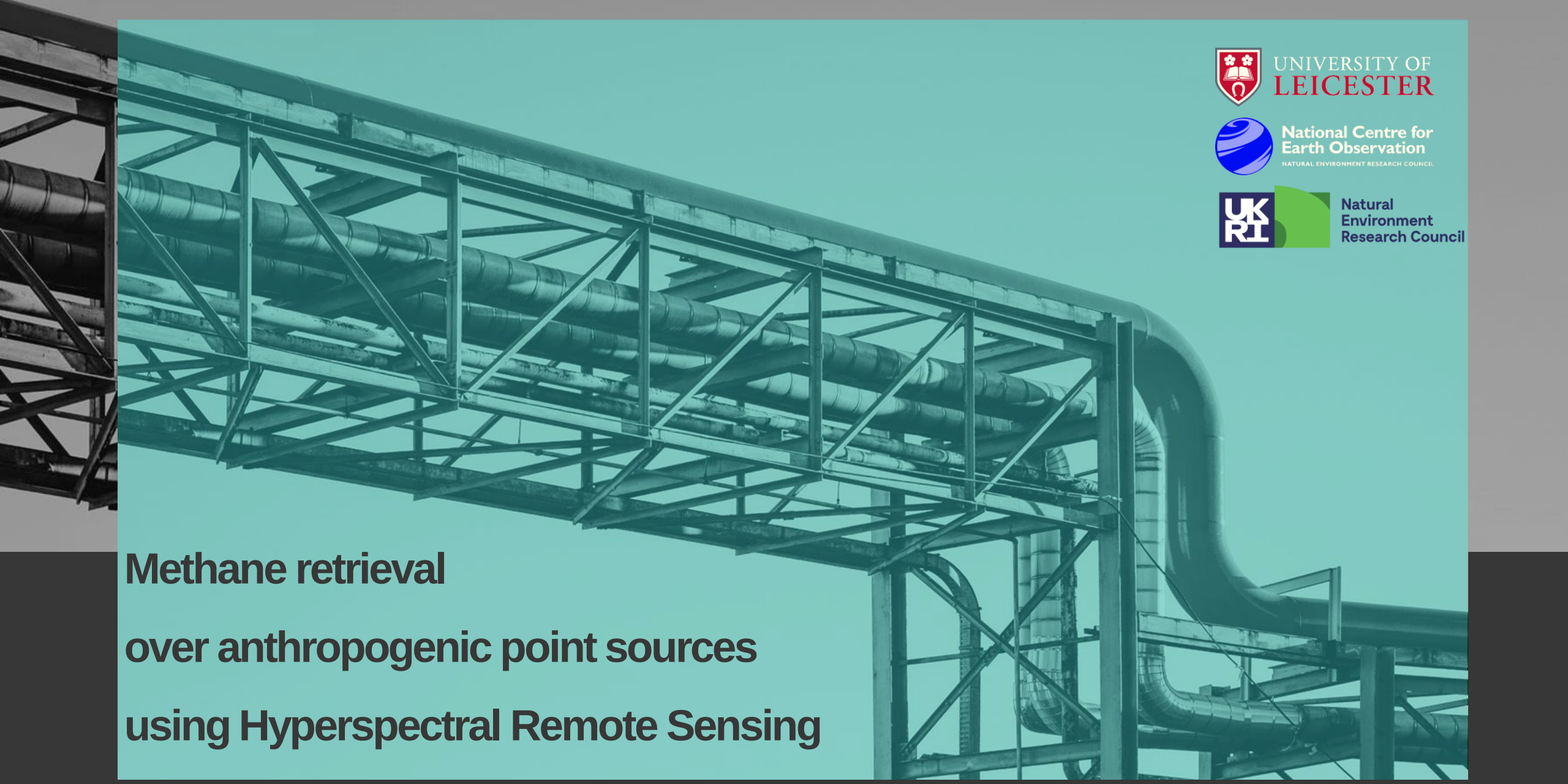


Methane retrieval over anthropogenic point sources using Hyperspectral Remote Sensing

Rocio Barrio Guillo, Hartmut Boesch, Robert Parker

The atmospheric **methane burden is increasing rapidly**, contrary to pathways compatible with the goals of the 2015 United Nations Framework Convention on Climate Change **Paris Agreement**.

Urgent action is required to bring methane back to a pathway more in line with the Paris goals.

