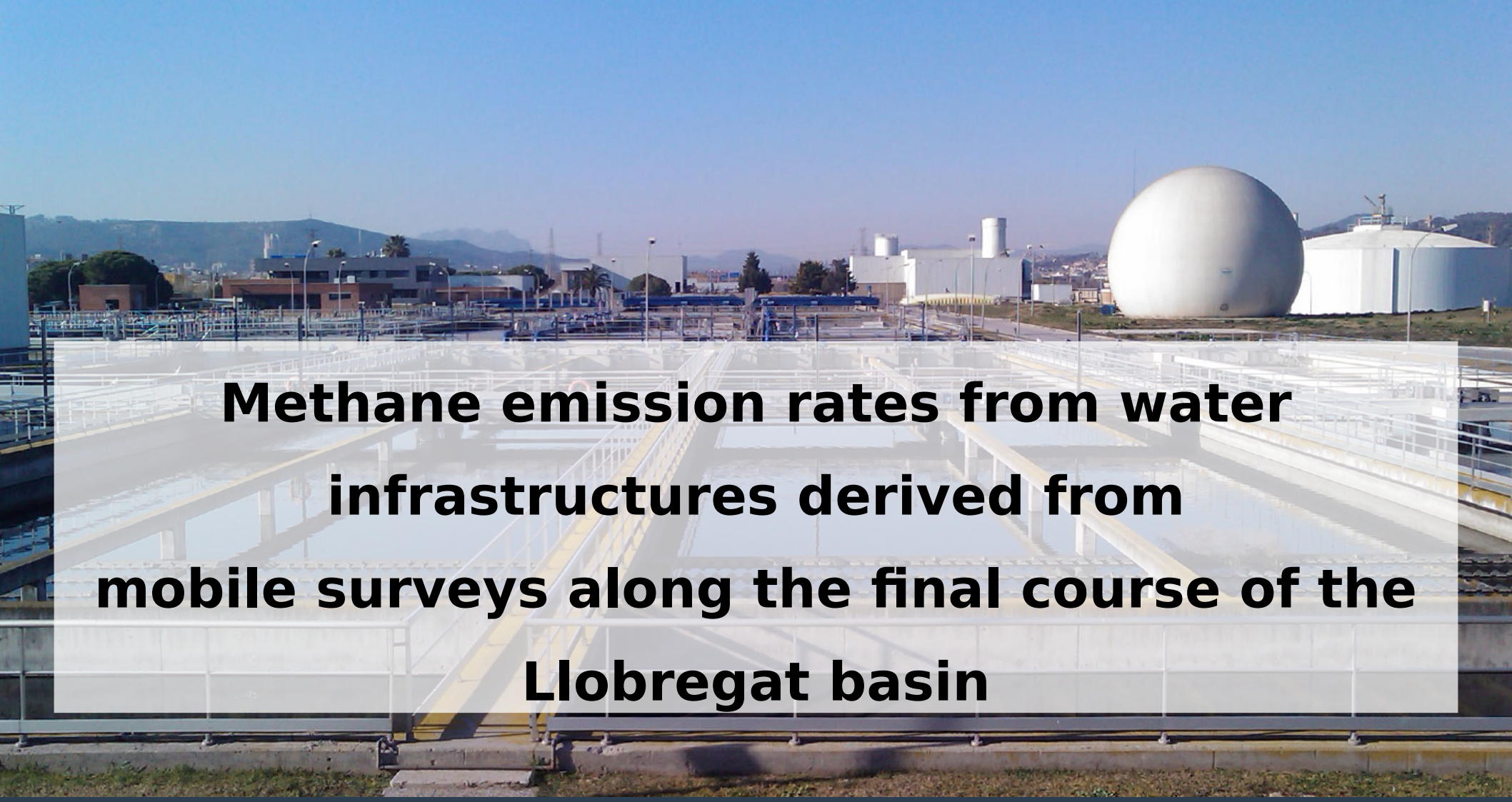


Methane emission rates from water infrastructures derived from mobile surveys along the final course of the Llobregat basin

