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RESEARCH ARTICLE

Satellite observations reveal extreme methane leakage from a natural gas well blowout

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Article Figures & SI Info & Metrics PDF

Significance

Emissions from the fossil fuel industry are one of the major sources of atmospheric methane. Gas leakages due to accidents in the oil and gas sector can release large amounts of methane within short periods of time. Although these emissions are very challenging to monitor, satellite measurement platforms offer a promising approach by regularly scanning the entire globe. This study demonstrates this capability of satellite measurements by reporting atmospheric measurements of methane emission

from a natural gas well blowout in Ohio in 2018. Assuming a constant emission rate during the whole event, we find the total methane emission from the 20-d blowout to be equivalent to a substantial fraction of the annual total anthropogenic emission of several European countries.

Abstract

Methane emissions due to accidents in the oil and natural gas sector are very challenging to monitor, and hence are seldom considered in emission inventories and reporting. One of the main reasons is the lack of measurements during such events. Here we report the detection of large methane emissions from a gas well blowout in Ohio during February to March 2018 in the total column methane measurements from the spaceborne Tropospheric Monitoring Instrument (TROPOMI). From these data, we derive a methane emission rate of 120 ± 32 metric tons per hour. This hourly emission rate is twice that of the widely reported Aliso Canyon event in California in 2015. Assuming the detected emission represents the average rate for the 20-d blowout period, we find the total methane emission from the well blowout is comparable to one-quarter of the entire state of Ohio's reported annual oil and natural gas methane emission, or, alternatively, a substantial fraction of the annual anthropogenic methane emissions from several European countries. Our work demonstrates the strength and effectiveness of routine satellite measurements in detecting and quantifying greenhouse gas emission from unpredictable events. In this specific case, the magnitude of a relatively unknown yet extremely large accidental leakage was revealed using measurements of TROPOMI in its routine global survey, providing quantitative assessment of associated methane emissions.

methane TROPOMI satellite remote sensing natural gas well blowout

Footnotes

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Author contributions: S.P., R.G., S.H., and I.A. led the study; P.T., T.K., R.H., and R.v.H. provided detailed analysis of the TROPOMI SWIR measurements and LB1 data; T.B., O.H., and J.L. provided the TROPOMI XCH_4 retrievals; S.P. analyzed the TROPOMI XCH_4 data and carried out WRF simulations; H.D.G., P.S., and J.D.M. performed the bottom-up inventory comparisons; S.P., R.G., S.H., S.P.H., and I.A. wrote the manuscript; and all authors discussed the results and commented on the manuscript.

The authors declare no competing interest.

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Data deposition: TROPOMI data are available at ftp://ftp.sron.nl/open-access-data-2/TROPOMI/tropomi/ch4/10_9/. WRF-CHEM model code is available at https://ruc.noaa.gov/wrf/wrf-chem/.

This article contains supporting information online at https://www.pnas.org/lookup/suppl/doi:10.1073/pnas.1908712116/-/DCSupplemental.

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