MethaneSAT: Towards detecting agricultural emissions from space

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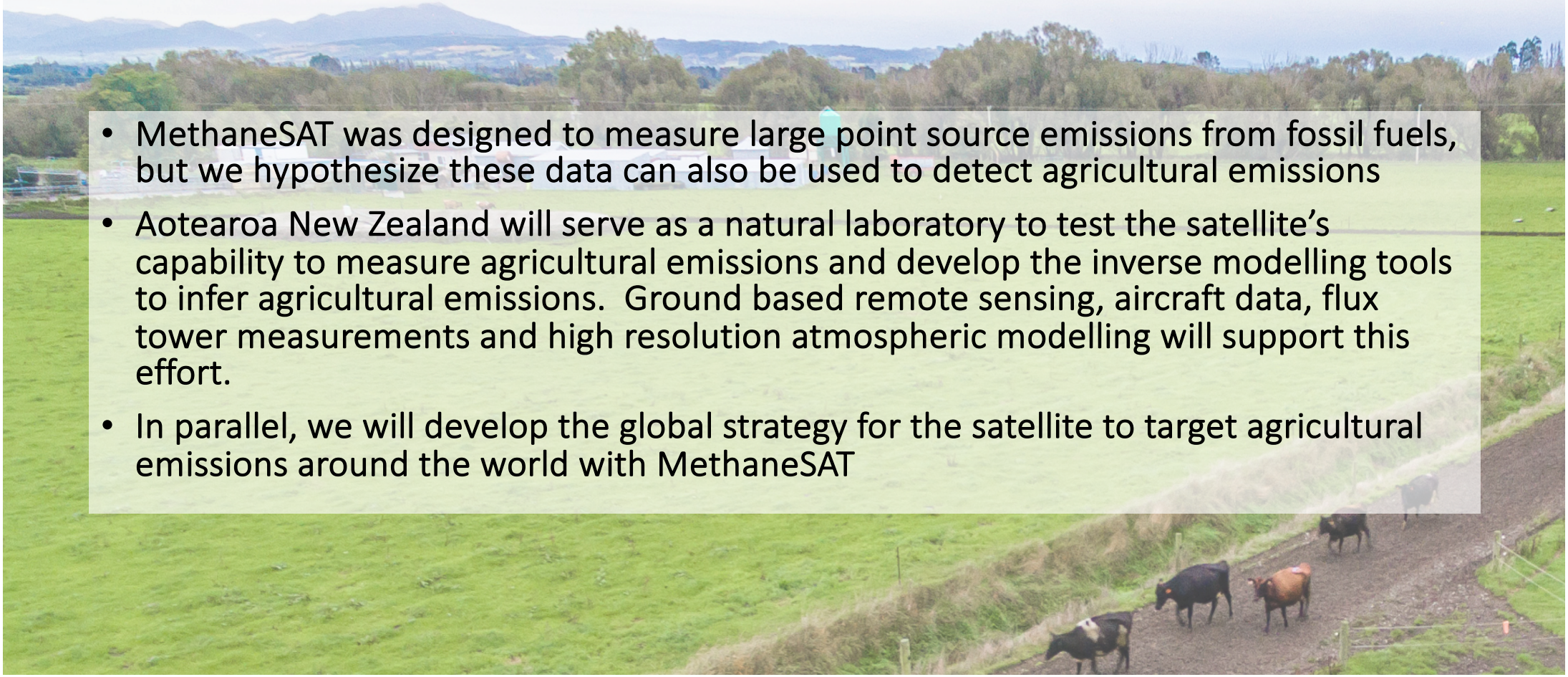


- MethaneSAT was designed to measure large point source emissions from fossil fuels, but we hypothesize these data can also be used to detect agricultural emissions
- Aotearoa New Zealand will serve as a natural laboratory to test the satellite's capability to measure agricultural emissions and develop the inverse modelling tools to infer agricultural emissions. Ground based remote sensing, aircraft data, flux tower measurements and high resolution atmospheric modelling will support this effort.
- In parallel, we will develop the global strategy for the satellite to target agricultural emissions around the world with MethaneSAT

New Zealand as a Testbed

- CH_4 emissions are dominated by a single source.

