

World Meteorological Organization in support of greenhouse gas mitigations

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WMO OMM

World Meteorological Organization
Organisation météorologique mondiale



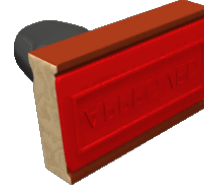
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

How to get emission estimates?

- “Bottom-up” estimate (inventory)

Emissions reporting
Reported and “verified” offsets
Site-specific measurements

National reporting is regulated by IPCC



- Limited for accidental emissions
- Emissions factors uncertainty
- Limited temporal resolution

- “Top-down” estimate

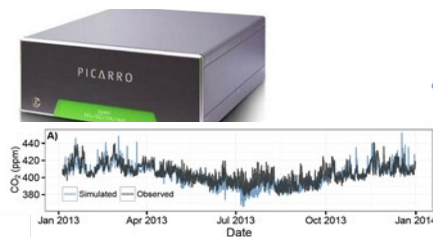
Atmospheric observations and analysis
Ecosystem and ocean observations

Research activities (no common standard)

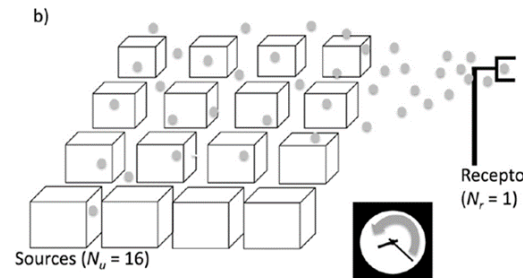


- Diversity of approaches
- Limited sectoral attribution

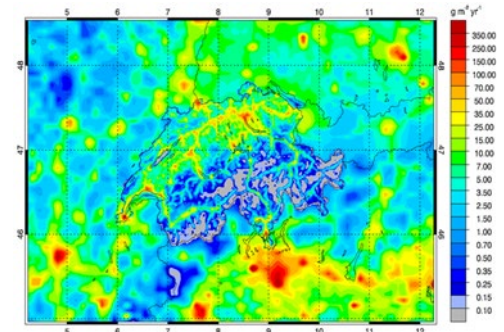
Combination of bottom-up and top-down provides most comprehensive knowledge (combine inventory and observations in a common analysis framework)