R. Curcoll*, C. Estruch, J. Freixas, and J-A. Morguí**

*roger.curcoll@uab.cat **josepanton.morgui@uab.cat

ICTA Institute of Environmental Science and Technology - UAB

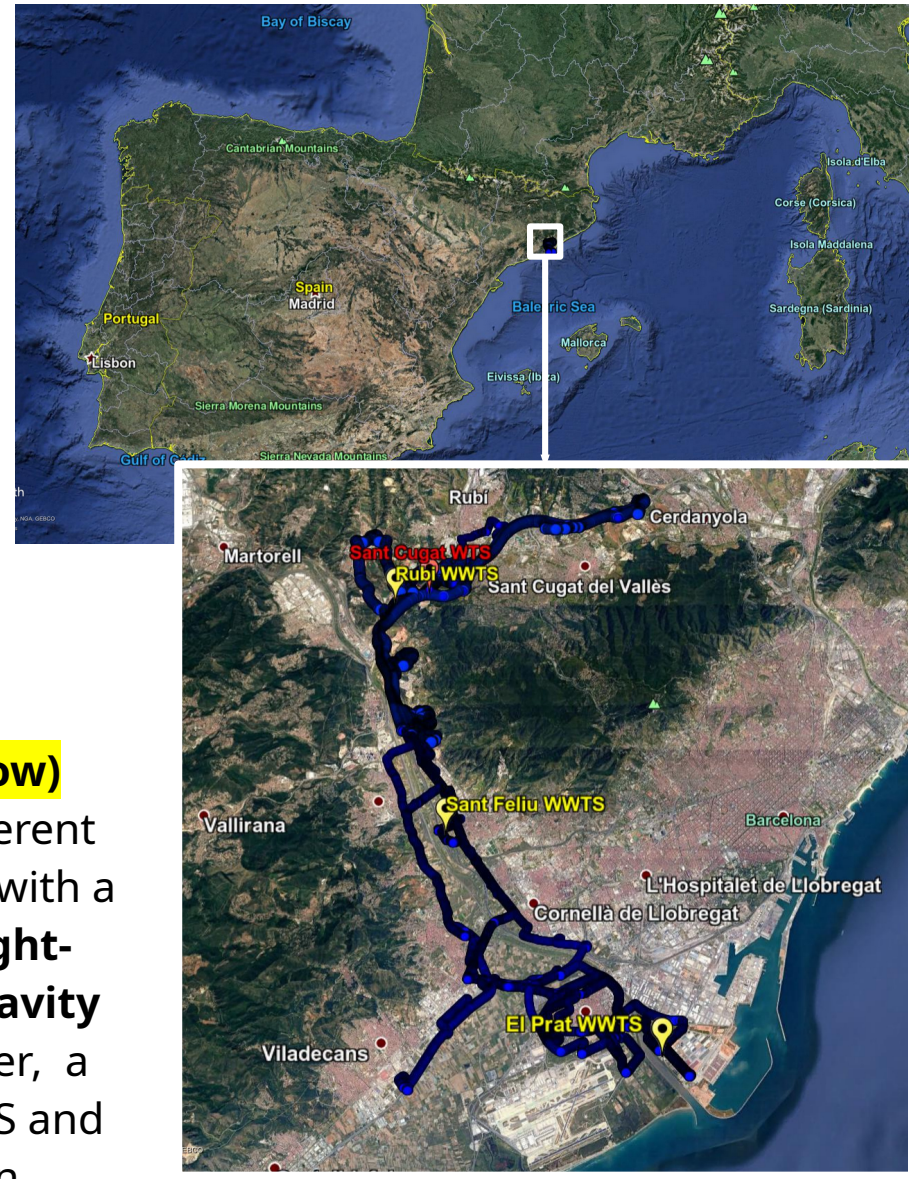
European Commission

CLIMATE & CLEAN AIR COALITION

Mobile measurements of CO_2, CH_4, NH_3 and H_2S along the final course of the Llobregat river

The final course of the Llobregat river **(south-west of Barcelona**, Spain) is surrounded by densely populated cities, industrial areas and agricultural lands. Multiple water infrastructures where anaerobic processes may be expected are present in the basin.