Emission reduction from "tractable" (easier to mitigate) **anthropogenic sources** such as the fossil fuel industries and landfills is being much facilitated by **technical advances in the past decade**, which have radically improved our ability to **locate, identify, quantify, and reduce emissions.**

Nisbet et al., 2020
https://doi.org/10.1029/2019RG000675

The issues with Inventories

…we find that methane emissions from natural gas, oil and coal production and their usage are 20 to 60 per cent greater than inventories.

Schwietzke et al., 2016

For example, of the 270 surveyed landfills, only 30 were observed to emit large plumes of methane. However, those 30 were responsible for 40% of the total point-source emissions detected during the survey.

Riley et al., 2019

My project objectives

Developing a CH_4 retrieval for point sources

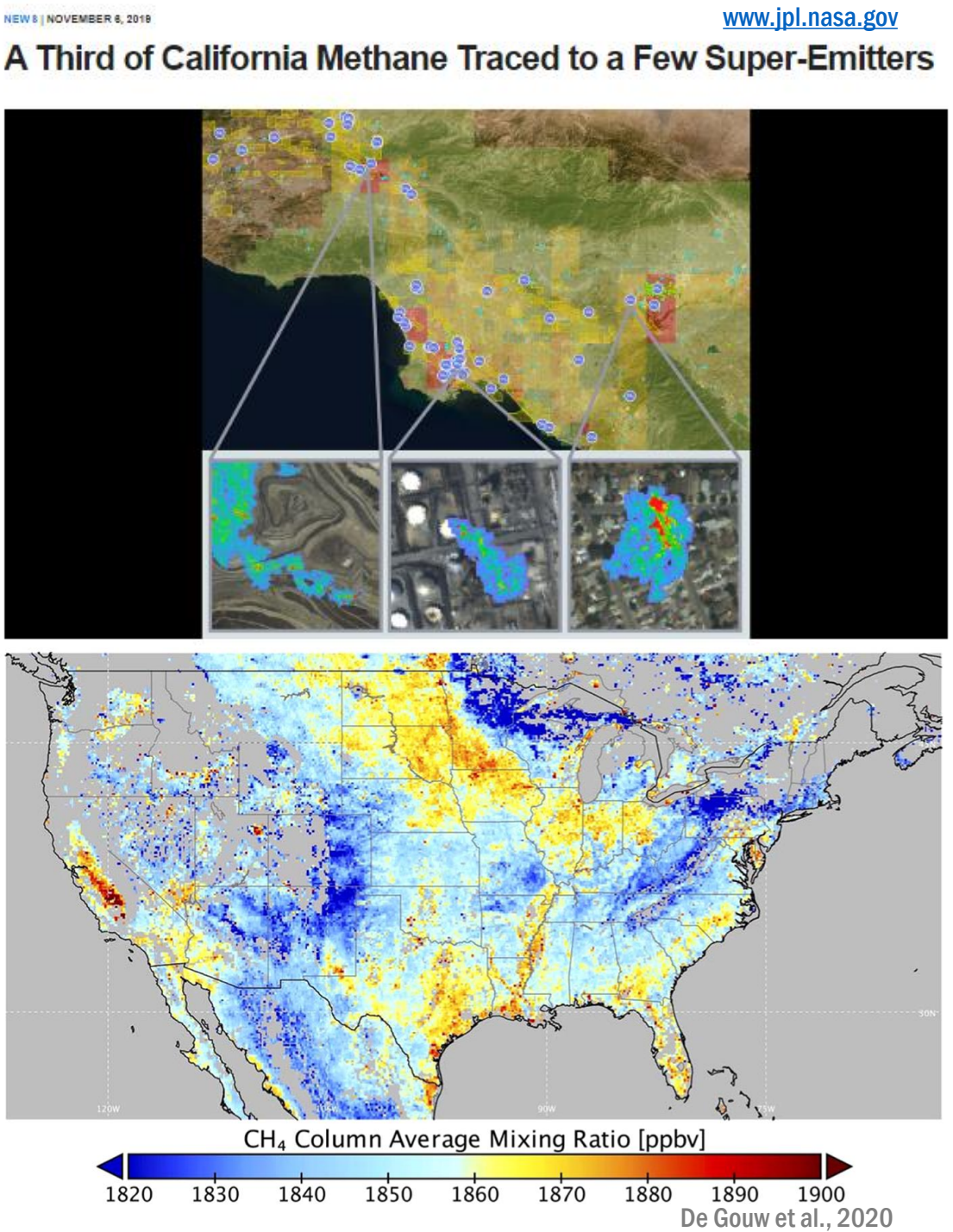
Requires very high spatial resolution; localised observations from aircraft hyperspectral

