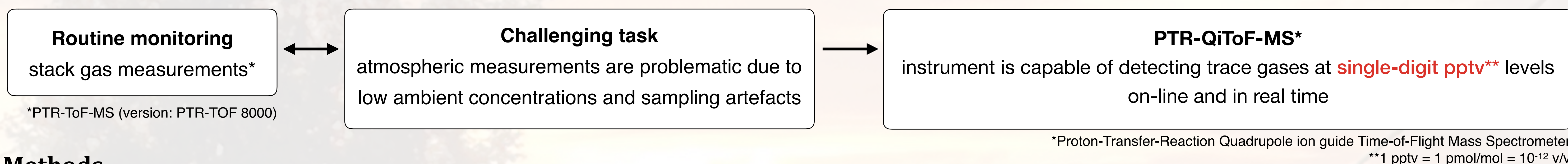
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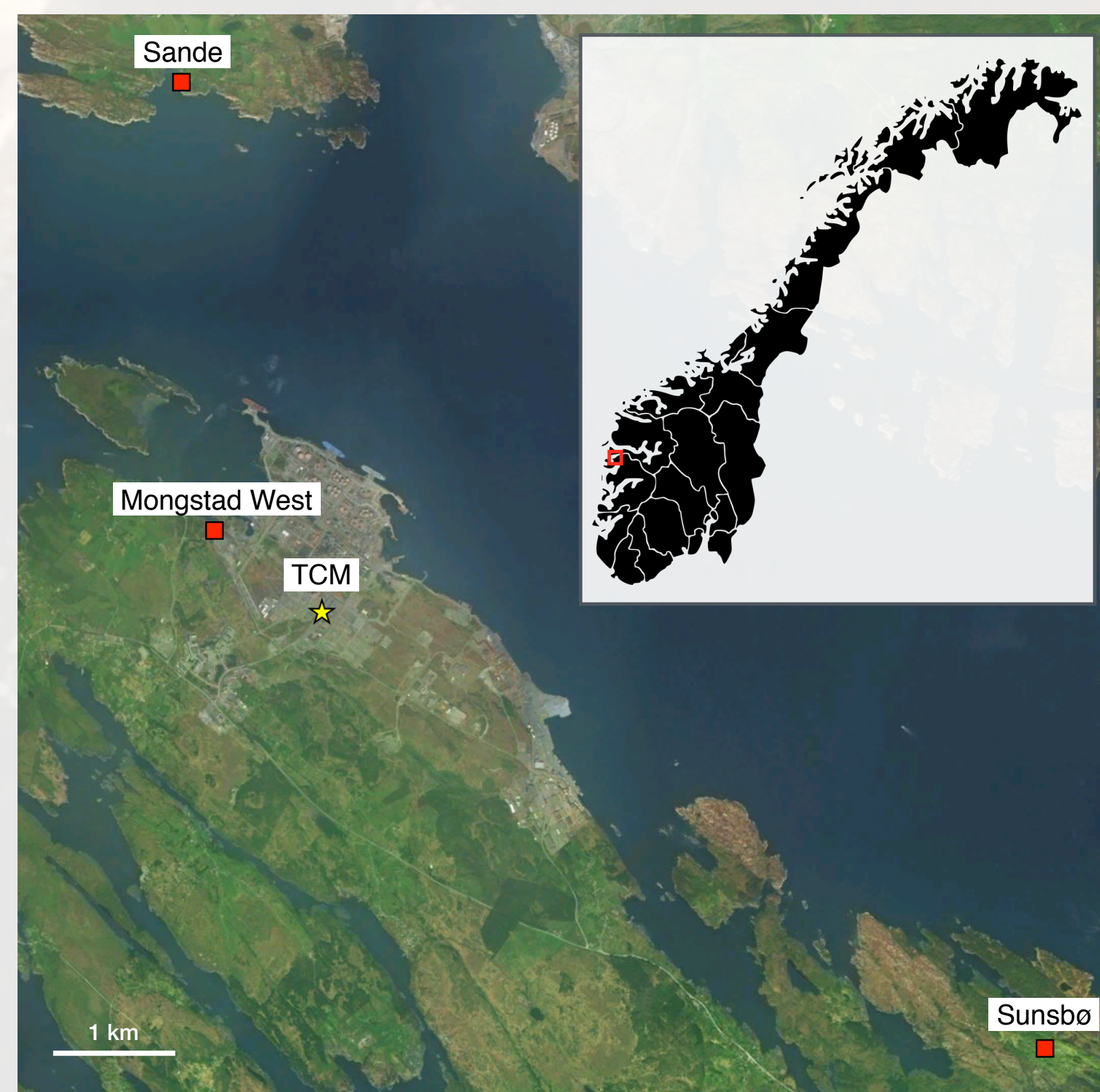
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Overview



