EGU2020-21759
AS3.14/BG2.21
D3186

Characteristics of urban methane emissions from Bucharest, Romania

Julianne Fernandez[1]
julianne.fernandez@rhul.ac.uk

J. France[1], H. Maazallahi[2], M. Corbu[3], M. Menoud[2], T. Röckmann[2], R. Fisher[1], D. Lowry[1]

[1] Department of Earth Sciences, Royal Holloway, University of London (RHUL), United Kingdom.
[2] Institute for Marine and Atmospheric research Utrecht (IMAU), Utrecht University, The Netherlands.
[3] National Institute for Aerospace Research "Elie Carafoli" (INCAS), Bucharest, Romania.

Bucharest, Romania

- Romania
  - Hydrocarbon rich region
  - Natural gas reserves: 105.5 billion m^3 [1]
  - Crude oil reserves: 600 million bbl [1]

  [1] cia.gov/library/publication

- Bucharest City
  - Area: 1,811 km^2
  - Population density: 7,909 km^2

- Aim of research
  - Locate areas of high methane emissions
  - Define major sources
  - Estimate emissions

- Importance
  - Locating of areas for GHG mitigation
  - Work towards budget/inventory accuracy

julianne.fernandez@rhul.ac.uk

Survey equipment

Fieldwork

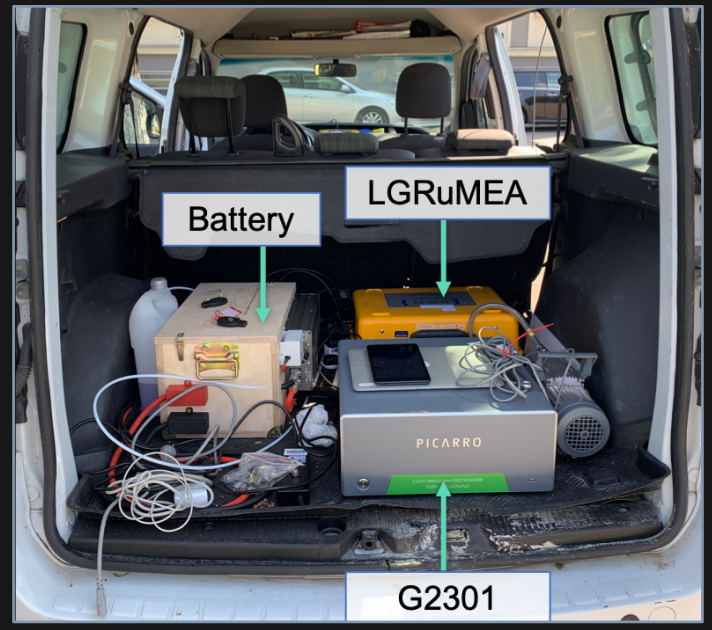
- Collaboration between UU, RHUL, & INCAS
- Mobile survey – 9 days (August 2019)
- 3 vehicles utilized

