Supplementary material

Title:

Methane (CH_4) sources in Krakow, Poland: insights from isotope analysis

Authors:

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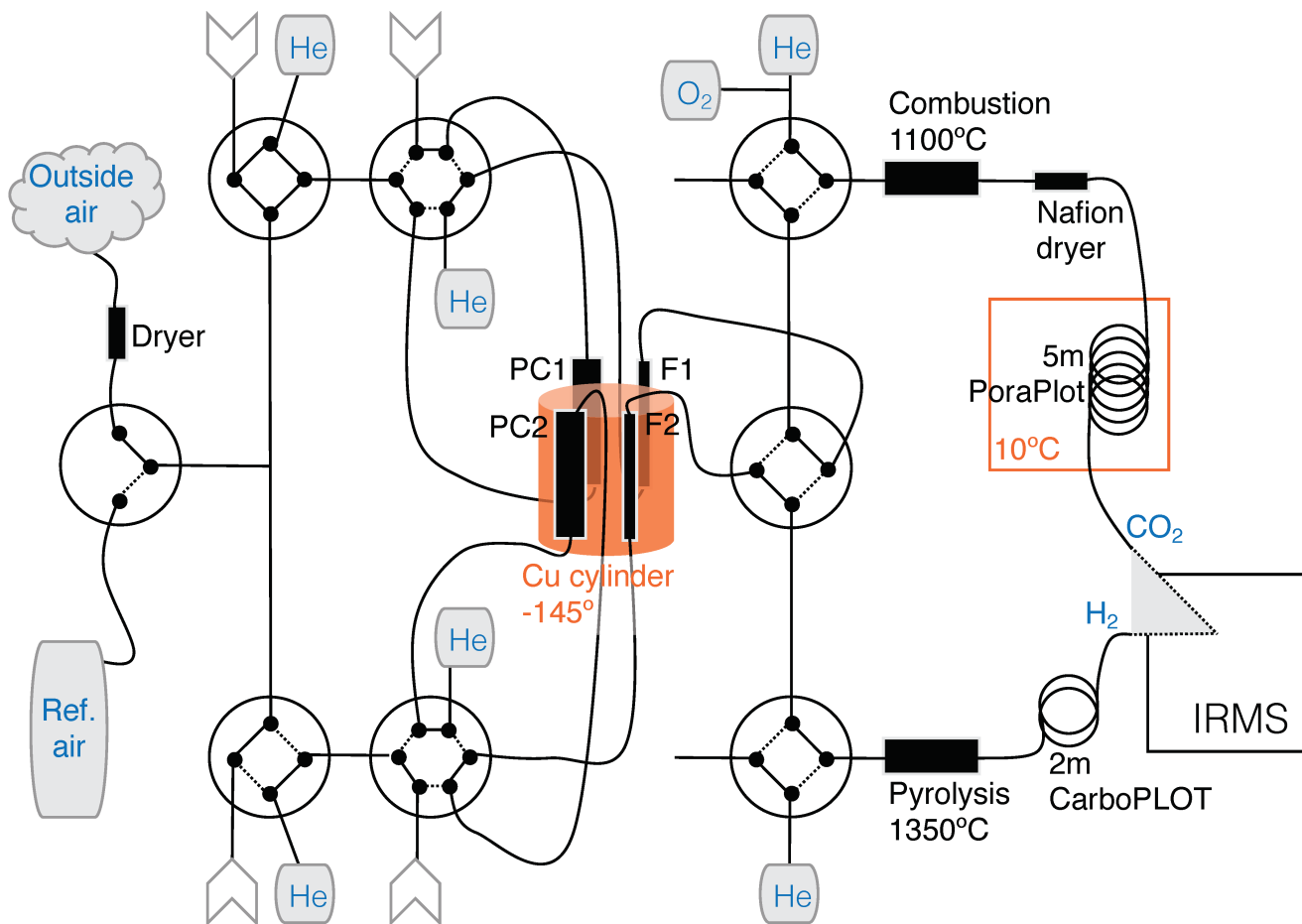
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Figure S1: Diagram of the extraction system for methane isotopic measurements in ambient air. PC: pre-concentration, F: focus traps, two 10 cm stainless steal tubes (1/8" and 1/16" o.d., respectively) filled with 2 cm HayeSep D in the centre and glass beads at both ends.