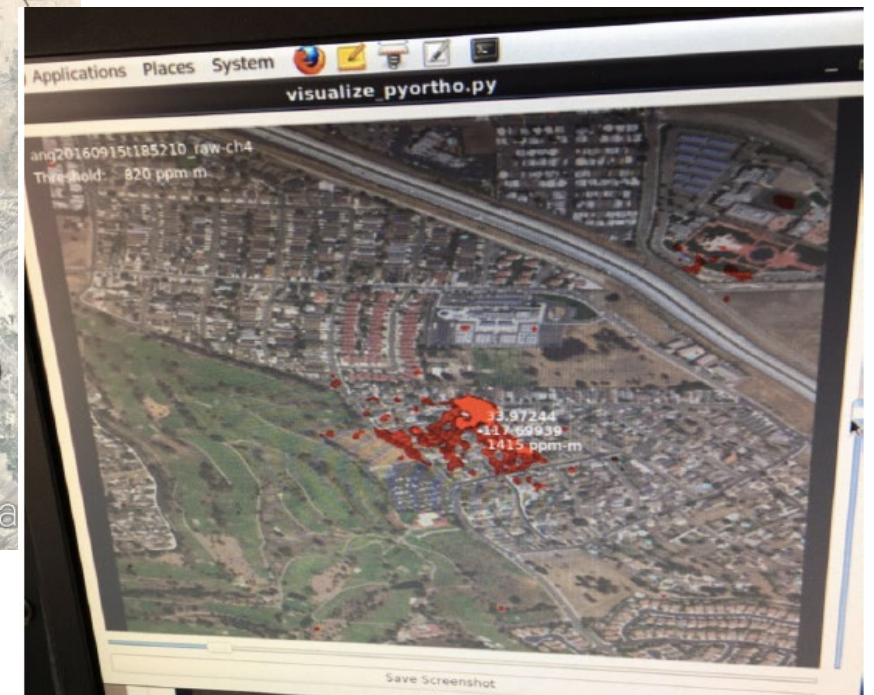
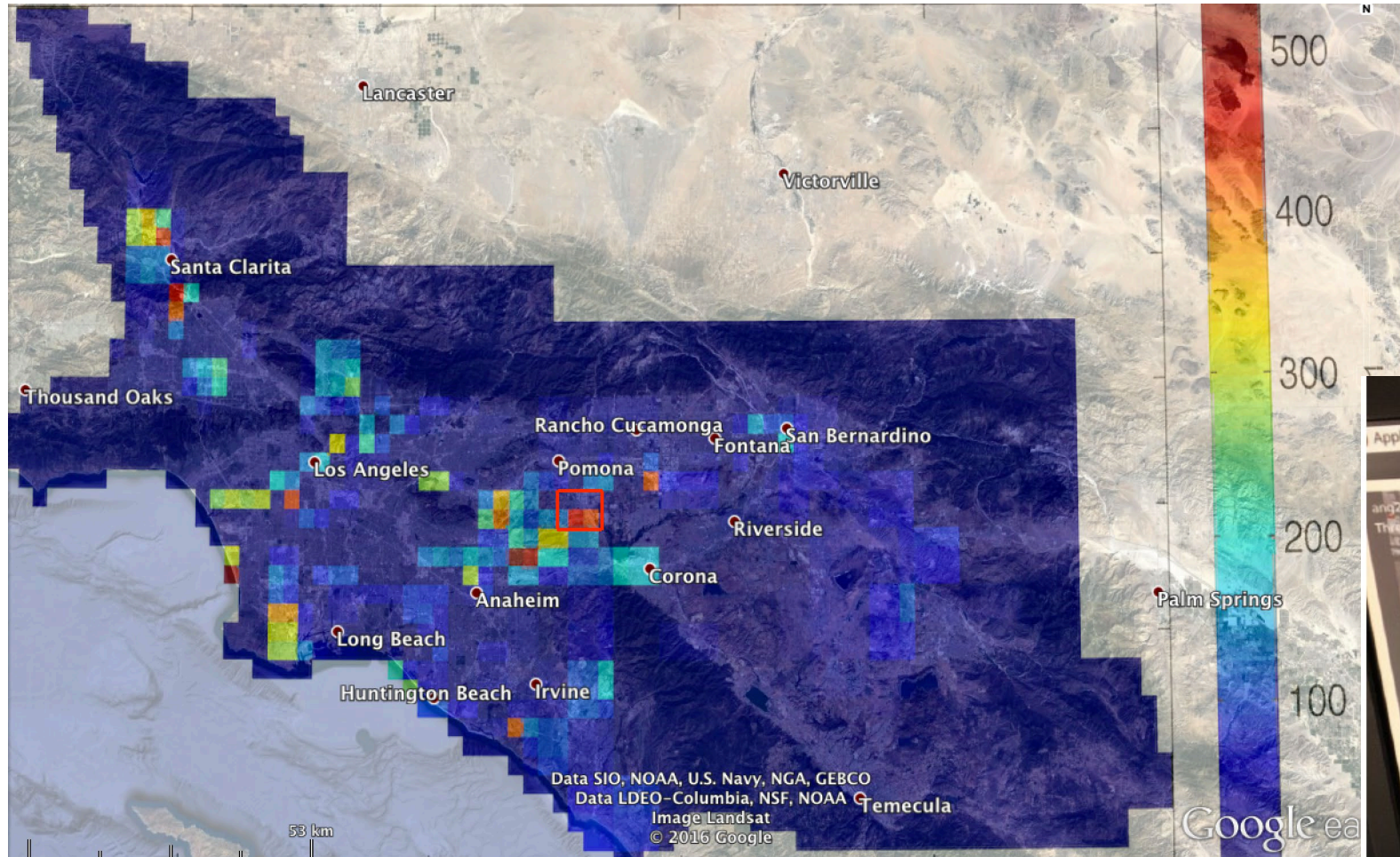
X



X



Los Angeles inverse model of 12 tower measurements shows methane hot spots at known & a large unknown source



Integrated Global Greenhouse Gas Information System (IG³IS) is



... a common framework for provision of the **systematic services to user community** who intend to reduce its greenhouse gas emissions

- Support the use of atmospheric concentration data to improve emission estimates
- Consensus on a coherent set of good-practice methods and guidelines
- Quality control (benchmarking)



Range of scales



How do we go about methane?