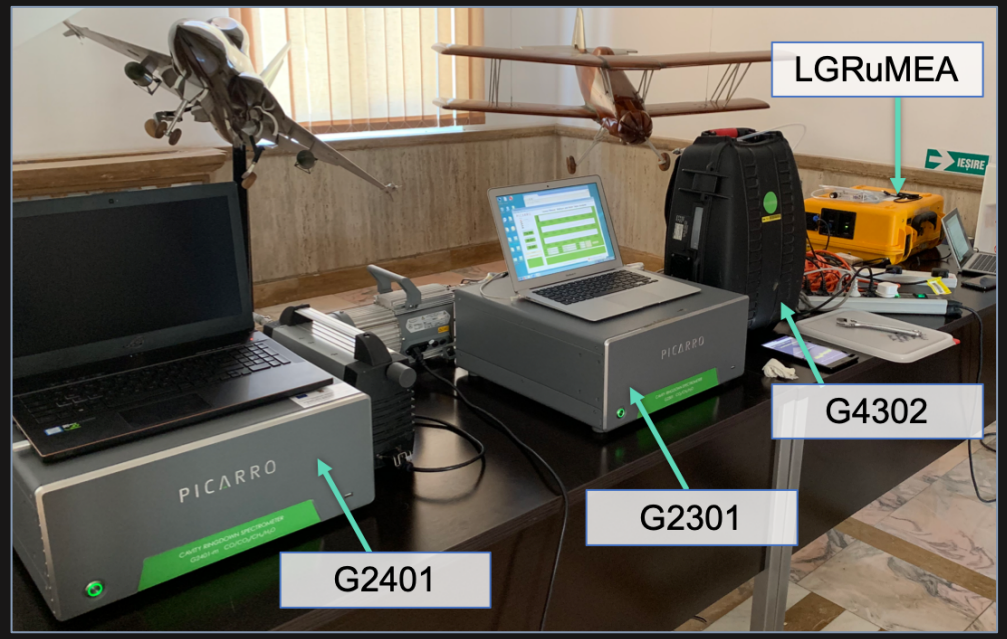
Mobile instruments

- Picarro G2401 (CO, CO_2, CH_4, H_2O)
- Picarro G2301 (CO_2, CH_4, H_2O)
- Picarro G4302 (CH_4, C_2H_6)
- LGRUMEA (CH_4, C_2H_6)