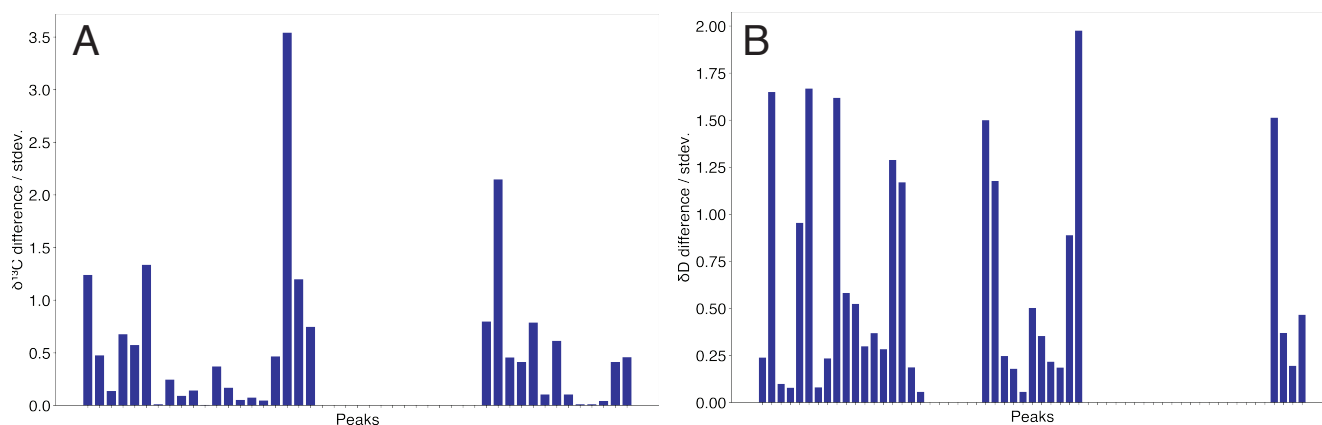

Figure S2: Ratio of the peak source signature difference between original and "corrected" $\chi(CH_4)$ data, over the original signature uncertainties (standard deviation, σ). For the "corrected" $\chi(CH_4)$, we applied an offset to the IRMS data to match the CRDS data in the periods where an offset was observed. Most differences are lower than 2σ for $\delta^{13}C$ (**A**), and δ^2H (**B**).
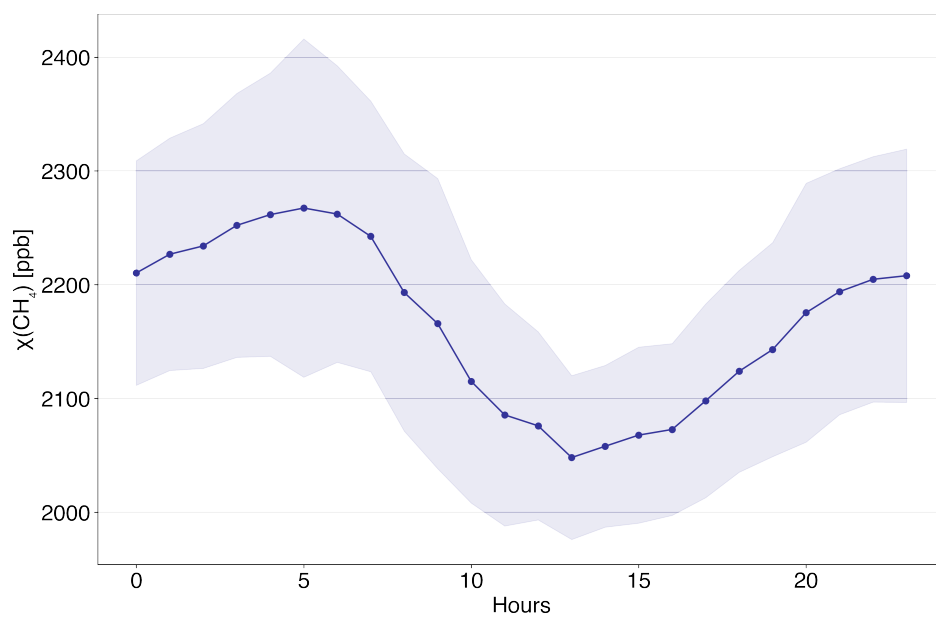
Figure S3: CH$_4$ mole fraction hourly averages during the fall (September 14 to November 15, 2018). Size of shaded area is 1σ.