CH_4 emissions make up nearly half of our gross emissions budget, and 85% of these emissions are from agriculture.

- CH_4 measurement capability.

One of the two founding TCCON sites and a growing national network of surface sites (9 CH_4 sites by the end of 2021 in a country the size of Colorado).

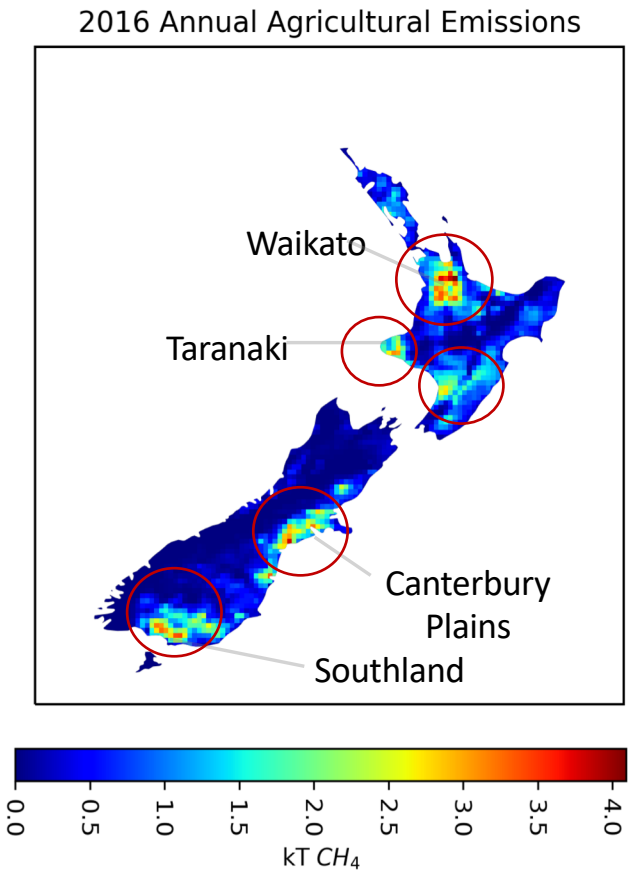
- Atmospheric modelling capability.

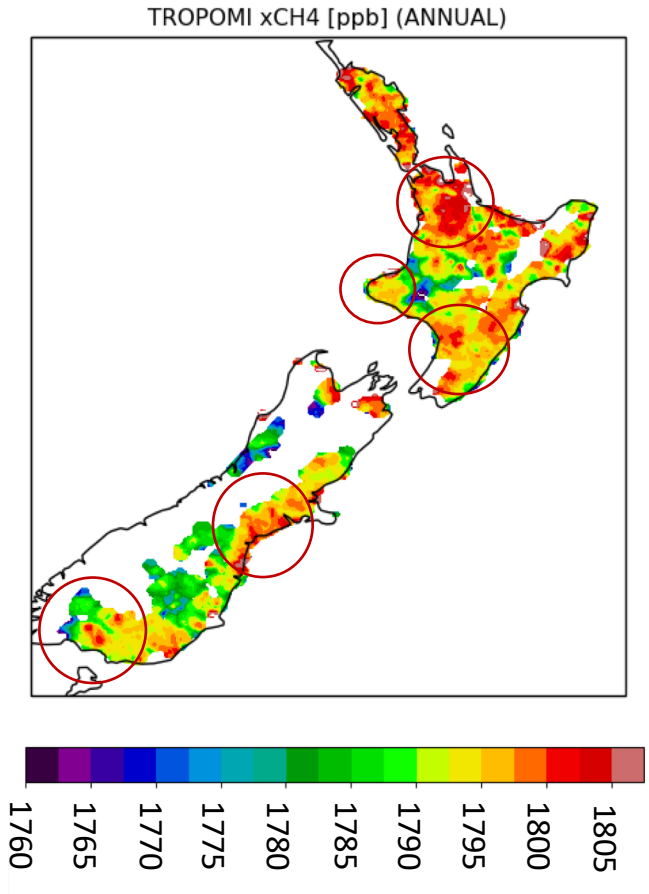
1.5km resolution atmospheric modelling nation-wide. National scale inverse modelling using ground-based observing sites.