Air sample collection

- 12V bag pump
- 3L SKC FlexFoil sample bags



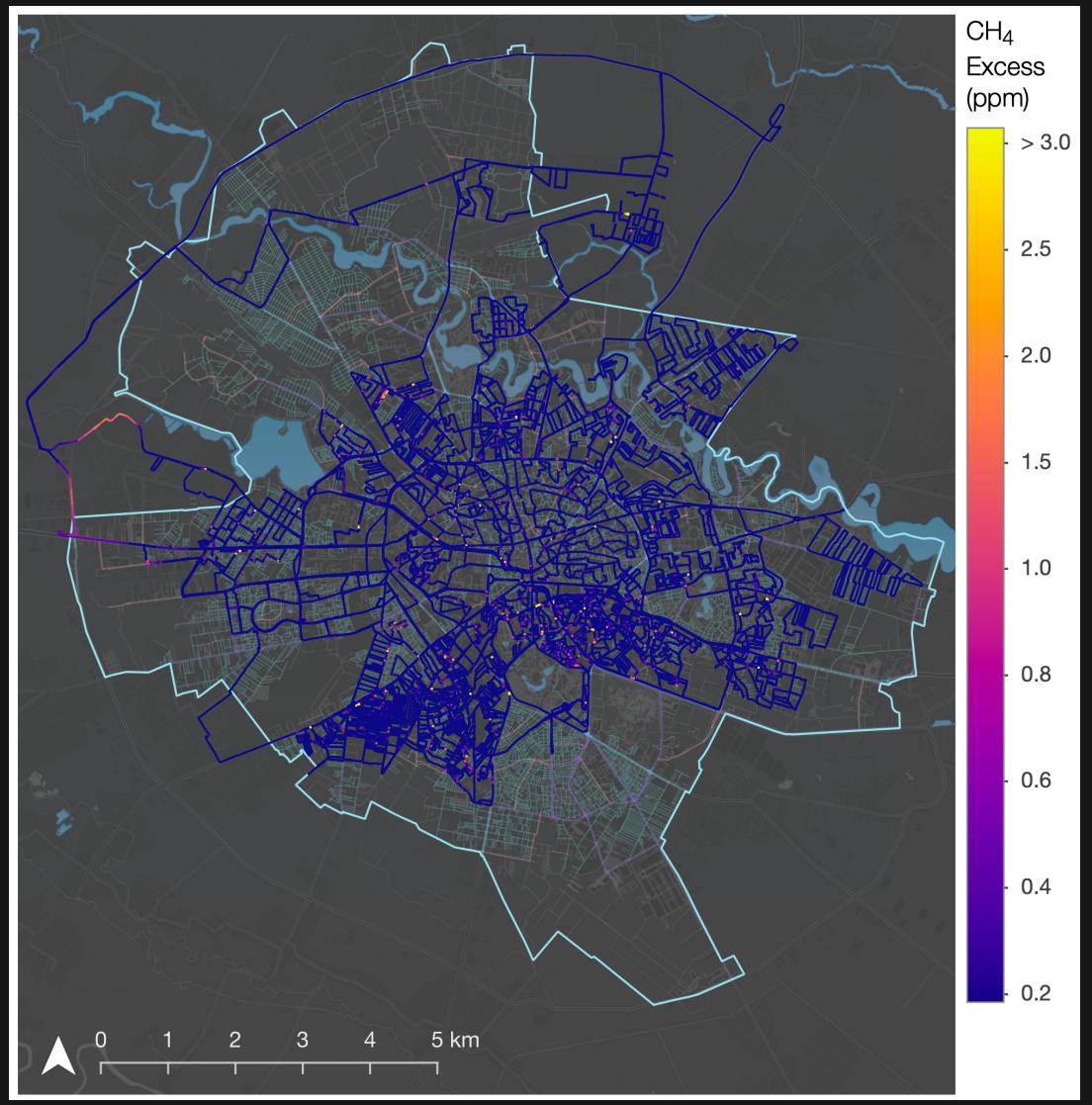


julianne.fernandez@rhul.ac.uk

Results: CH_4 Concentrations

Methane elevations (ppm)