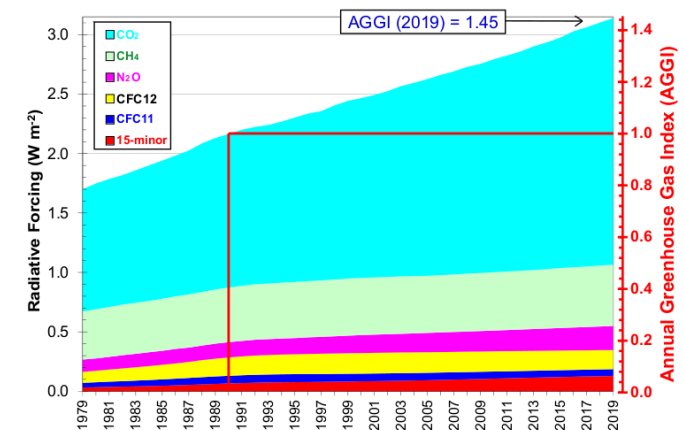
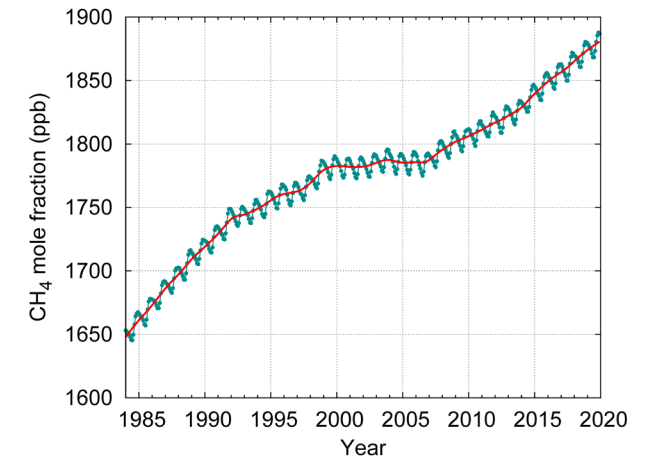
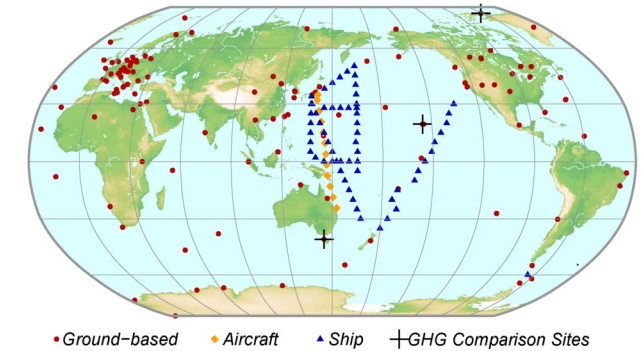
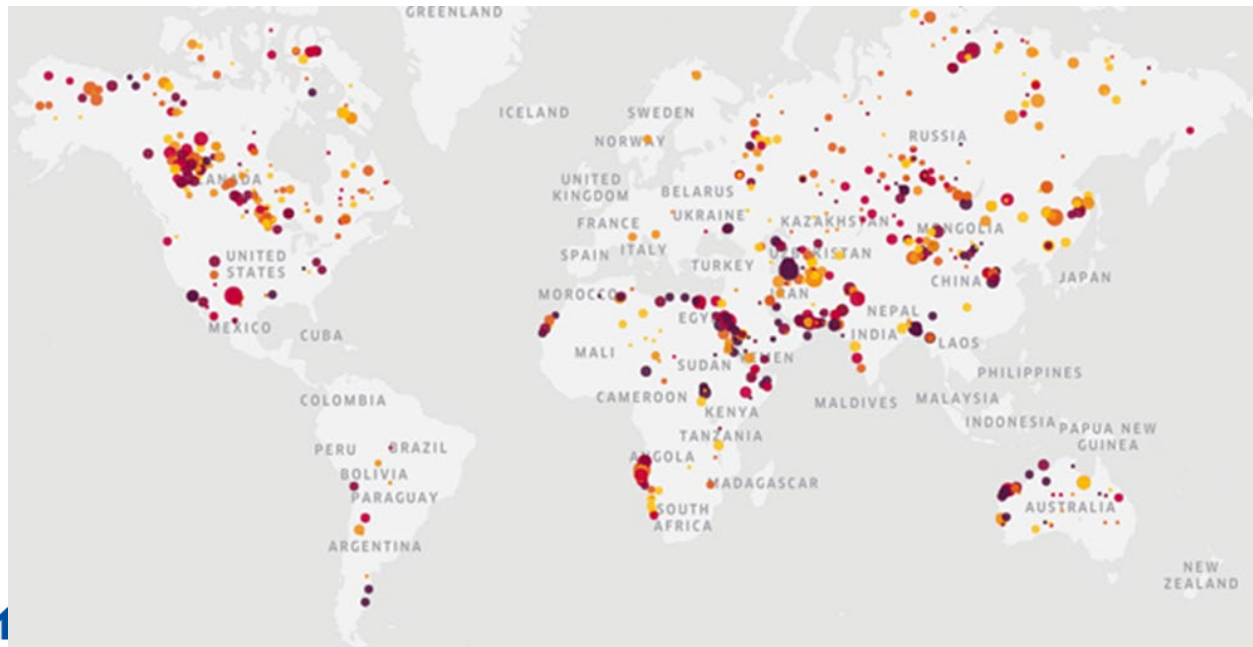
Addressing CH₄ emissions includes:

- Identification
- Quantifying
- Attribution

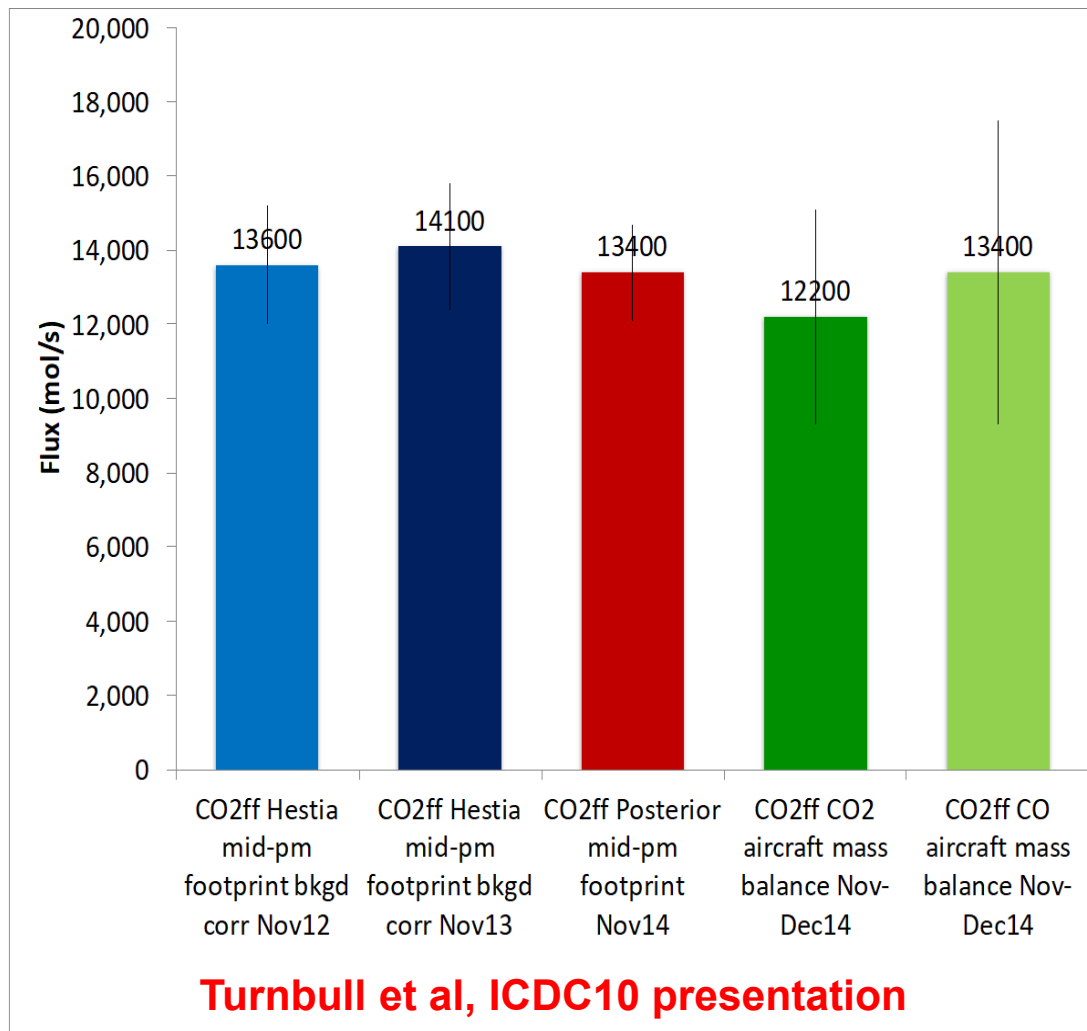
WMO global network was designed to observed global and regional features of methane and **needs to be complimented** by more targeted measurements at more local scale (through the dedicated projects, for example IMEO) and satellite data