Seven **mobile measurements** campaigns with **multiple passes-through** were performed during 2019 along the final course of the Llobregat basin to study the variability of methane and other gases emissions throughout the year.



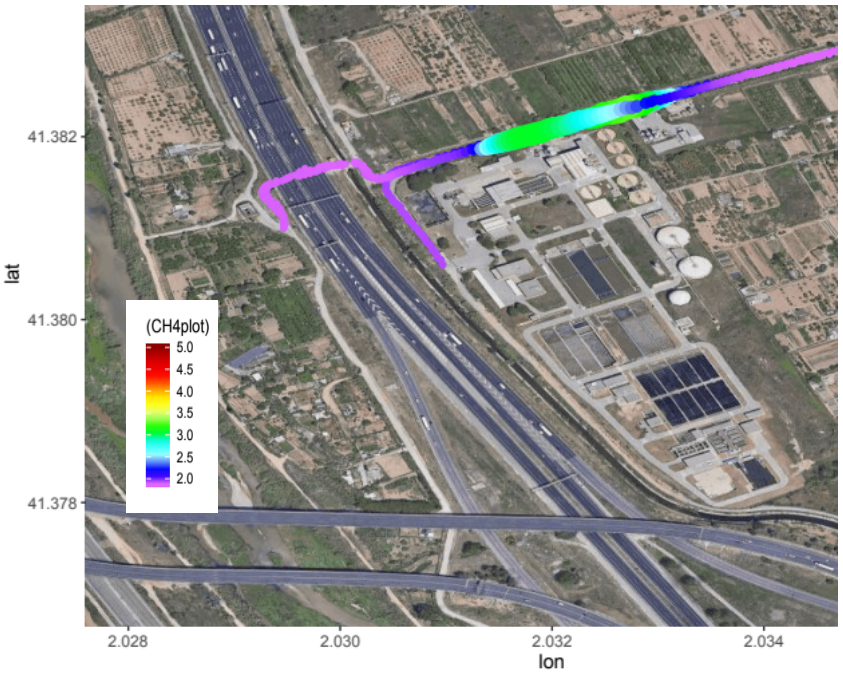
The surveys at water infrastructures **(in yellow)** were carried out in different days at different times with a car equipped with a **flight-ready CO2/CH4/H2O cavity ring-down** spectrometer, a **NH3/H2S analyze**r, GPS and a meteorological station.

Methodology

CH_4 measurements at WasteWater Treatment Stations (WWTS) were compared with output plume from Gaussian model (Aermod)

08/03/2019. EDAR Sant Feliu de Llobregat Waste Water Treatment Station

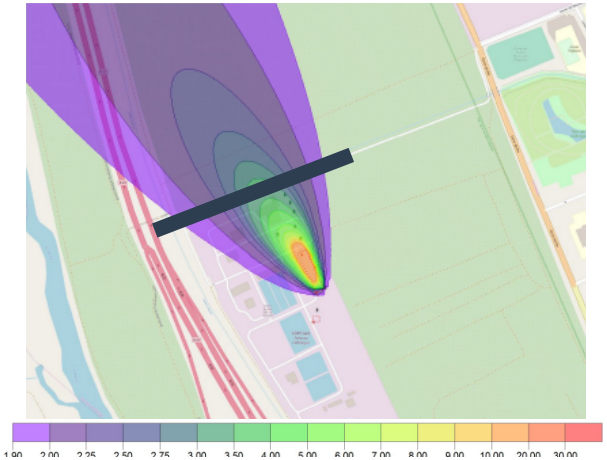
CH4 from mobile methane survey.



Modelled plume for same time period of the survey using a Gaussian Model*

A prior emissions of WWTS extracted from total annual emissions reported**.