- Background defined by
  - Time range: 250 sec
  - Percentile = 2%



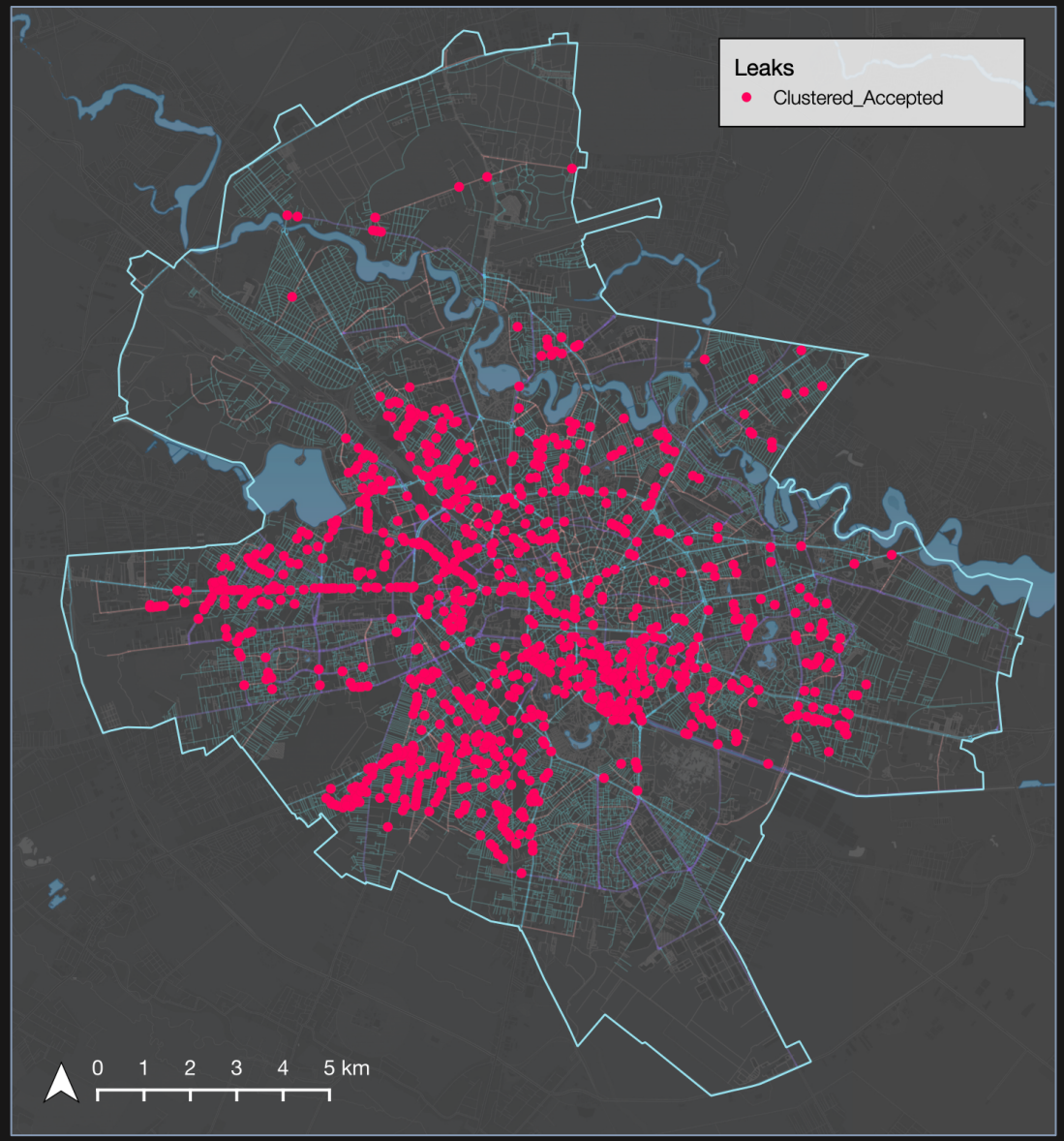
julianne.fernandez@rhul.ac.uk

Results: Emissions

Methane Emissions (L min^{-1})

- Data evaluation algorithm
  (Weller et al., 2019)
- Leak indications = 2,482
- Max = 291 L min^{-1}
- Average = 4 L min^{-1}

