How a European network may help estimating methane emissions at the French national scale

Isabelle Pison[1], Antoine Berchet[2], Marielle Saunois[1], Philippe Bousquet[1], Grégoire Broquet[1], Sébastien Conil[3], Marc Delmotte[1], Olivier Laurent[1], Damien Martin[4], Simon O'Doherty[5], Michel Ramonet[1], T. Gerard Spain[6], Kieran Stanley[5], Alex Vermeulen[7,a], and Camille Yver Kwok[1]

[1]Laboratoire des Sciences du Climat et de l'Environnement, LSCE-IPSL (CEA-CNRS-UVSQ), Université Paris-Saclay, 91191 Gif-sur-Yvette, France.
[2]Laboratory for Air Pollution/Environmental Technology, Empa - Swiss Federal Laboratories for Materials Science and Technology, Dübendorf, Switzerland
[3]Agence Nationale pour la gestion des Déchets RadioActifs, Châtenay-Malabry, France
[4]Centre for Climate and Air Pollution Studies, School of Physics, National University of Ireland Galway, Galway, Ireland
[5]Atmospheric Chemistry Research Group, School of Chemistry, University of Bristol, Cantocks Close, Bristol, United Kingdom
[6]National University of Ireland Galway, Galway, Ireland
[7]Energy Research Centre of the Netherlands, Heerhugowaard, The Netherlands
[a]now at Dept. Phys. Geography and Ecosystem Science, Lund, Sweden

Correspondence to: I. Pison (isabelle.pison@lsce.ipsl.fr)

Supplementary material

S.1 Time series of the afternoon (14 h-18 h) hourly data at the stations in 2012

Only the data selected for assimilation is shown here i.e the 14 h-18 h hourly means when the boundary layer height is higher than 500 m in the model, at the highest available level for sites with several levels.
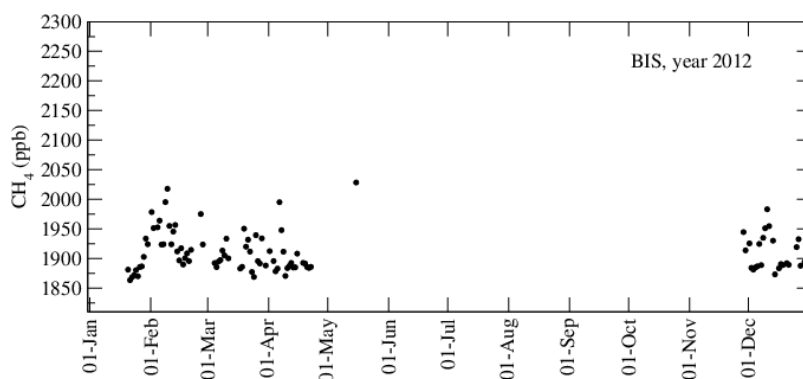

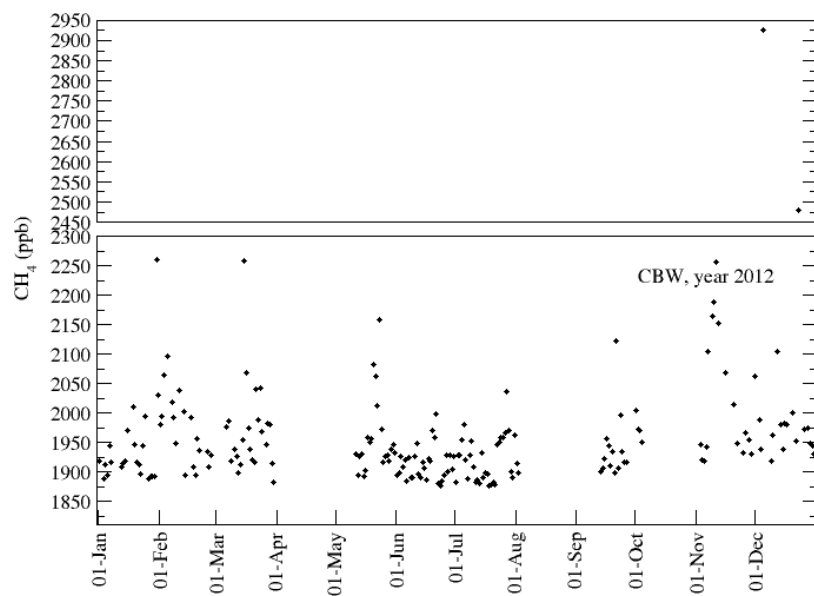**Figure S.1.** *Afternoon hourly means of CH₄ mixing ratios at Biscarosse (France) in 2012.*