Emission plume origin was located at anaerobic digesters (main emitter, according reports)

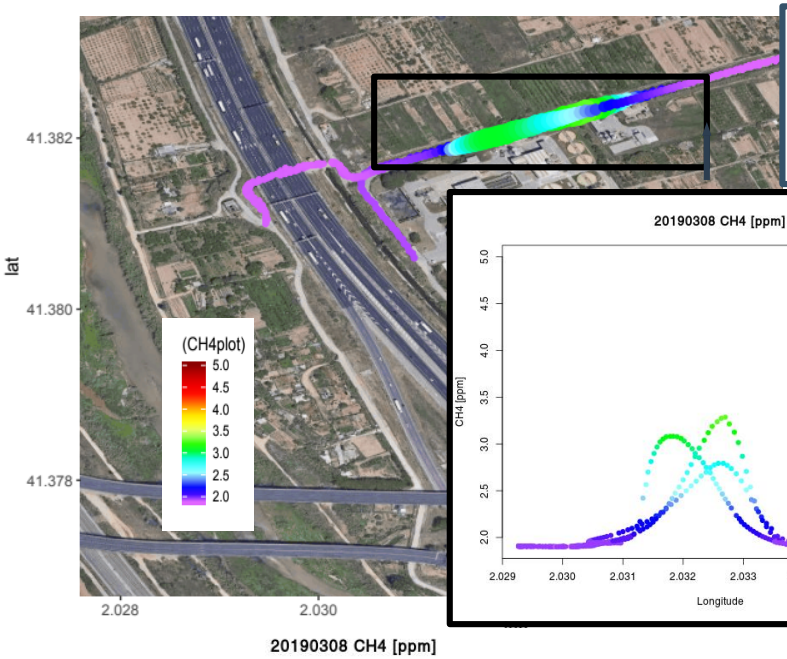


*Meteorology fields extracted from WRF modellisations at 1 km resolution.

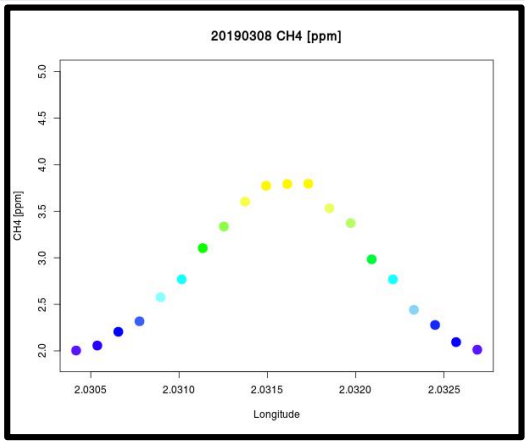
**https://docs.amb.cat/alfresco/api/-default-/public/alfresco/versions/1/nodes/81a24d34-54e9-4009-bac3-0263a883e1b8/content/EDAR+St.+Feliu.pdf?attachment=false&mimeType=application/pdf&sizeInBytes=83584