- TBA
  - C_1:C_2 source apportionment
  - Scaling up emissions

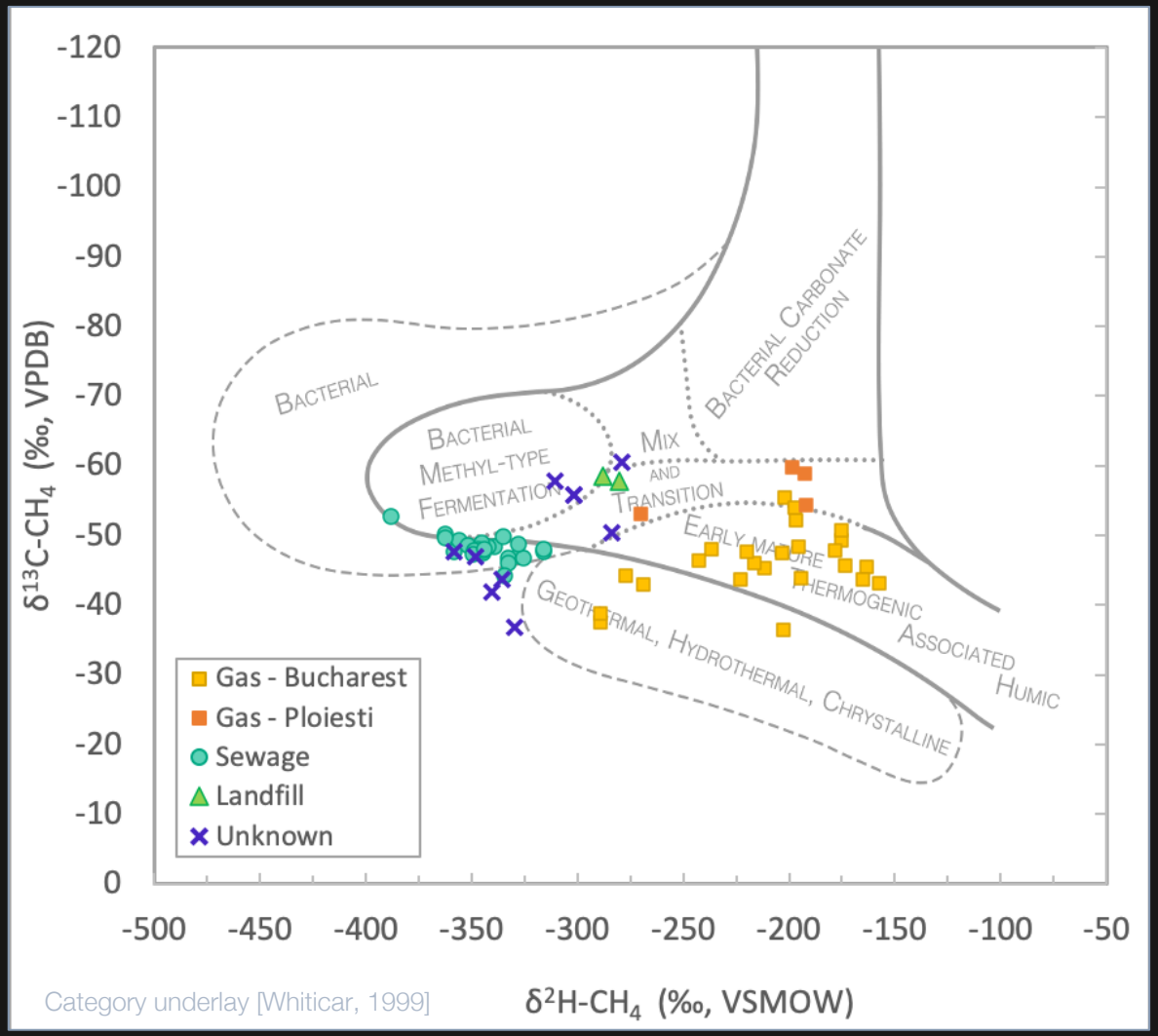


julianne.fernandez@rhul.ac.uk

Results: Isotopic source signatures

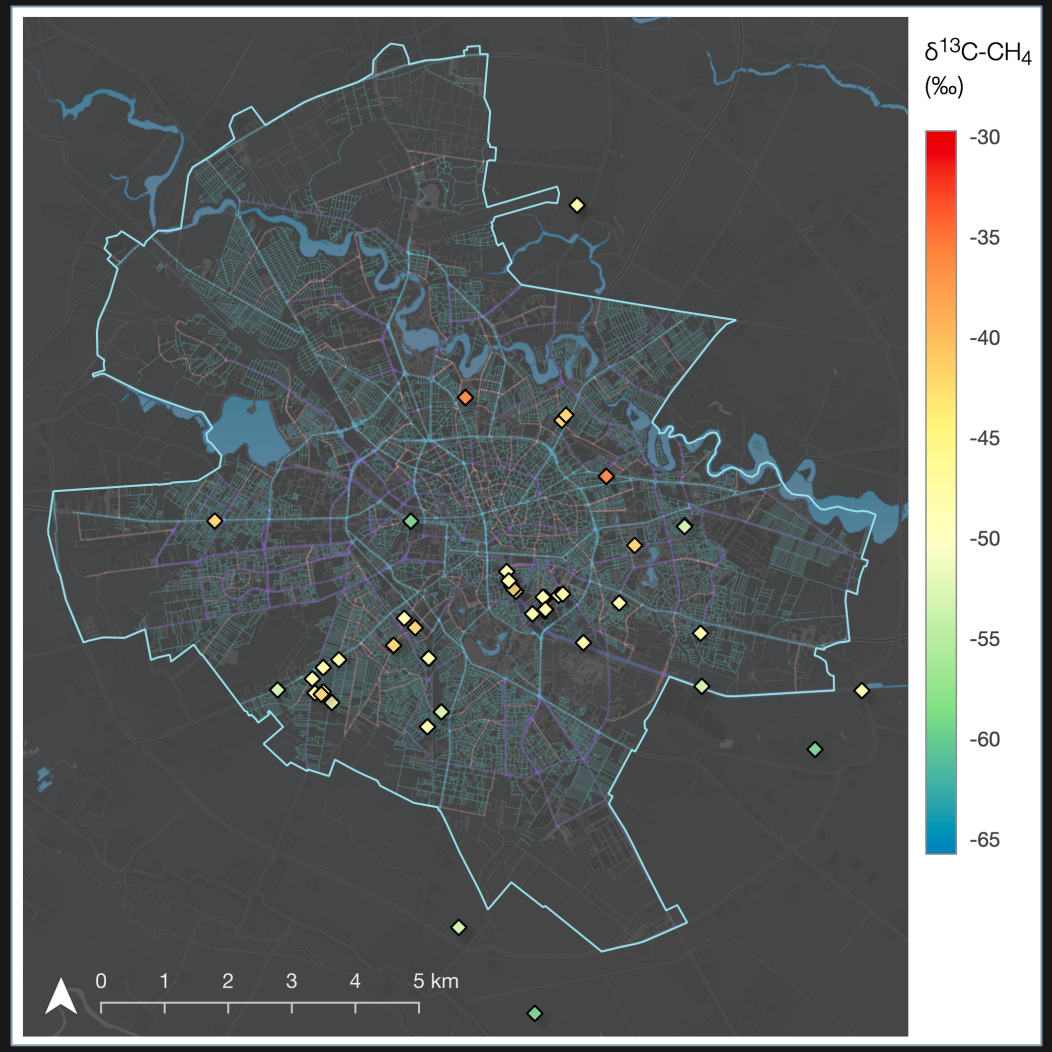
Methane Source Signatures