Figure S.2. *Afternoon hourly means of CH$_4$ mixing ratios at Cabauw (The Netherlands) in 2012.*
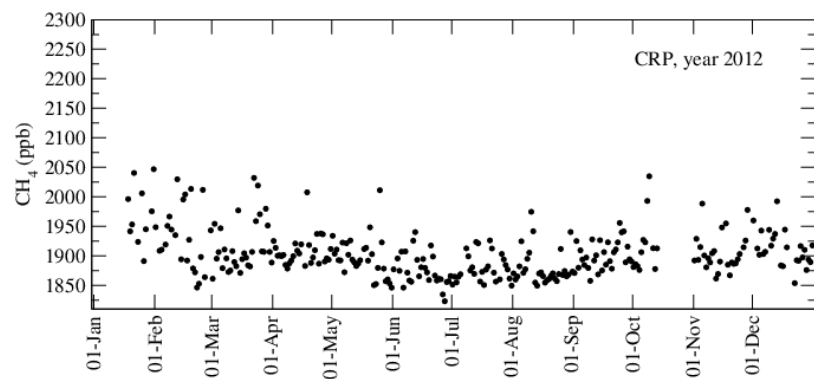

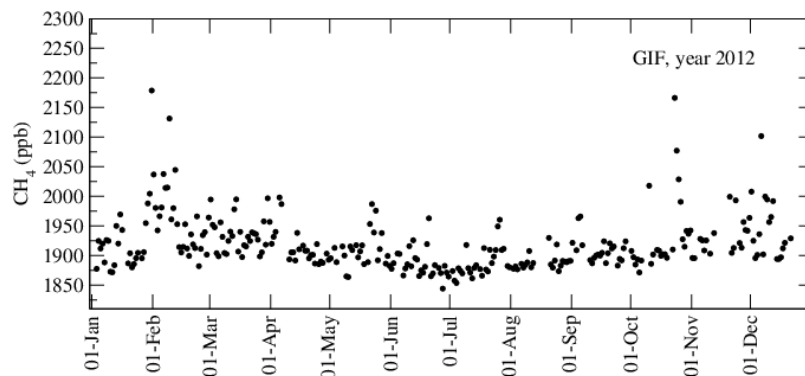**Figure S.3.** *Afternoon hourly means of CH$_4$ mixing ratios at Carnsore Point (Ireland) in 2012.*

Figure S.4. *Afternoon hourly means of CH$_4$ mixing ratios at Gif-sur-Yvette (France) in 2012.*
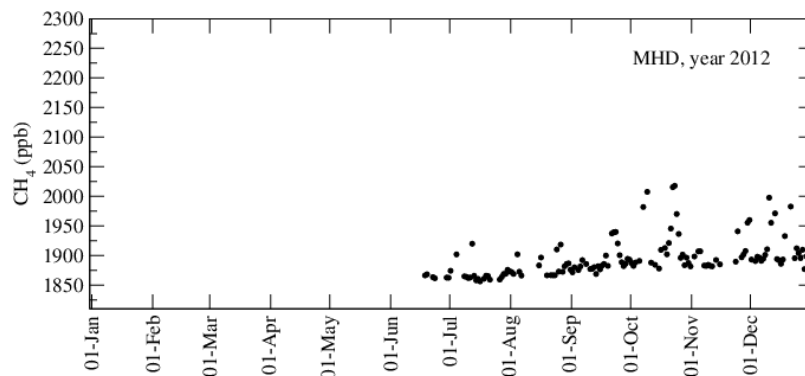