Identification:

Abnormal methane concentrations over 2019 as measured by Sentinel-5P.



Quantification: Indianapolis CO₂ff flux comparison



Comparison of whole city, winter, fossil fuel CO₂ flux

- Hestia high resolution bottom-up data product
 - Atmospheric inversion based on **in situ tower CO₂ data** and WRF/LPDM
 - Mass balance using downwind **aircraft measurements**
- Flask measurements used to convert total CO₂ or CO to CO₂ff for aircraft and inversion
 - Matched times and footprint
 - Corrected to the same background

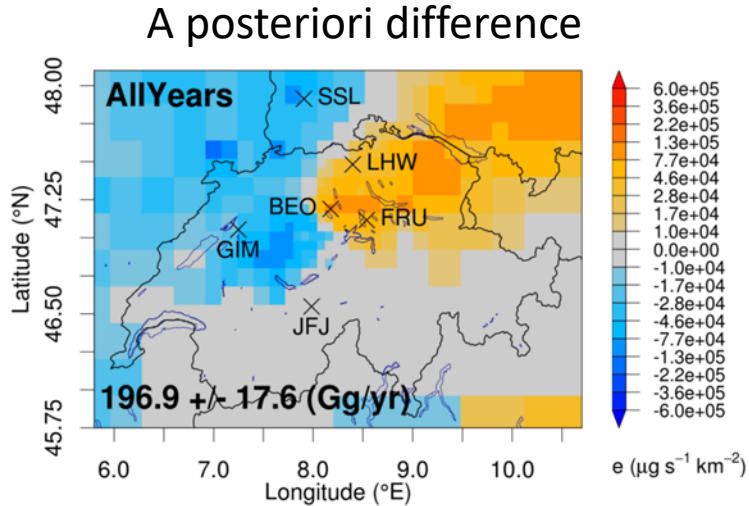
Excellent agreement across top-down and bottom-up methods

13,300 mols/s ± 6%

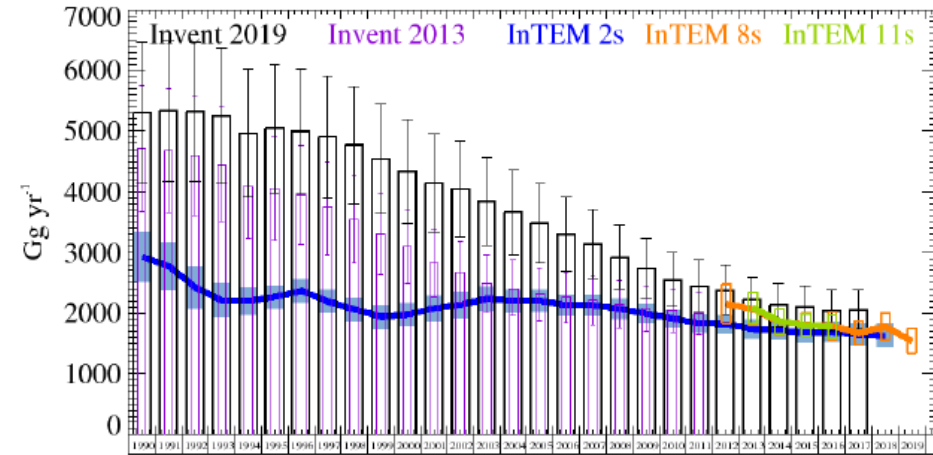
How to ensure the compatibility of different approaches?