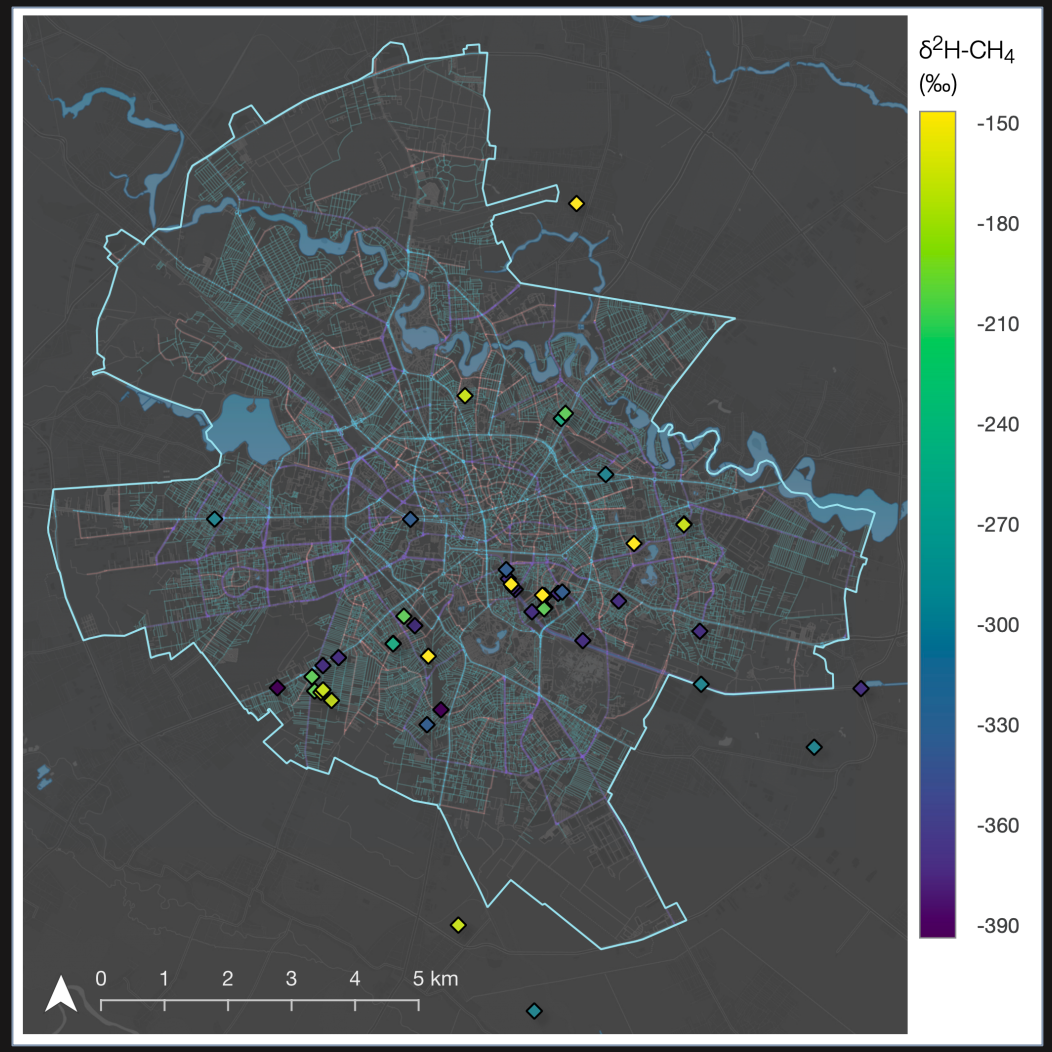
- Measured by CF-GC-IRMS (RHUL & UU)
- Defined by Keeling Plot analysis
- ~ 109 samples collected
- 55 source signatures (w/both $\delta^{13}C$ & $\delta^{2}H$)
- All ≥ 200 ppb [CH_4] above background