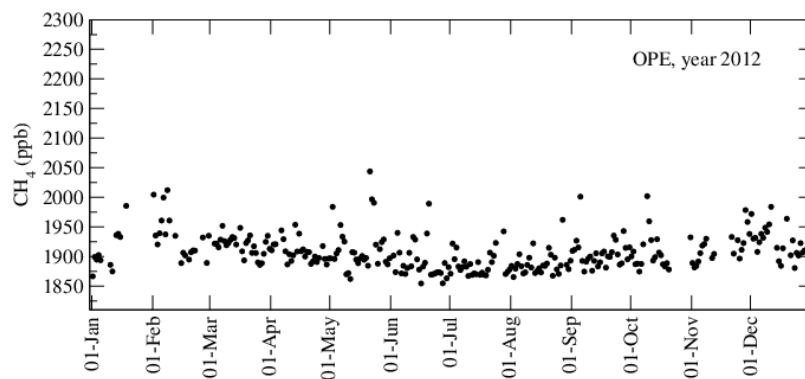**Figure S.5.** *Afternoon hourly means of CH$_4$ mixing ratios at Mace Head (Ireland) in 2012.*

Figure S.6. *Afternoon hourly means of CH$_4$ mixing ratios at the Observatoire Pérenne de l'Environnement (France) in 2012.*
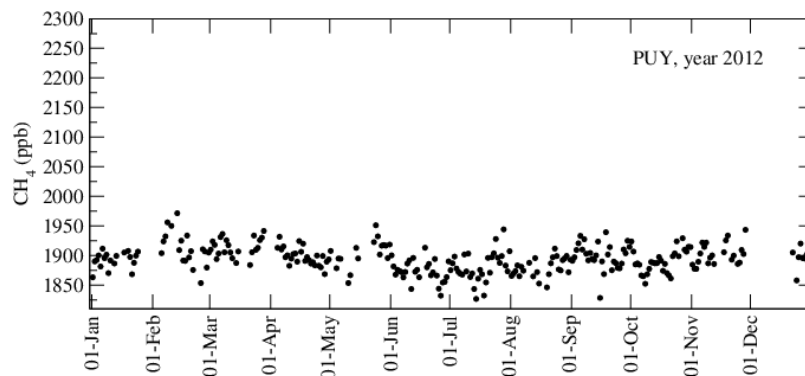
3

Figure S.7. *Afternoon hourly means of CH₄ mixing ratios at Puy-de-Dôme (France) by a gas-chromatograph in 2012.*
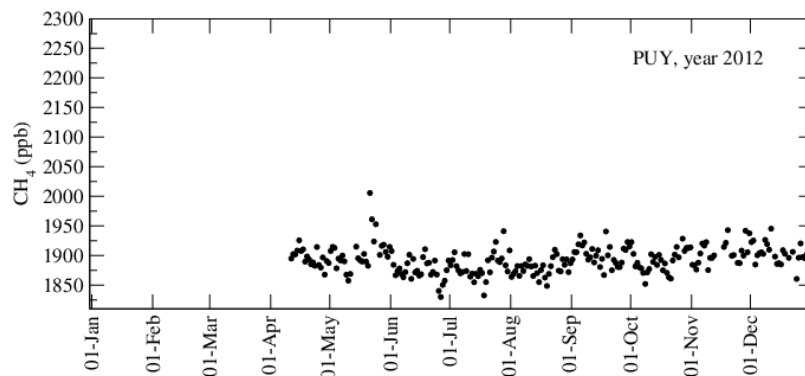

Figure S.8. *Afternoon hourly means of CH₄ mixing ratios at Puy-de-Dôme (France) by a Picarro instrument in 2012.*
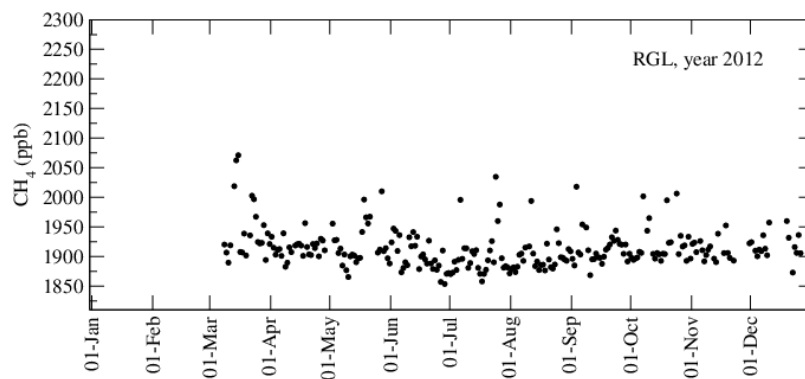