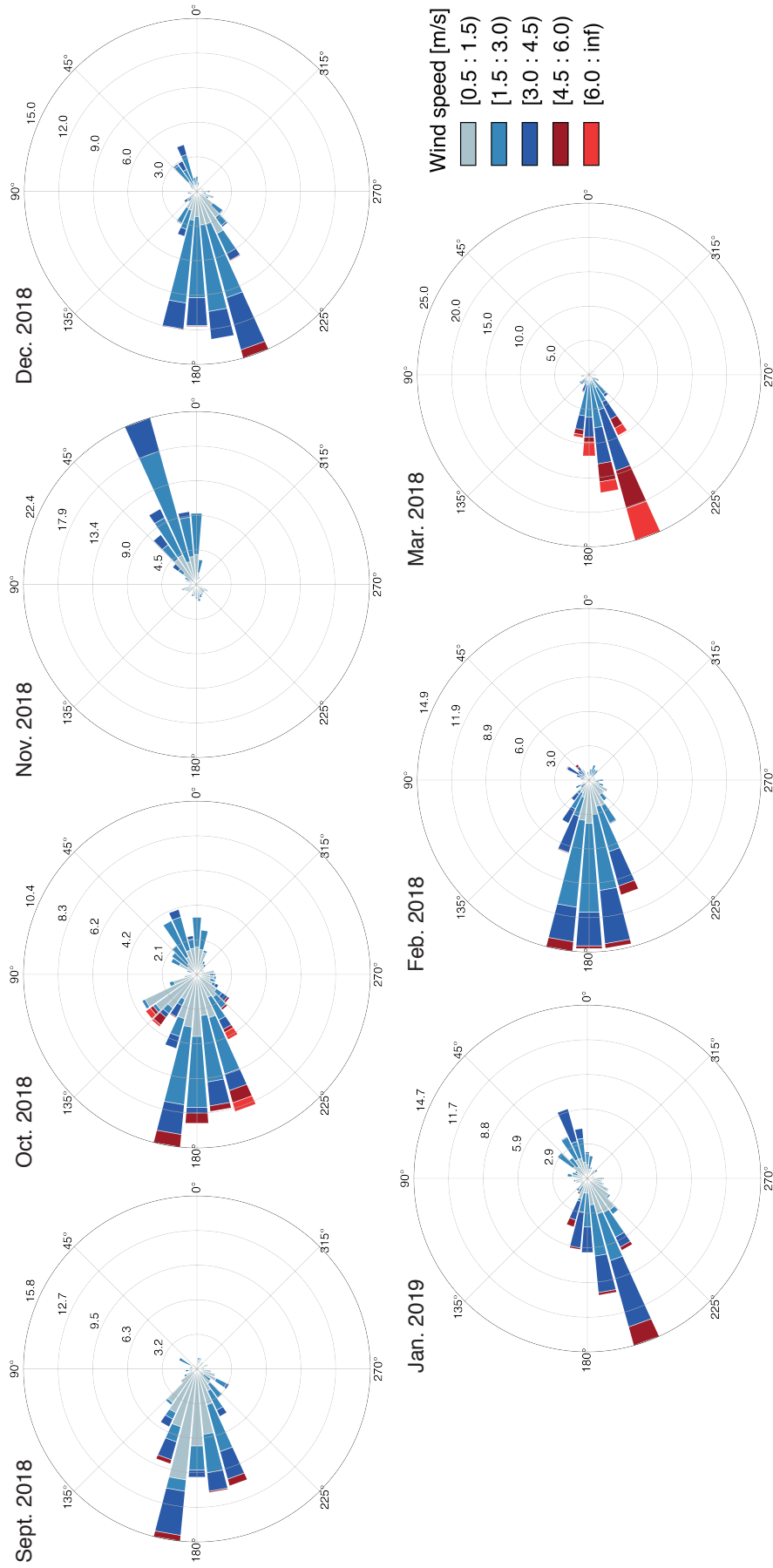
Figure S4: Monthly wind directions during the ambient air measurement period, at the measurement location. Bar lengths are percentages of records during the specified month (r-axis); colours define the wind speed range (legend).
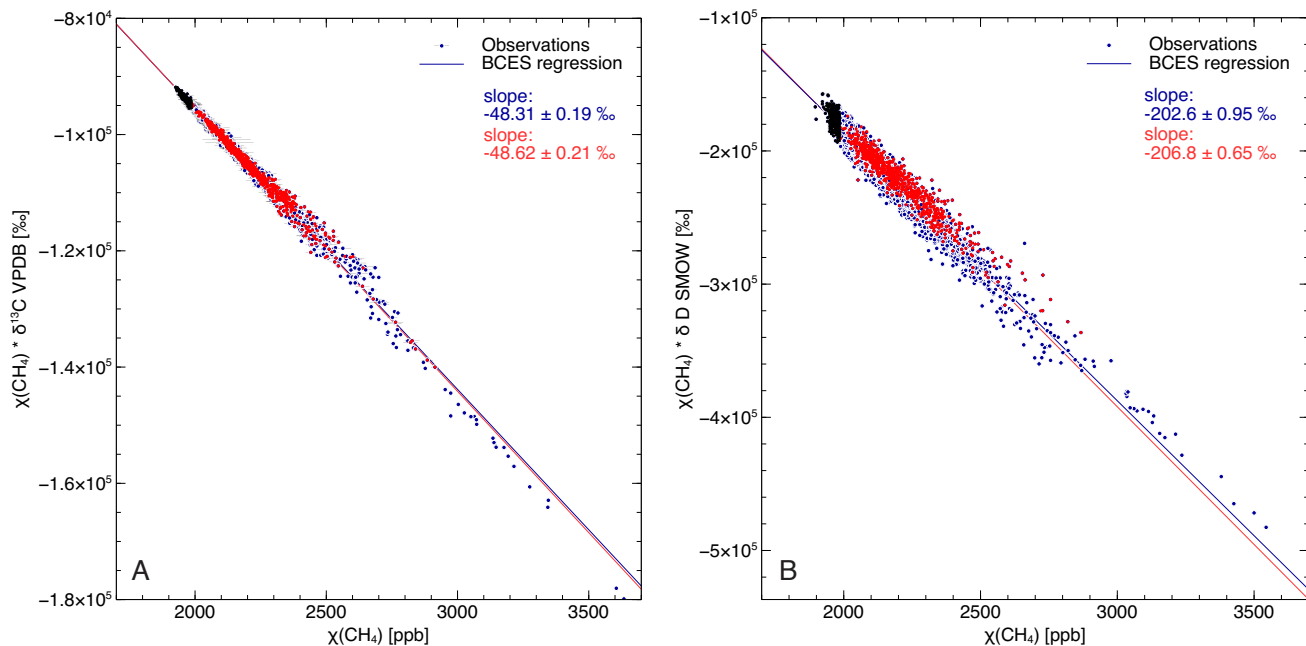
Figure S5: Miller-Tans plots using all the **A.** δ^{13}C-CH$_4$ and **B.** δ^2H-CH$_4$ data in ambient air collected during the measurement period. The red points show when there was a mismatch in the mole fractions between the IRMS and CRDS instruments, and the black points show the background data (χ(CH$_4$) < 1986.0 ppb, i.e. 10th lower percentile).