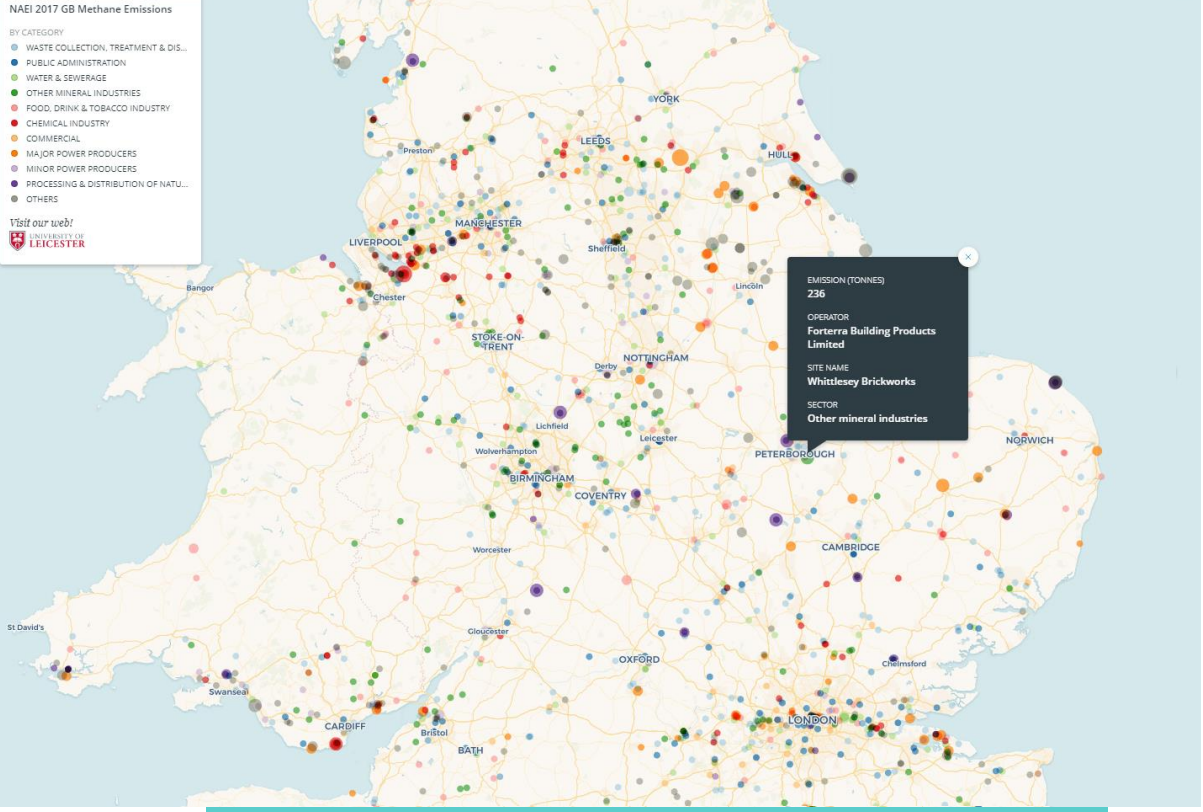
Analysing CH_4 at a local scale worldwide

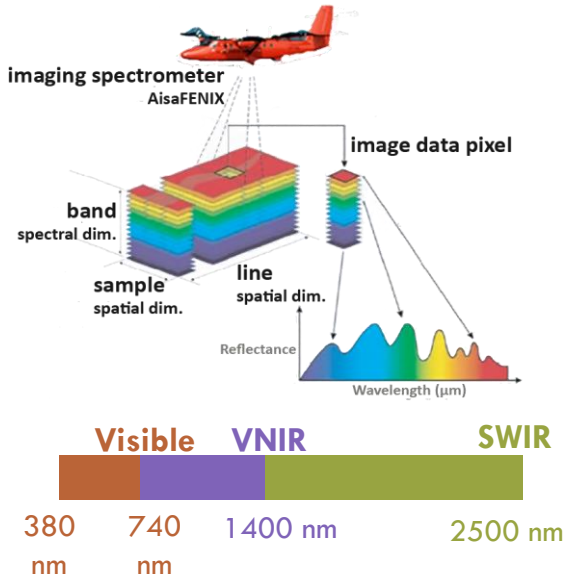
Requires global data from satellites, eg. Sentinel 5 Precursor.