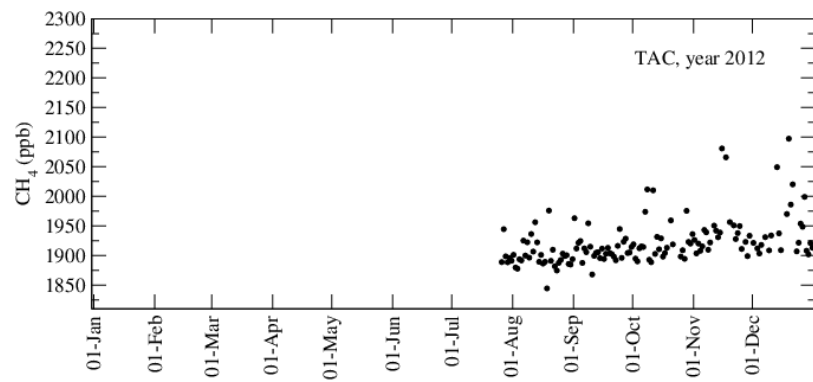**Figure S.9.** *Afternoon hourly means of CH₄ mixing ratios at Ridge Hill (United Kingdom) in 2012.*

Figure S.10. *Afternoon hourly means of CH$_4$ mixing ratios at Tacolneston (United Kingdom) in 2012.*

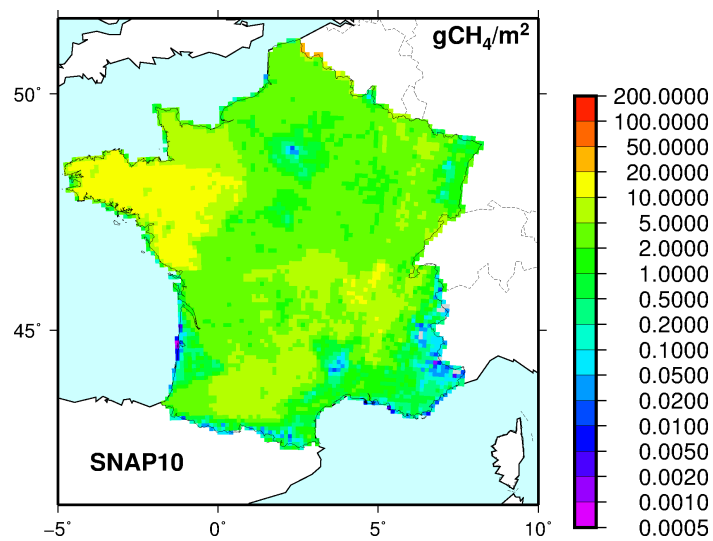## S.2   Prior maps of CH$_4$ emissions by IER

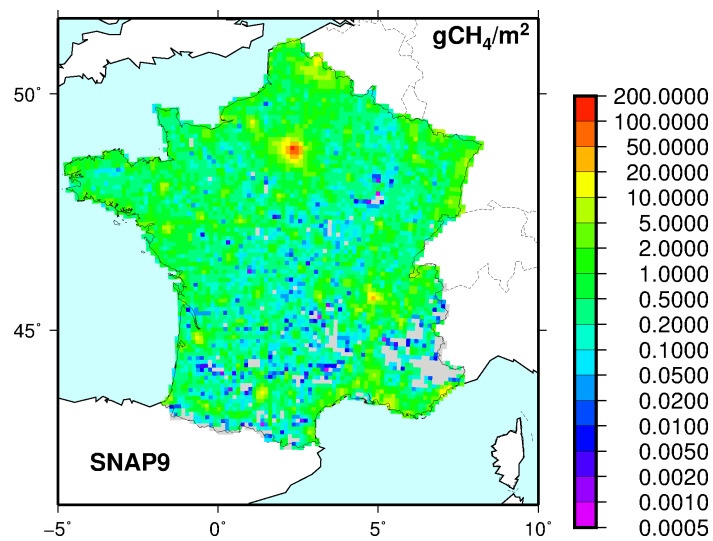**Figure S.11.** *SNAP 10: agriculture, yearly total in France in 2012: 2356 Gg.*