Quality assurance for the modelling systems

Methane in Switzerland (2013-2018)



Methane in the UK



IG³IS Crosscutting activates (benchmarking experiments)

Objectives: Demonstrate the potential of atmospheric inversion systems to detect major changes in emissions

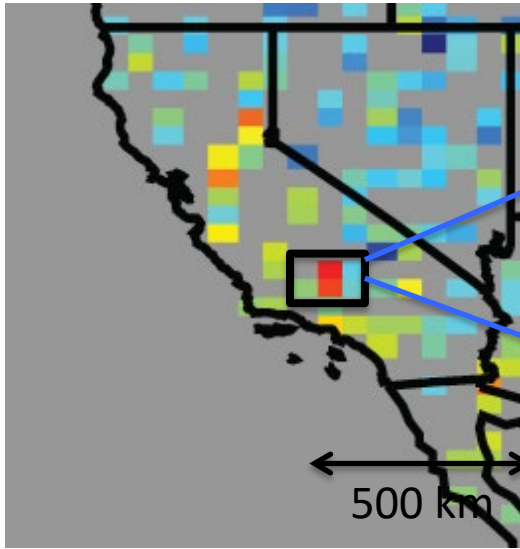
Urban scale: The Harding Street power plant shift, Indianapolis (stopped burning coal in February of 2016, replaced by natural gas in the following months), focus on CO₂

National scale: CH₄ in Europe in collaboration with VERIFY

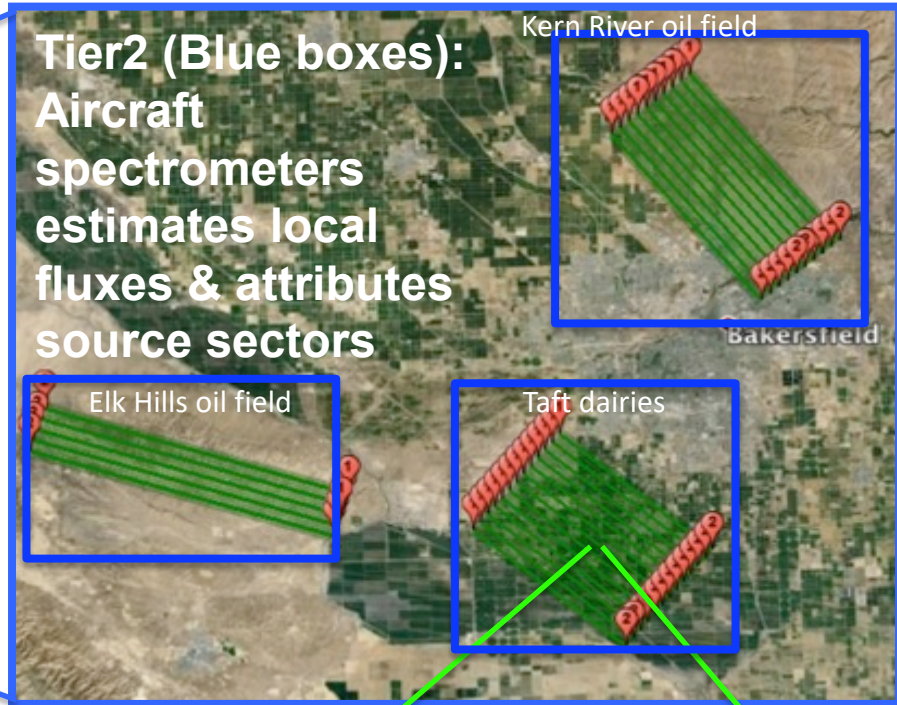
Tiered approach to observations and attribution

