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The MethaneSAT satellite, which launched in March 2024, is a joint American and Aotearoa-New Zealand (Aotearoa-NZ) initiative, involving a partnership between Environmental Defense Fund's (EDF) subsidiary MethaneSAT LLC, and the New Zealand government. The satellite's core mission is to support CH_4 emission reductions around the world by measuring atmospheric CH_4 with unprecedented precision and mapping flux rates. While MethaneSAT was designed to detect emissions from oil and gas infrastructure, it can also be used to measure agricultural methane emissions. We will present preliminary results demonstrating MethaneSAT's capability to detect and quantify both diffuse emissions from pastoral agriculture and point source emissions from intensive agriculture.

New Zealand is the ideal test case for diffuse pastoral agricultural emissions, due to its high CH_4 emissions, approximately 85% of which are from agriculture. We model XCH_4 over New Zealand using 1.5 km spatial resolution, New Zealand specific bottom-up CH_4 fluxes and the Numerical Atmospheric dispersion Modelling Environment (NAME III), driven by meteorological input from the New Zealand Convective Scale Model (NZCSM, 1.5 km spatial resolution) Numerical Weather Prediction (NWP) model. The MethaneSAT-like targets are created for different scenarios to assess the changes in the XCH_4 enhancements relative to meteorological conditions and bottom-up fluxes. We use the modelled agricultural XCH_4 fields to test operational methods that are being developed for Level 4 products (i.e., emissions) in an Observing System Simulation Experiments (OSSE) framework and adapt them for diffuse agricultural sources. We will present results of modelled XCH_4 scans for the main agricultural targets across New Zealand and the application of the MethaneSAT Level 4 methods (i.e., Geostatistical Inversion Framework, Divergence Integral Method) for agricultural sources. We will also present preliminary results from a pre-launch field campaign, which utilised two EM27/SUN portable Fourier transform spectrometers (FTS) as well as ground based and airborne in-situ measurements. The detected methane enhancements between the two EM27/SUNs (one at a fixed location and one moved up/downwind) were consistent with modelled values.

Then, we will show XCH_4 measurements and emissions estimates from intensive agricultural systems in the US (e.g. dairies and feedlots) from MethaneAIR, an airborne precursor instrument. CH_4 emissions have been quantified from MethaneAIR data collected over more than 30 unique farms in the US and compared with independent emissions estimates. Here, we evaluate the performance of the Level 4 methods over these MethaneAIR targets and discuss successes and remaining challenges.
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