- Bottom-up data.

Seasonally varying high resolution emission maps. Strong history of eddy covariance studies.

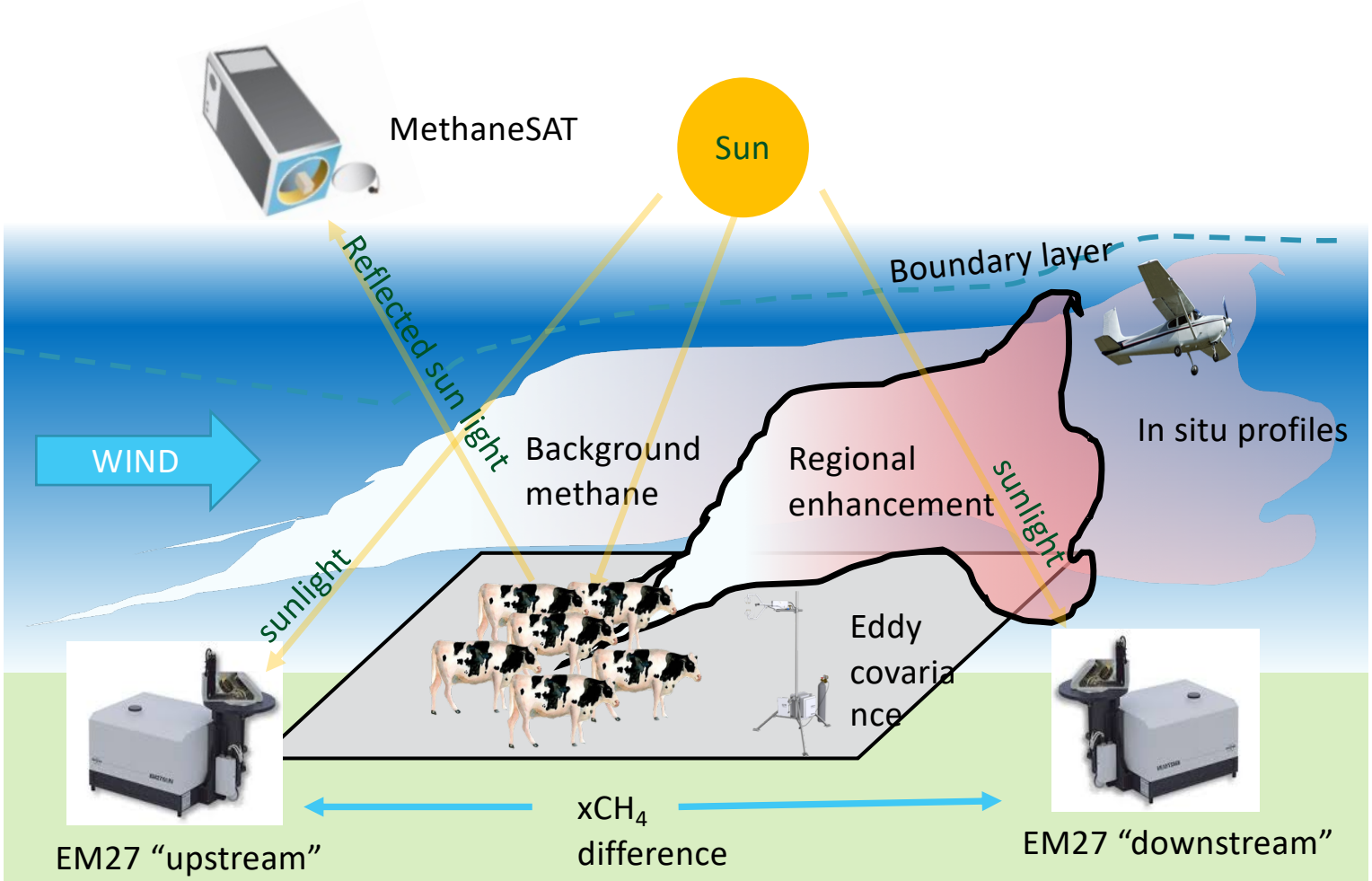
Will we be able to detect diffuse agricultural emissions from space?