Methods



Locations:

Sunsbø (60°46'10.1"N, 5°09'08.6"E)
Sande (60°50'56.6"N, 5°00'21.0"E)
Mongstad West (60°48'45.7"N, 5°00'43.4"E)

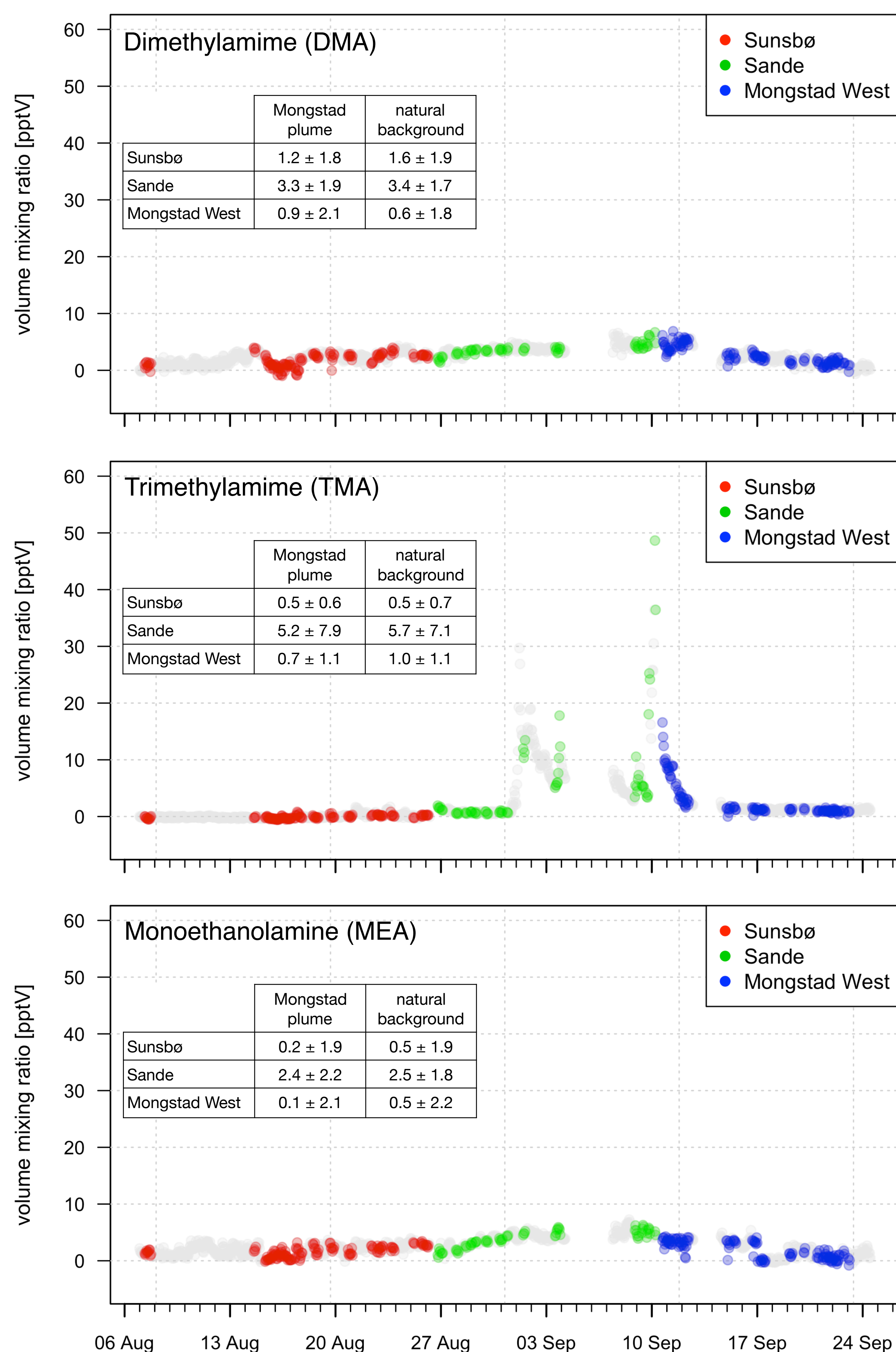
Target compounds:

Methylamine (MA) CH₅N
Dimethylamine (DMA) C₂H₇N
Trimethylamine (TMA) C₃H₉N
Monoethanolamine (MEA) C₂H₇NO
2-amino-2-methylpropanol (AMP) C₄H₁₁NO
Diethylamine (DEA) C₄H₁₁N
Piperazine (PZ) C₄H₁₀N₂

Setup:

- routine mode of operation**
 - H₃O⁺ chemical ionisation
 - drift tube pressure 3.8 mbar, drift tube temperature 60 °C
- optimised inlet system**
 - ambient air sampled at a flow rate of 12 litres per minute
 - passivated stainless steel tube material (SilcoNert® 2000)
 - OD: 6.35 mm, length: 115 cm, temperature: 60 °C
- zero air generation**
 - amine-free zero air from ambient air
 - catalytically cleaned (Pt/Pd at 325 °C)
- instrumental background**
 - periodically checked - every 12 hours for 30 minutes

Results



Hourly average time series of DMA, TMA and MEA amine as measured at Sunsbo, Sande and Mongstad West in August and September of 2015. The color-coded data points identify the time periods when the Mongstad outflow was advected to the sampling sites.

MEA

- instrument is not capable to detect MEA due to the abundant O₂⁺ signal that distorts the mass spectrum in the region where MEA is detected.

DMA

- measured values were within single-digit pptv levels which is close to the instrumental detection limit
- 2-minute average data show episodic short-term enhancements in the 10 to 22 pptv range at all three measurement sites
- enhancements were found both in natural background air and in the outflow from the Mongstad complex.

TMA

- levels were typically close to zero
- episode (Sept 1-12) hourly average volume mixing ratios up to 49 pptv
- enhanced levels of TMA were observed at the Sande and the Mongstad West site, both in natural background air and in the outflow from the industrial site.

MEA

- within the single-digit pptv
- 1-2 pptv enhancement was observed (Aug 31-Sept 10) both in natural background air and in the Mongstad outflow
- surprising* since MEA is believed not to have natural sources
- further research is needed to confirm these findings and exclude potential signal interferences for MEA

AMP

- were not detected at levels above 10 pptv

DEA

- it was not possible to measure these species at single-digit pptv levels due to mass spectral interferences

PZ

- A PTR-QiTOF instrument was **successfully deployed** in the field for the first time **to measure amines in ambient air**
- The time series data indicate that **amine levels were not enhanced** in the Mongstad outflow when compared to natural background conditions (see tables in respective amine time series plots)
- TCM was operating on MEA during the ambient measurements when single-digit pptv levels of MEA were observed in ambient air - no indications were found that these small enhancements were caused by emissions from TCM.
- further analytical work is required**