Comparing CH_4 fluxes to emission inventories

Combining methods, eg. high resolution transport models, to evaluate emissions







CH_4 targets

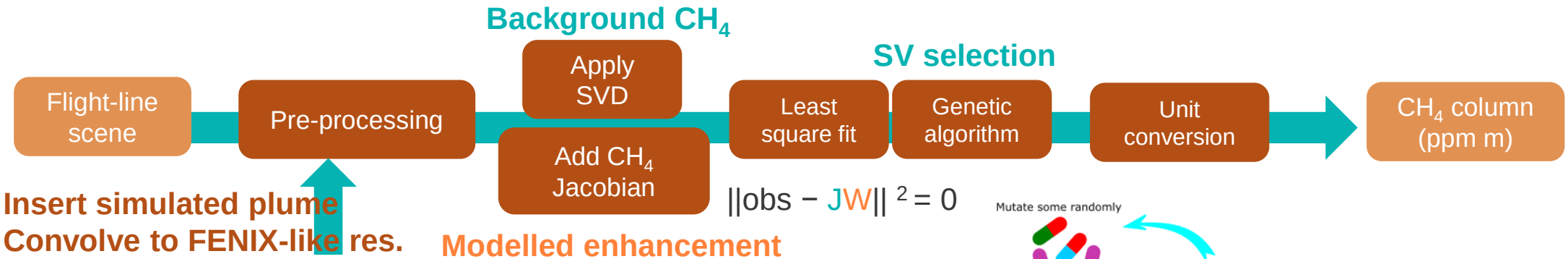
for AisaFENIX campaign, UK, May 2018

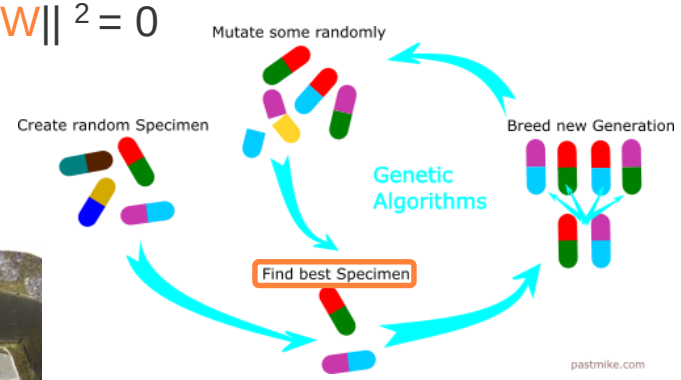
Novel application for this instrument

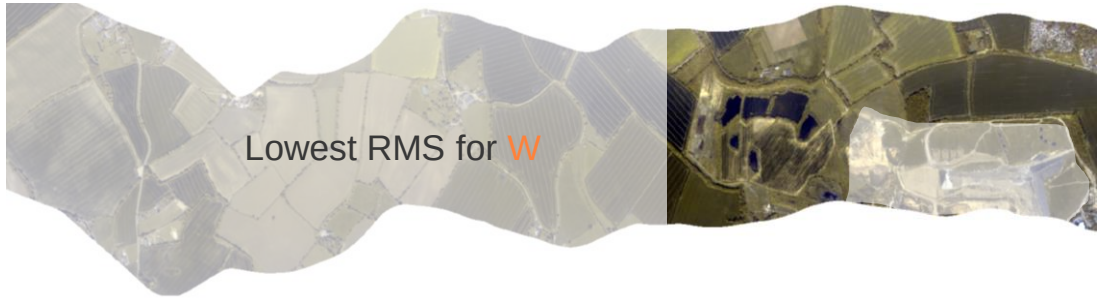
First UK CH_4 point source campaign using remote sensing

Using SVD for spectral analysis

The goal is to identify large CH_4 enhancements over the background CH_4 with a statistical approach:
It's faster and no instrument knowledge is required