julianne.fernandez@rhul.ac.uk

Results: Isotopic source signatures





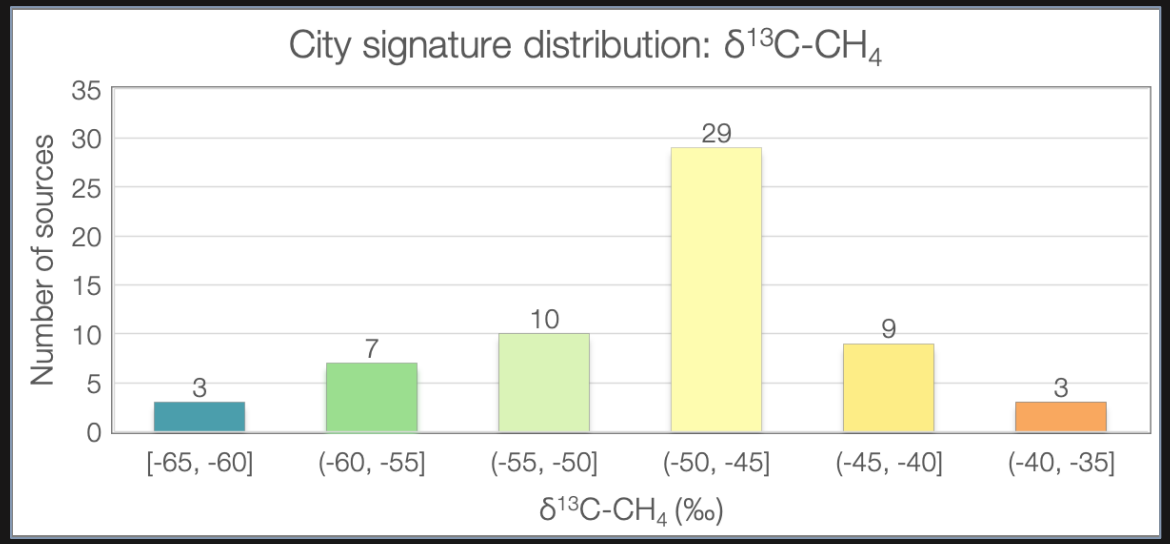
- $\delta^{13}C\text{-}CH_4$ spatial distribution is less variable compared to $\delta^{2}H\text{-}CH_4$

julianne.fernandez@rhul.ac.uk

Results: Isotopic source signatures

$\delta^{13}C\text{-}CH_4$ (‰)