- Preliminary analysis of TROPOMI data shows key agricultural regions are visible in satellite CH_4 data
- High satellite CH_4 in the high north most likely due to transport

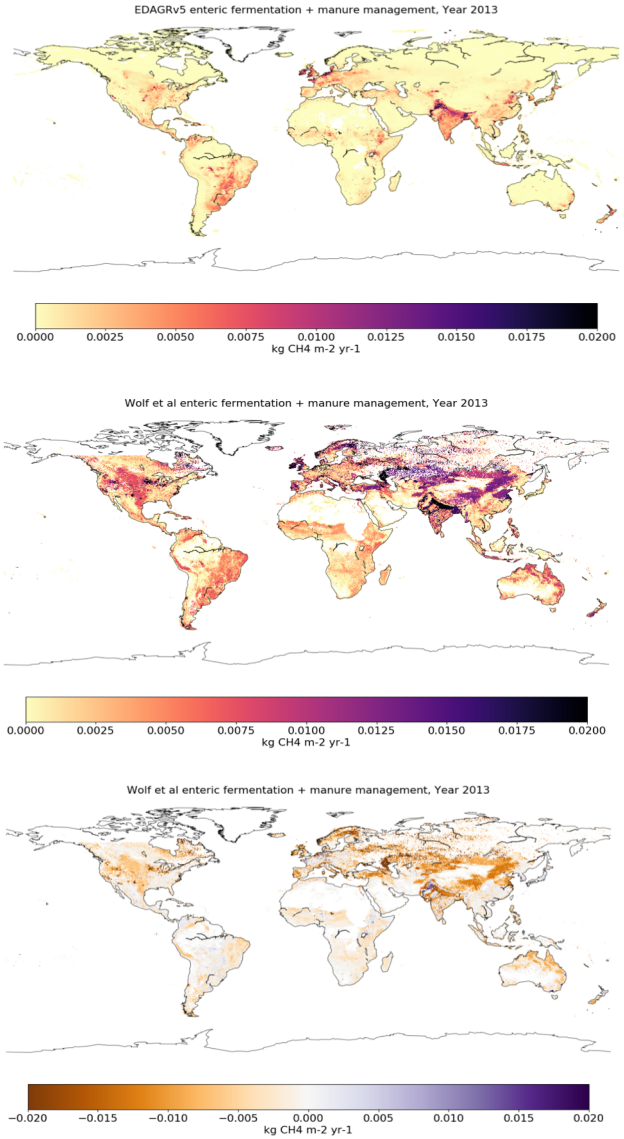
Supporting Measurements



- The satellite data will be complemented by a series of regional field campaigns in key target regions.
- The field campaigns will include two EM27 instruments and vertical profile observations of CH_4 and other gases.

Identifying Global Agricultural Targets

- Both livestock and rice agriculture will be considered
- Emissions are large and therefore easy to detect.
- Topography, albedo, climate and location mean that it is feasible for the satellite to observe the location.
- There are limited co-located sources, so attribution is straightforward
- Emissions are highly uncertain. Current emissions databases diverge widely in some regions.
- Little conflict with acquiring fossil targets.
- There are viable mitigation solutions or policy actions that can be taken to reduce emissions.



Emissions from two different inventory products, EDGARv5 (top), Wolf et al. middle), and the difference between them (bottom).

Our four year project starts 1 July 2021.

Thanks to ….

- Ministry of Business, Innovation, and Employment and NZ Space Agency for funding
- UK Met office and NIWA's NZLAM and NZCSM weather forecasting teams for atmospheric models
- New Zealand's atmospheric greenhouse gas measurements team: yesterday, today, and tomorrow.