Figure S.12. *SNAP 9: waste treatment and disposal, yearly total in France in 2012: 522 Gg.*
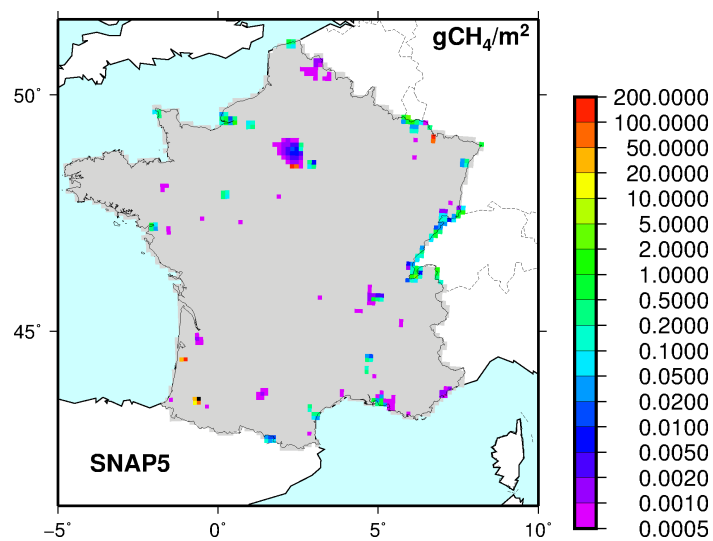
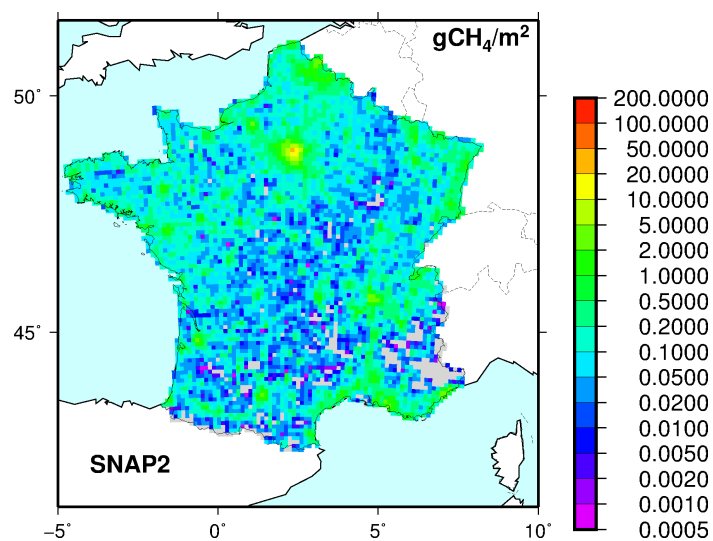**Figure S.13.** *SNAP 5: distribution of fossil fuel, yearly total in France in 2012: 94 Gg.*

Figure S.14. *SNAP 2: non-industrial combustion plants, yearly total in France in 2012: 107 Gg.*