- Range from -65 to -37
  - 61 source signatures
  - Average: -49.1 ± 0.7

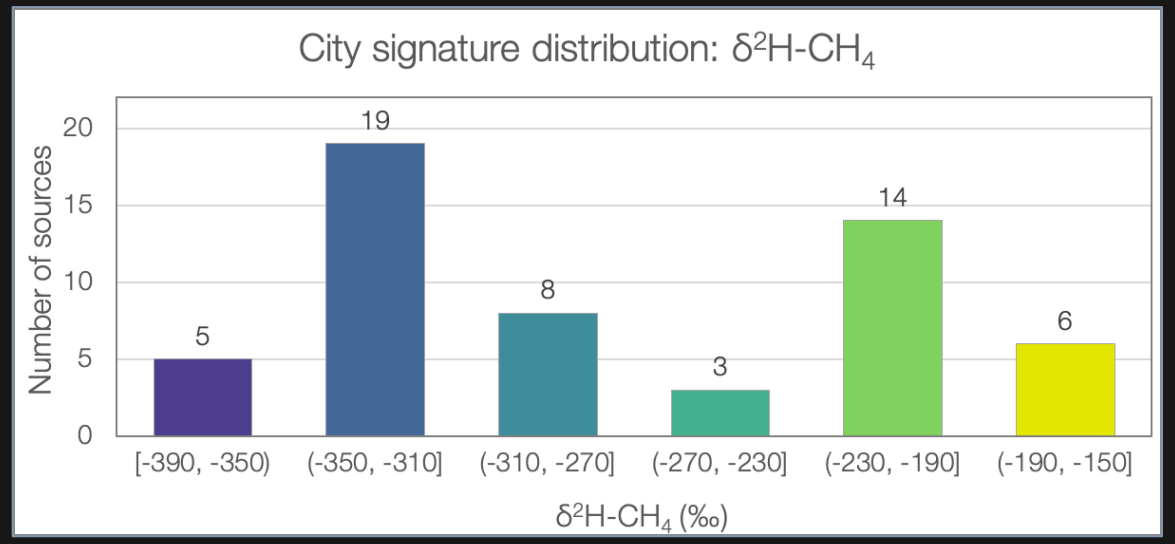


Carbon

- Normal distribution
  - Indicates only 1 major source

$\delta^{2}H\text{-}CH_4$ (‰)

- Range from -388 to -157
  - 55 source signatures
  - Average: -274.4 ± 9.4



Hydrogen

- Clear bimodal distribution
  - Indicates 2 major sources

julianne.fernandez@rhul.ac.uk

Example leak

Big leak (outside of Bucharest)

- $[CH_4]$ = ~290 ppm
- $\delta^{13}C\text{-}CH_4$ = -50.7 ± 0.1‰
- $\delta^{2}H\text{-}CH_4$ = -175.3 ± 1.7‰
- $C_1:C_2$ = 0.02
- Flux = 5,084 L min^{-1}

julianne.fernandez@rhul.ac.uk

Important Findings

- Lots of leaks
- Need of more than one isotopic tracer for source determinations

julianne.fernandez@rhul.ac.uk

EGU2020-21759
AS3.14/BG2.21

D3186

ACKNOWLEDGEMENTS

- The Climate and Clean Air Coalition (CCAC), Oil and Gas Methane Science Studies managed by United Nations Environment Program
- European Union's Horizon 2020 Research & Innovation, Marie Sklodowska-Curie grant agreement No. 722479, and all MEMO^2 colleagues (https://h2020-memo2.eu).
- RHUL Greenhouse Gas Research Lab: Peter Nisbet-Jones, Semra Bakkaloglu, Alice Cozens, Amber Riddle, Mathias Lanoiselle, & Barbara White

ROYAL HOLLOWAY UNIVERSITY OF LONDON

Universiteit Utrecht

INCAS National Institute for Aerospace Research "Elie Carafoli"

CLIMATE & CLEAN AIR COALITION

MEthane goes MObile MEasurements and MOdelling

MARIE CURIE ACTIONS