Tier 1: Satellite detects hotspot region

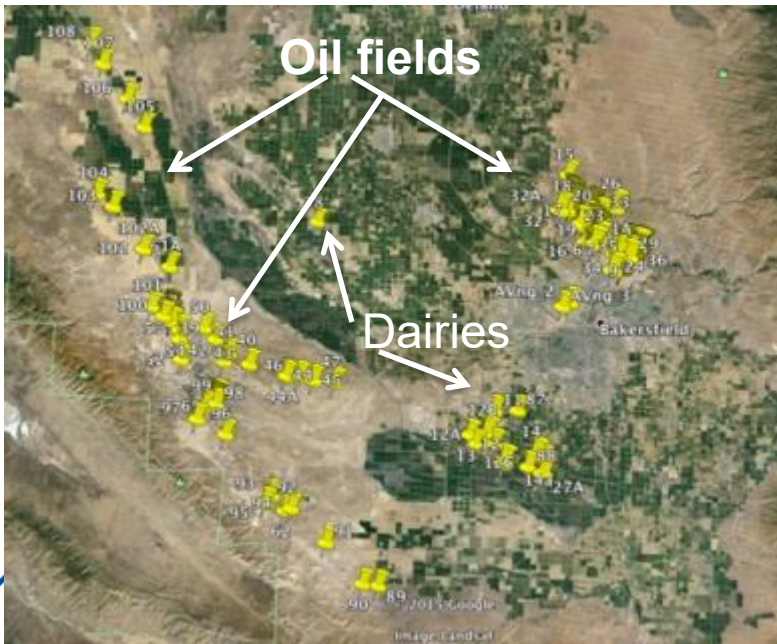
Turner et al 2015



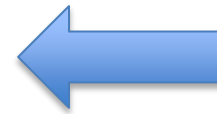
Tier2 (Blue boxes):
Aircraft
spectrometers
estimates local
fluxes & attributes
source sectors