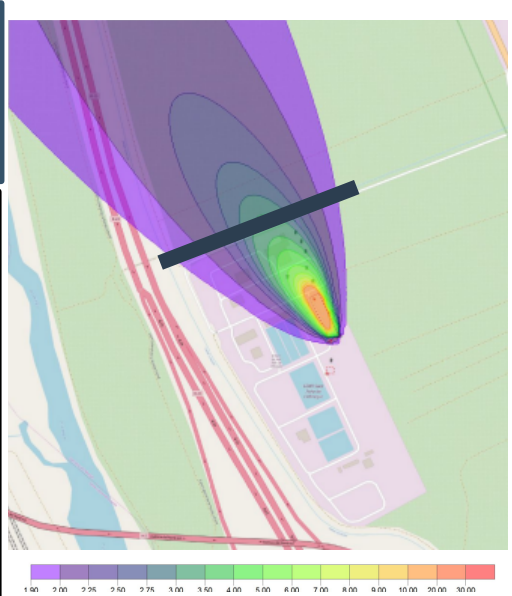
Comparison of concentration areas

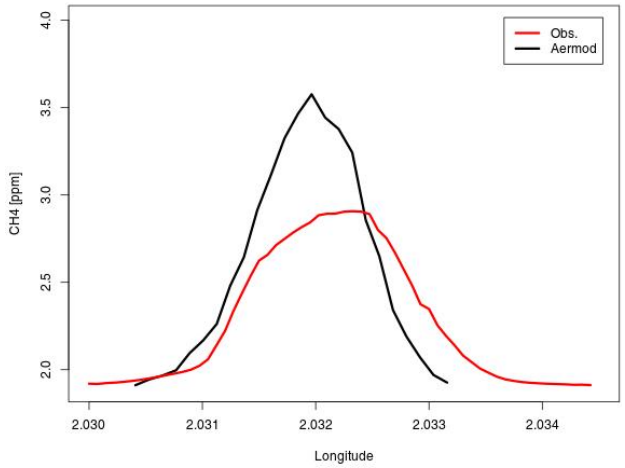
Comparison of measured CH_4 values and CH_4 concentration extracted from modeled output plume at same place. Comparison of concentration areas (PPM*linial_metre.)



08/03/2019.
EDAR Sant Feliu de Llobregat Waste Water Treatment Station







To cope with dilution effect and smoothing when measuring, we compare peak areas along the same transect to determine agreement between model and measures.

Peak Areas

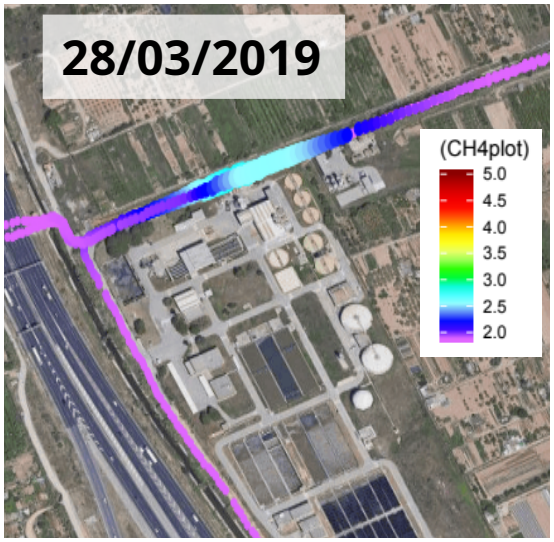
Observations 136 ppm·m

Gaussian model: 168 ppm·m

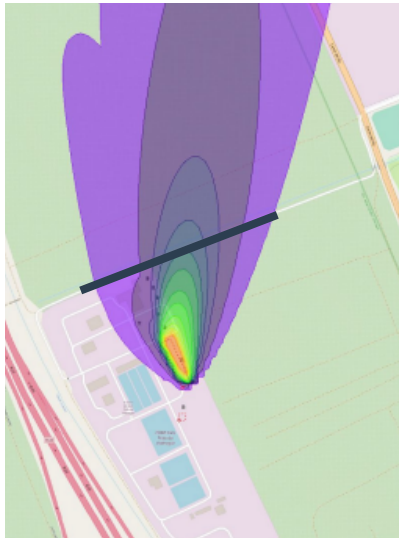
Some days the agreement between methane observations and modeling after emission reports is excellent

Recalculation of methane emissions

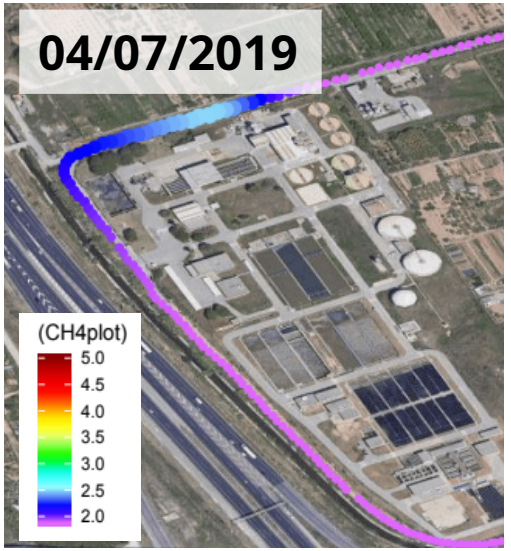
Recalculation of methane emissions using concentrations area (ppm·m) of the at the transect. Posterior emissions are estimated using a Newton's method and recomputing output plume with Gaussian model.