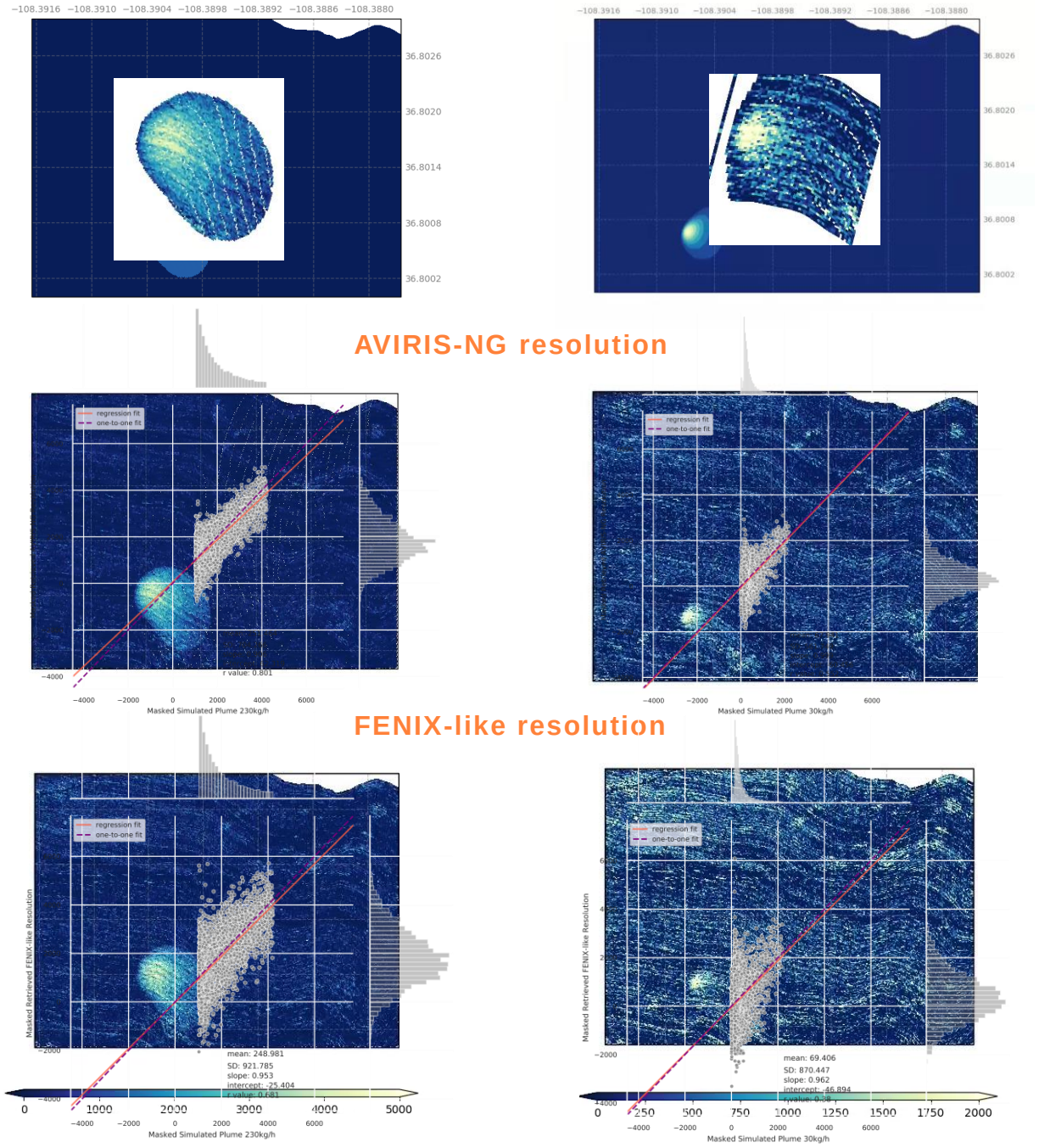
Plume simulations

Can we find the plume?

