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Author: Dr. Grégoire Hein
Absolut Sensing, France, gregoire@absolut-sensing.com

GESAT: SUPPORTING THE ESTABLISHMENT OF A NEAR-REAL TIME METHANE EMISSIONS MONITORING SYSTEM

Abstract

While carbon dioxide is the main contributor to climate change, it is not the only anthropogenic greenhouse gas. Methane has a global warming potential 30 times greater than that of CO2. Atmospheric methane mostly comes from human activities such as oil and gas exploitation, mining, agriculture, and waste management. Accurate and trusted monitoring systems are needed for the regulation of methane emissions at both national and international levels to support the mutual verification of inventories and reported values but also for the detection of fugitive emissions. It is not always possible or desirable to rely on in-situ, drone, or air assets due to operational, technical, commercial, or political reasons.

The temporal aspect of the measurement is a key metric for the assessment of emissions, as quantifying their evolution provides better feedbacks to decision makers on the effectiveness of their policies. However, no existing or planned program combines high spatial, spectral, and temporal resolutions. Absolut Sensing's GESat is a program that solves this trilemma, by providing daily measurements over areas of interest all over the globe of methane emission plumes with a threshold < 100kg/h. GESat is based on a constellation of micro-satellites incorporating a miniaturized imaging spectrometer based on an innovative dispersive design. The instrument incorporates a miniaturized hyperspectral shortwave infrared imager with a 50m GSD (ground sampling distance). To achieve these high resolutions while maintaining a usable signal to noise ratio, the instrument uses Cryassy, a breakthrough in integrated dewar detector cryogenic assembly (IDDCA) developed by our sister company Absolut System. Designed for smallsats, it enables the use of a wide range of high performance, low noise infrared detectors for applications previously limited to bigger platforms.

In addition to a sensor technology breakthrough, establishing a high spectral spatial resolution global near-real time methane emissions system requires two key ingredients: the deployment of at least several dozens of satellites to achieve the required coverage and revisit time levels, and the ability to process emissions data directly in space on-board each satellite. Our constellation will initially consist in 12 satellites deployed by 2025, expanded to 24 by the end of 2027, where each satellite will incorporate neural network-based methane retrieval algorithm, efficient lossless compression, and automated cloud detection. Together these on-board processing capabilities will allow for high-confidence methane emission alert functionalities which, working in tandem with existing reference missions (PRISMA, Sentinel-2, Landsat-8/9), would provide a global interoperable methane detection capability.