50 km

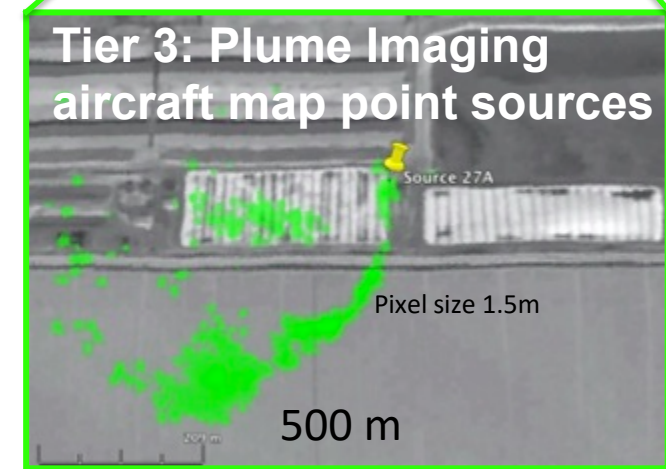


Enhanced
Activity Data



Tier 4 (not
shown): Surface
observations

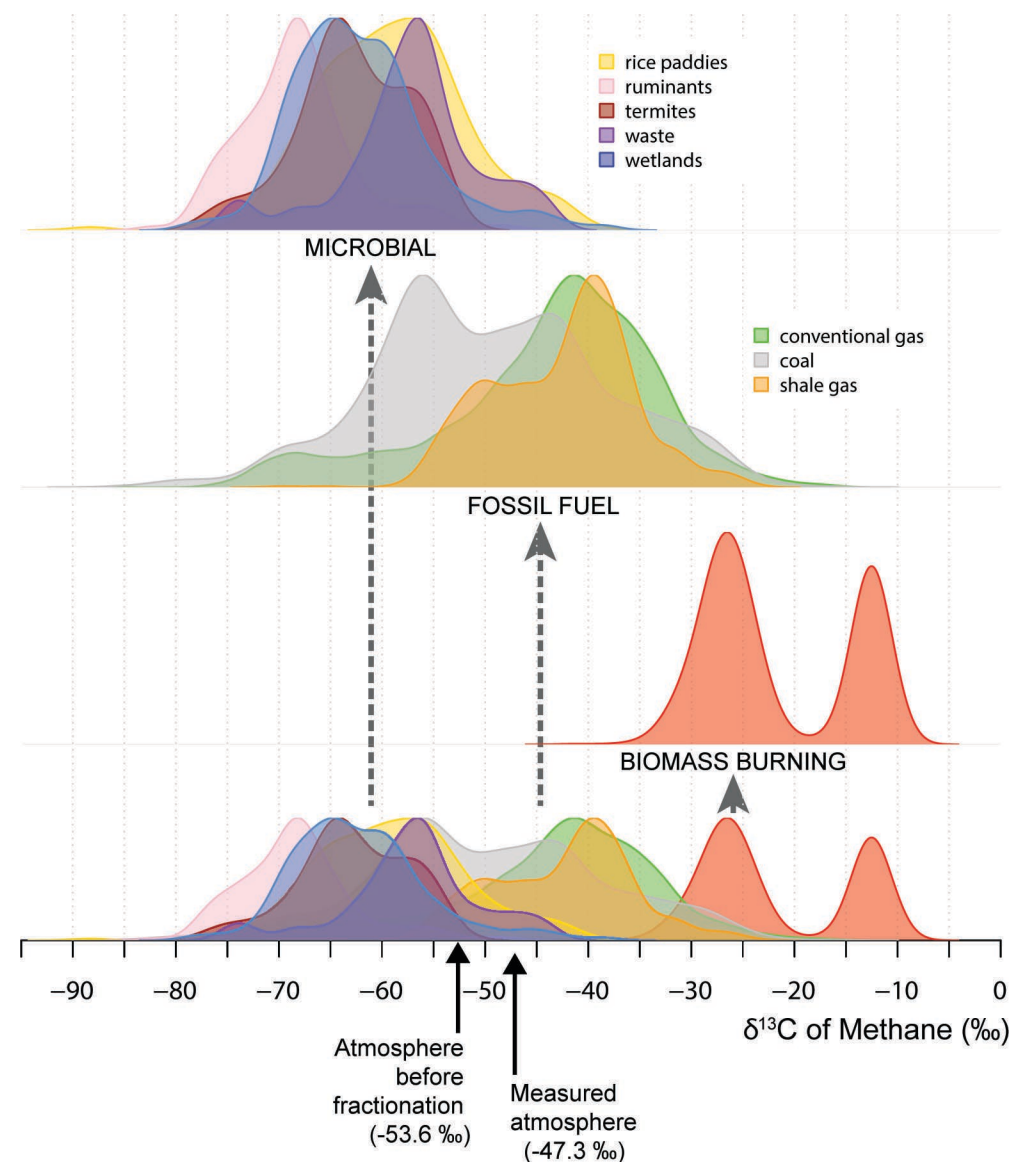
Tier 3: Plume Imaging
aircraft map point sources



Challenges with the implementation of the observations-based emissions estimates: attribution

Emission attribution to individual sectors remains a challenge that requires additional measurements (isotopes or co-emitted species as demonstrated in global studies)

- WMO established primary standards for the concentration observations and includes many modelling centers in its structures
- International Atomic Energy Agency (IAEA) is a custodian agency for the stable isotopes primary standards
- **IAEA and WMO** works together on the technical cooperation project INT7020 “Developing Capacity Towards The Wider Use Of Stable Isotopic Techniques For Source Attribution Of Greenhouse Gases In The Atmosphere” to establish good practices for isotopic measurements of methane and to organize regional training centers to increase capacity of the Members to utilize such measurement techniques

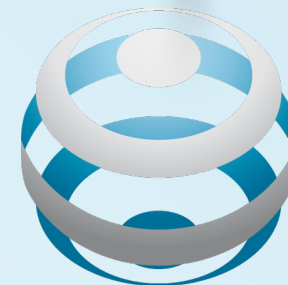


Thank you!



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ATMOSPHERE
WATCH**