S.3 Information used at the measurement sites in 2012
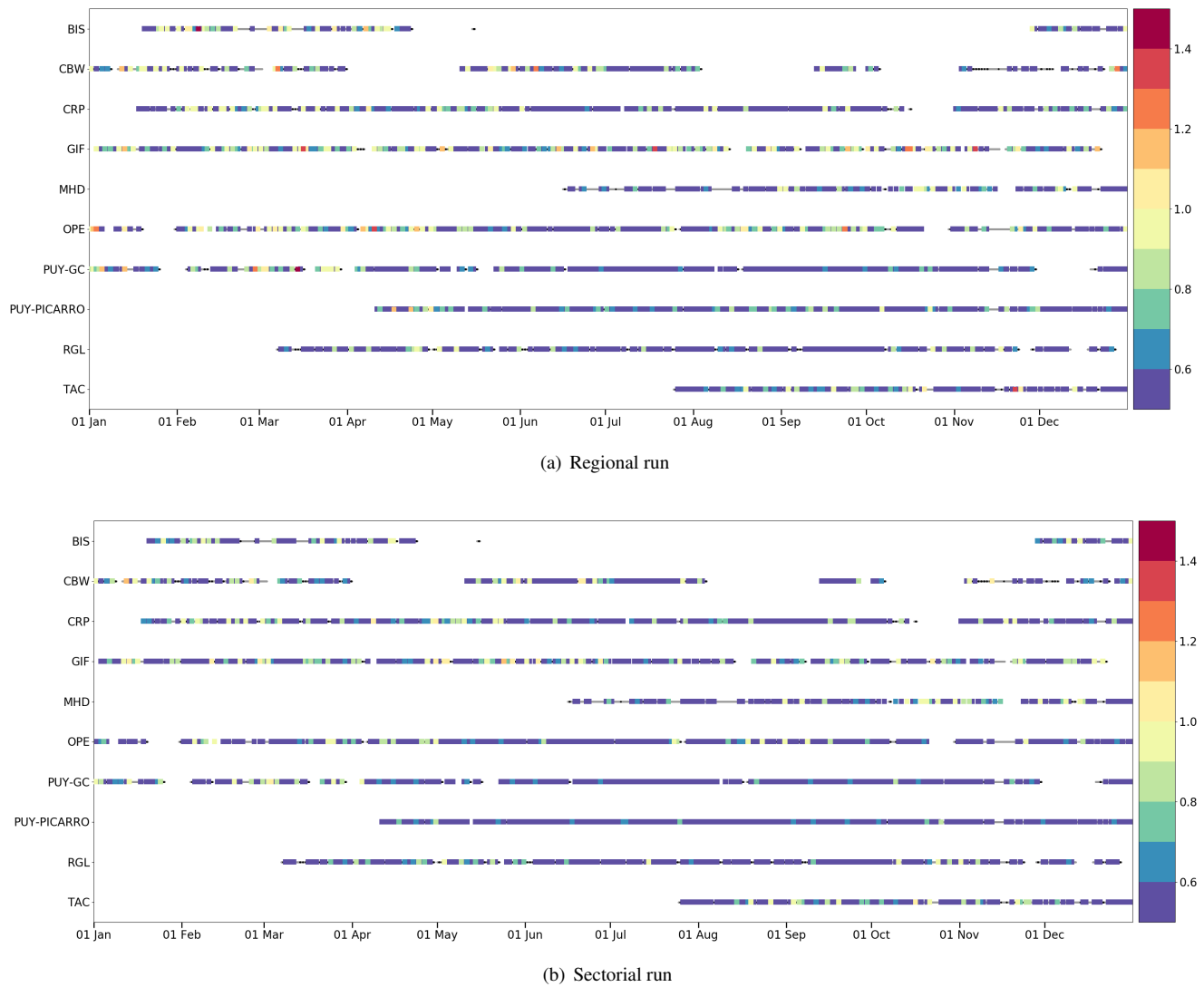

(a) Regional run

(b) Sectorial run

Figure S.15. *Available hourly means of CH₄ mixing ratios and contribution of each site to the inversion of CH₄ emissions: available data in grey; selected data (between 14 h and 18 h UTC when the boundary layer height is higher than 500 m in the model) in black; on the colour scale, data actually used by the inversion i.e after filtering out plume situations and under-constrained areas: the value gives the information brought each day (from 0 to a maximum of 5 for the 5 hourly means between 14 and 18 h included); it is computed from the diagonal terms of the sensitivity matrix. A value of 1 means that the data assimilation system uses the equivalent of one hourly mean.*