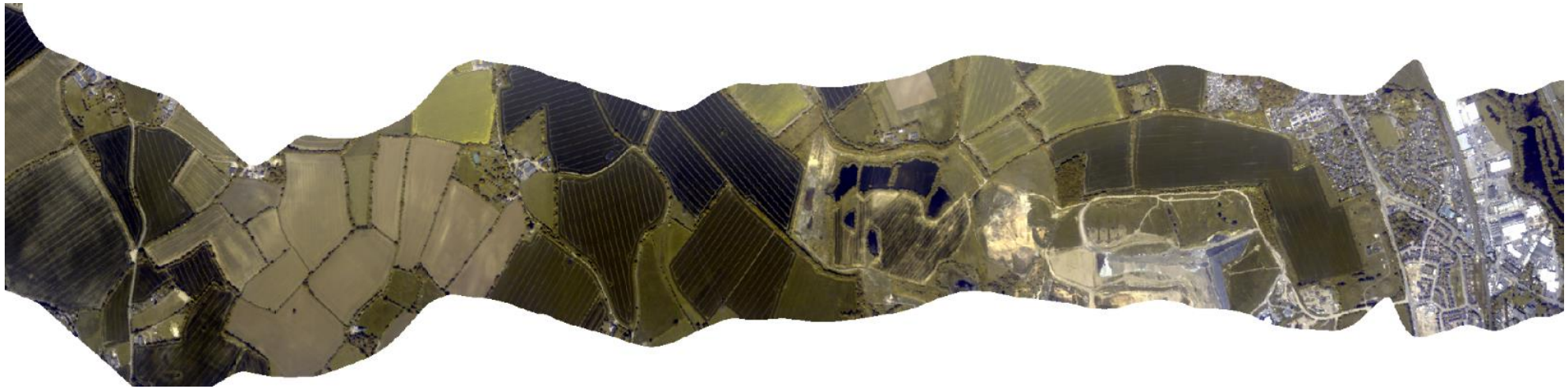
How well does the retrieved agree with the simulation?

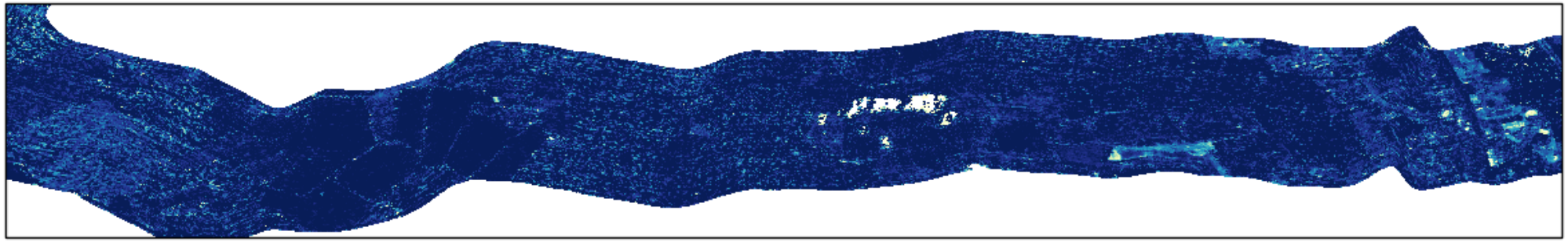
Challenges

- **Stripeing pattern in the image**
- **Reflective surfaces (albedo bias)**



FENIX landfill preliminary results





Next steps

Run simulations on other scene

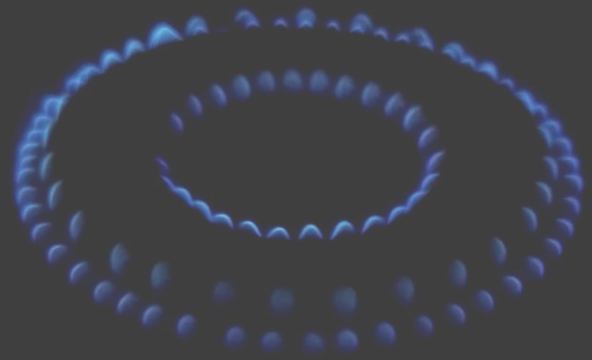
Check how reflective surfaces (buildings, etc.) affect the retrieval

Run our retrieval on all sites for FENIX

Isolate plumes and calculate fluxes

Use Sentinel 5P CH_4 for super-emitters globally

Evaluate emission inventories through atmospheric modelling



SUMMARY

- Developed our own retrieval method tested on AVIRIS-NG.
- Results compare very well to simulated plumes.
- Promising for confidence in retrievals from FENIX data.

Thank you

Genetic algorithm for singular vector selection

Allows an automated background CH_4 characterisation of the spectral data for our retrieval