Can I identify a flare with a performance issue: Satellite monitoring – Wide area methane emissions monitoring

Summary

Satellite monitoring can be used to monitor for flares with anomalous methane emissions. Whilst several technologies are now available, and further systems and services being launched in the coming years the technology can be broadly classed into two types of activity:

1. Wide area survey – in which the spatial resolution is low. An example of this is the Tropomi sensor onboard the Sentinel-5P satellite. Monitoring of this kind can identify trends in total methane emissions

within a region.

2. Directed satellite monitoring – here, the satellite is directed towards specific locations and monitored with a higher resolution (see separate technology entry for details).

There are advantages and challenges associated with both technologies but both rely upon additional information – such as visible imagery or VIIRS to differentiate flaring from other potential sources of methane, such as intentional venting.

In addition to satellite operators, there are a growing number of service organisations that will process publicly available or privately sourced data and use analytics to give insights to an operator.

How it Works

- The satellite is positioned with a low-altitude polar orbit designed to give global coverage. For example, Sentinel 5-P is at 824km which provides daily coverage to all parts of the earth.
- Methane and other gases such as NO2 are measured using multi-spectral imaging whereby sunlight that is scattered back to space by Earth's surface and atmosphere, is measured and used to detect the unique fingerprints of gases in different parts of the spectrum.
- The sensor measured the total-column of methane in the atmosphere –it is not differentiating between background methane or emissions from different sources that overlap vertically. Tropomi measures methane to ppbv and has been validated relative to measurements taken at ground level
- The image is dictated by the resolution of the imager. For Tropomi this equates to 7km2 at the nadir (lowest point to the ground per orbit)
  Converting image data into emission rates requires additional data inputs, most notably windspeed.

Advantages

- ✓ Global coverage provides an overview of changes in flaring – allowing regional trends to be measured.
- ✓ Publicly accessible data provides an independent view of changes to flaring

Limitations

- ✗ Multi-spectral imaging is dependent upon daylight and cloud-free cover for the location of interest. In some parts of the world, cloud free days are rare.
- ✗ Quantification is dependent upon additional information, such as wind speed.
- ✗ The relatively low resolution of current systems means that individual flares cannot be differentiated by wide area systems. In parts of the world where multiple operators are co-located, flaring cannot be assigned to any specific operator or facility.

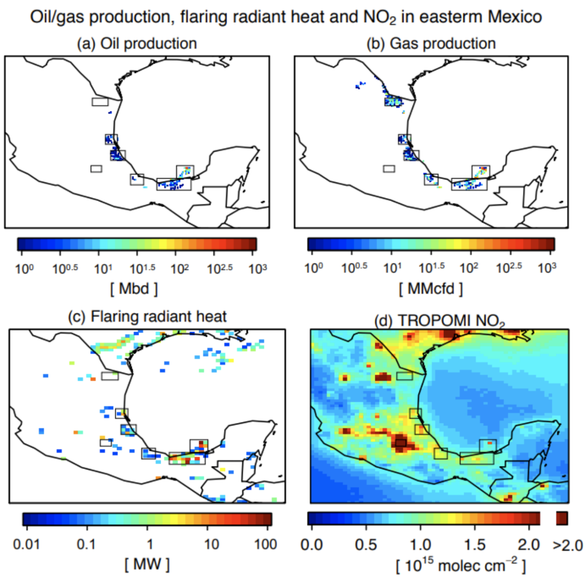
Measurements conducted over water, ice or snow are subject to light reflection, which impairs data accuracy. Work is ongoing to develop specialised ‘glint mode’ analytics to provide improved data over water.

Go Deeper

- Tropomi
- Academic publication: Daily Satellite Observations of Methane from Oil and Gas Production Regions in the United States
- Academic publication: Unravelling a large methane emission discrepancy in Mexico using satellite observations

Case study

Flaring in Mexico



Oil/gas production, flaring radiant heat, and TROPOMI NO_2 column mixing ratio in eastern Mexico. (a) Oil production from the Hydrocarbon Information System 540 (https://sih.hidrocarburos.gob.mx/, accessed in June 2020). The unit Mbd is thousand barrels per day. (b) Same as (a) but for gas production. The unit MMcfd is million cubic feet per day. (c) Gas flaring radiant heat from the Visible Infrared Imaging Radiometer Suite (VIIRS) data (Elvidge et al., 2015). (d) Tropospheric column density of NO_2 from TROPOMI. All data are averages for May 2018 – December 2019 in eastern Mexico.

Can I identify a flare with a performance issue?

Can I identify a flare with a performance issue: Optical Gas Imaging

Can I identify a flare with a performance issue: Helicopter Optical Gas Imaging

Can I identify a flare with a performance issue: Point Sensors and Arrays

Can I identify a flare with a performance issue: Alarm systems – Image Processing

Can I identify a flare with a performance issue: Alarm systems – Acoustic Alarms