Development of the MethaneSAT cloud and aerosol filter

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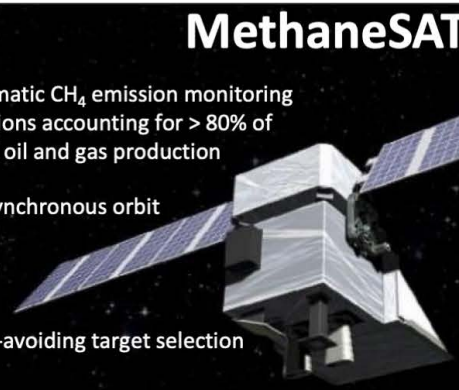
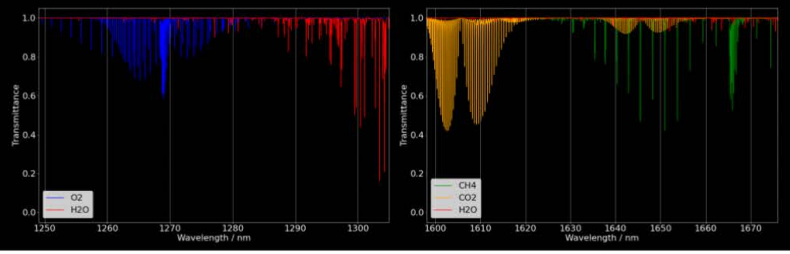
* Available at Gather.town booth
July 12, 18-20 JST (11-13 CEST / 5-7 EDT)

MethaneSAT

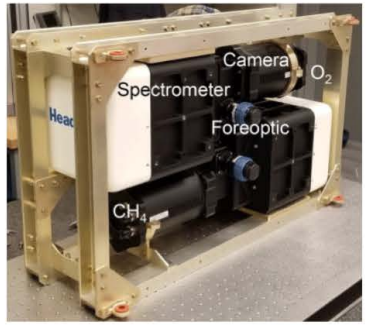
- Systematic CH_4 emission monitoring of regions accounting for > 80% of global oil and gas production
- Sun-synchronous orbit
- Cloud-avoiding target selection



O_2 Spectral Window	1249 – 1305 nm FWHM = 0.171 nm
CH_4 Spectral Window	1598 – 1676 nm FWHM = 0.234 nm
SNR	~180
Spatial resolution	~130 x 400 m² (nadir)
Target area	200 x 200 km²
Orbit	526 km

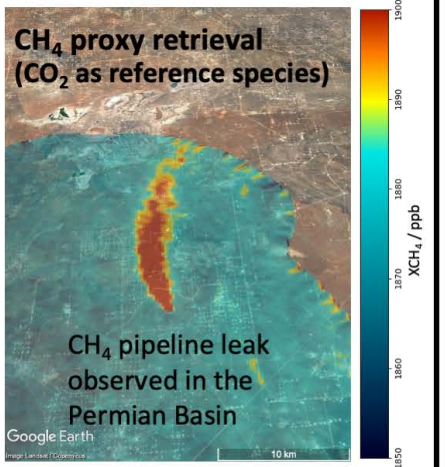


MethaneAIR

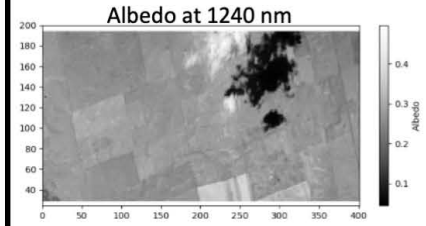


Staebell et al., AMT (2021)

Testbed for MethaneSAT algorithms and operational infrastructure

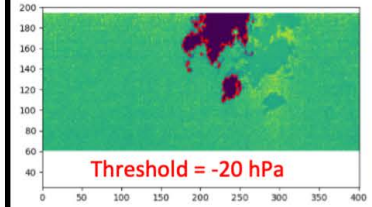


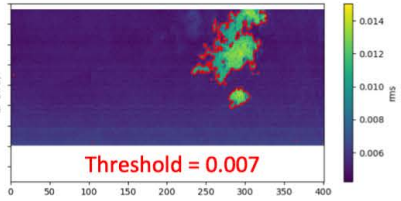
Filtering for clouds and shadows in MethaneAIR scenes



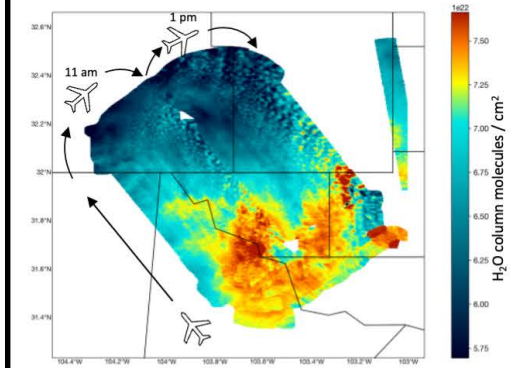
Surface pressure retrievals from the O_2 band are compared to surface pressure values from a meteorological database to identify clouds

Shadows stand out in the RMS of the spectral fit residuals





MethaneAIR H_2O



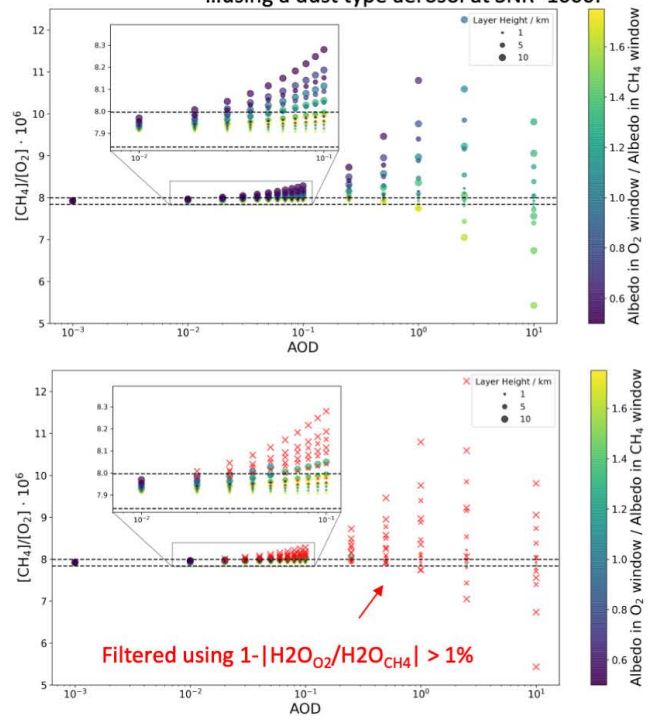
H_2O retrievals during 2 h mapping of Permian basin show development of the boundary layer

H_2O as a potential secondary science target for MethaneAIR/SAT

Filtering for aerosols

a test case with synthetic spectra

...using a dust type aerosol at SNR~1000:



Lightpath differences between the two bands are significant even at AOD < 0.1

Method performs well also in situations with double scatterer layers, e.g. dust+cirrus (not shown here)

Summary and Outlook

Complementary filters for contaminated scenes:

Surface pressure retrieval	→ cloud
Spectral RMS of fit	→ shadow
H_2O retrievals from 1.3 and 1.6 µm ranges	→ aerosol

Further development through application to MethaneAIR data and global MethaneSAT OSSEs

H_2O retrievals from MethaneAIR indicate the instrument can inform on boundary layer processes

Questions:
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