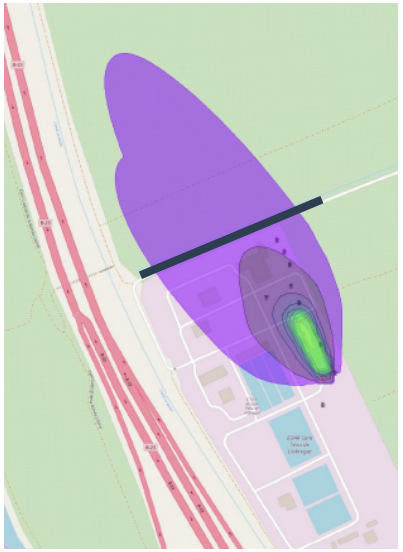
Mobile measurements



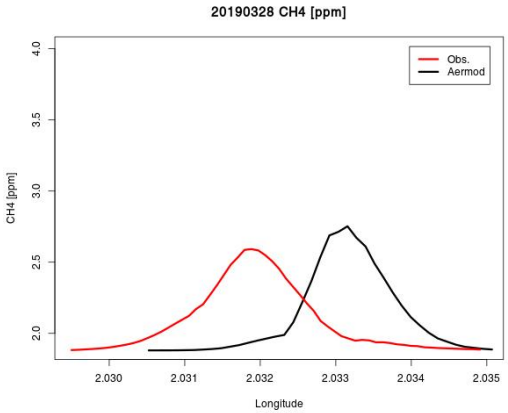
AERPLOT



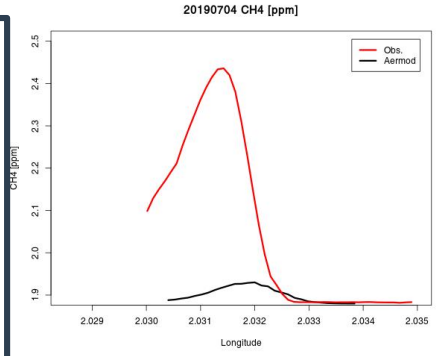
Mobile measurements



AERPLOT



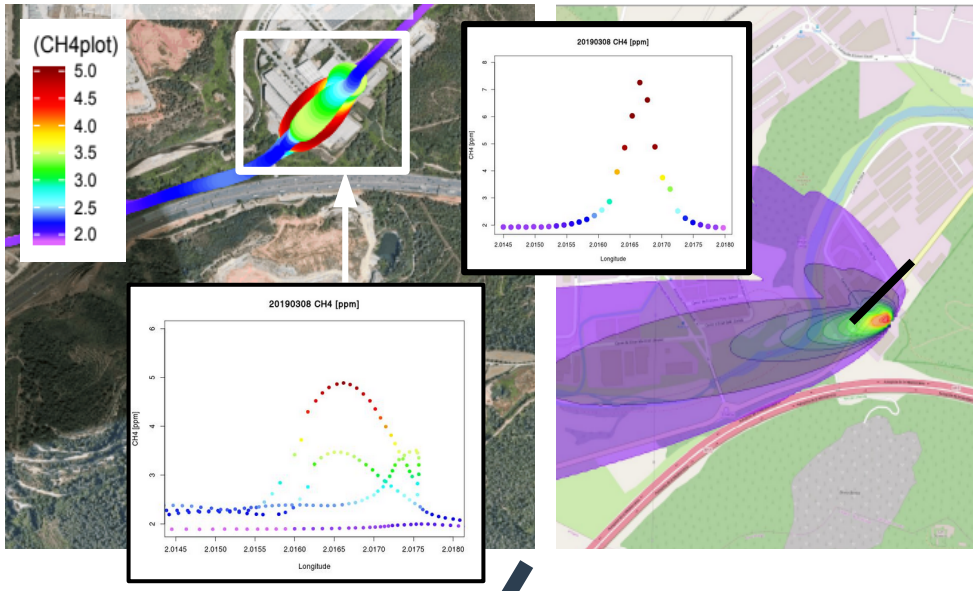
-Some days areas are almost equally, emissions estimation from measured concentrations are equally to priori values.
-Some other days concentration measured is much higher than modeled => Higher emissions than those inventoried