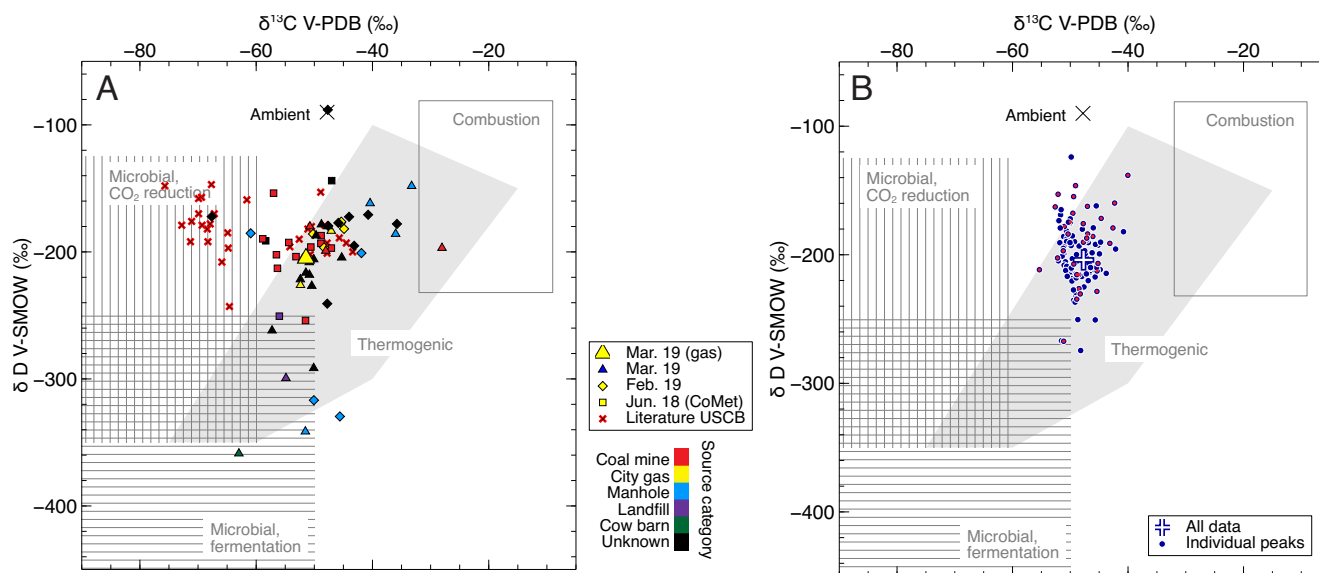

Figure S6: Dual isotope diagrams with signature ranges of specific CH$_4$ formation processes (background grey patterns), reproduced from Milkov and Etiope (2018). **A.** Source signatures of the sampled sites around Krakow and in the USCB (Kotarba 2001, Kotarba and Pluta 2009 and Kedzior et al. 2013). **B.** Source signatures of the emission peaks measured in ambient air. Red points: mismatch in the mole fractions between the IRMS and CRDS instruments, which peak isotopic signatures did not significantly differ (we retained all the data).
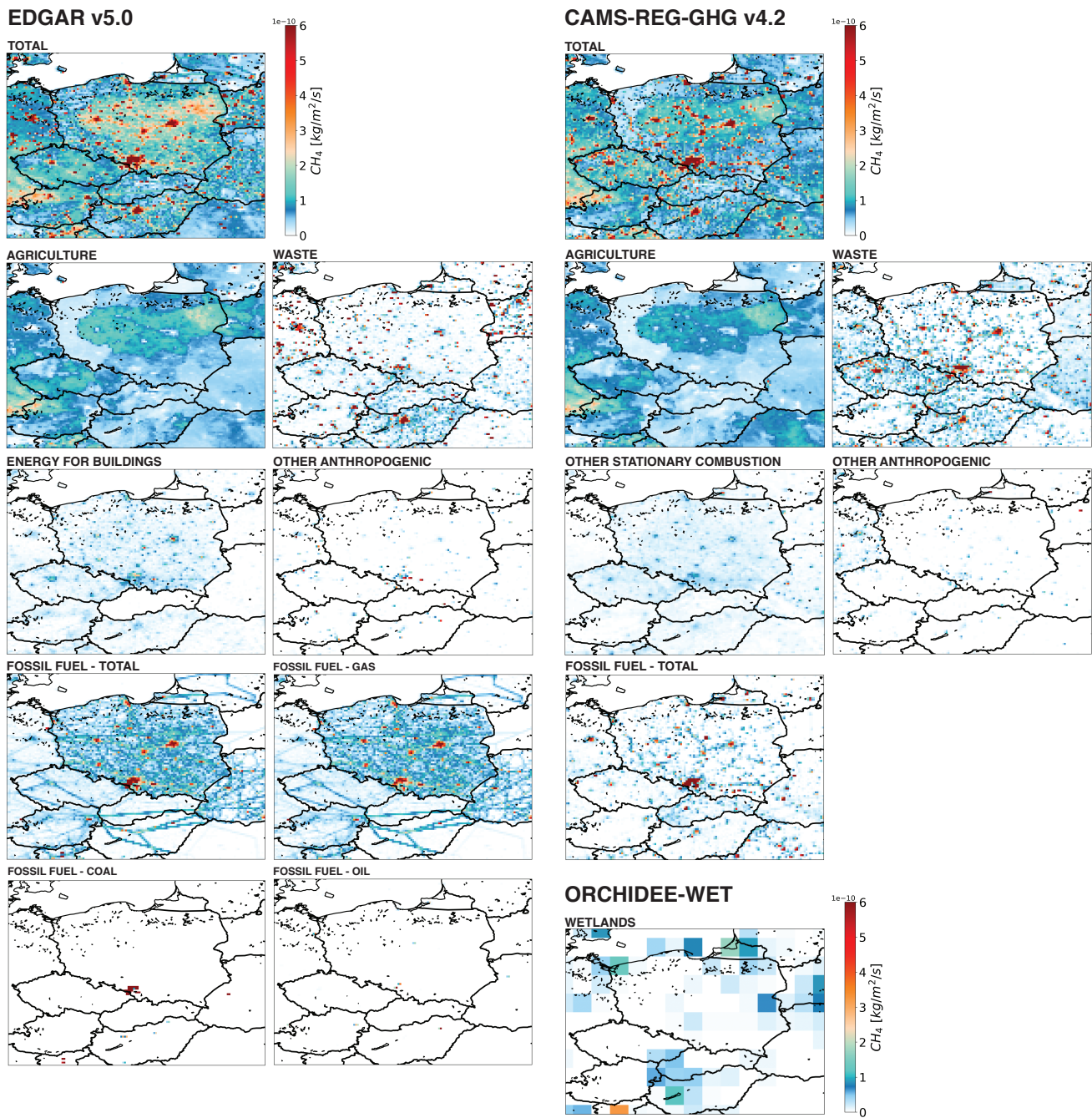
Figure S7: Reported CH_4 emission rates over the domain used in CHIMERE, from two inventories: EDGAR v5.0 (left columns) and CAMS-REG v4.2 (right column).