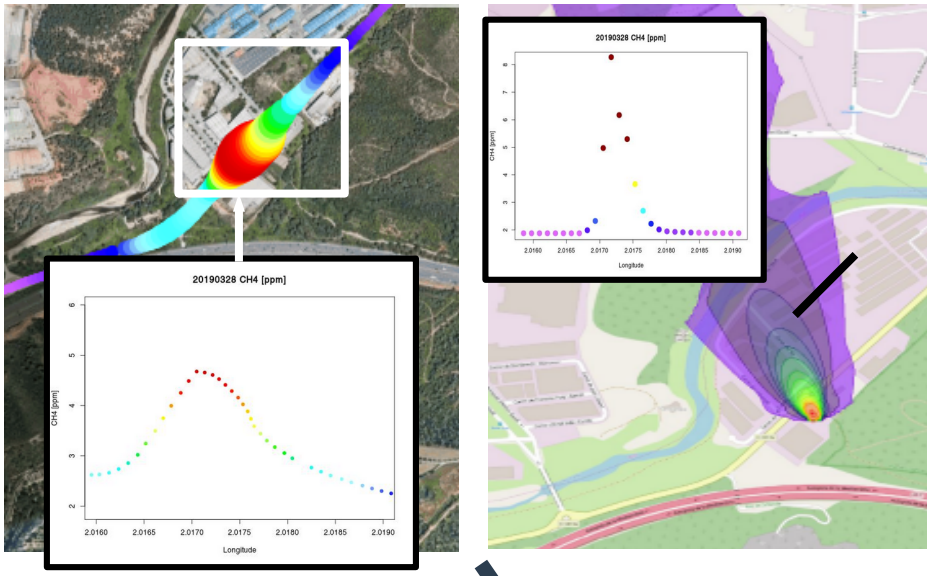
Estimation of methane emissions from WTS

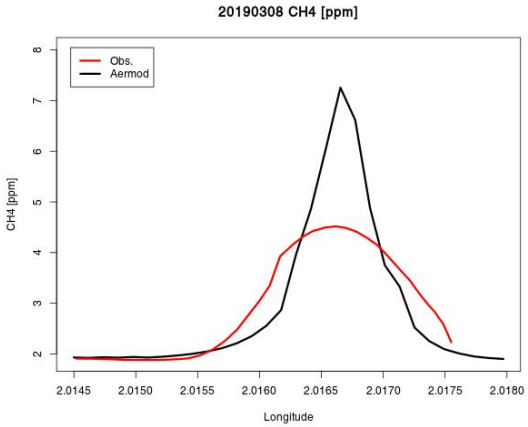
Estimation of emission at spots without official emission rates (Sant Cugat Waste Treatment Station) using same methodology

08/03/2019

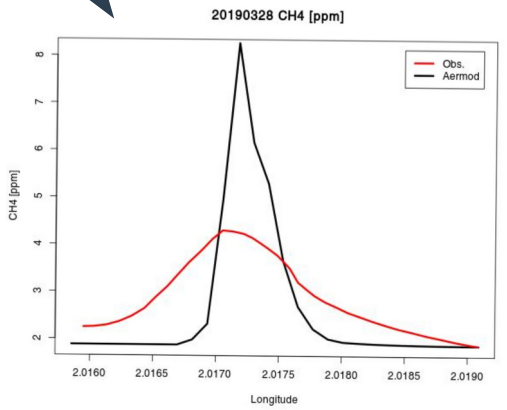


28/03/2019



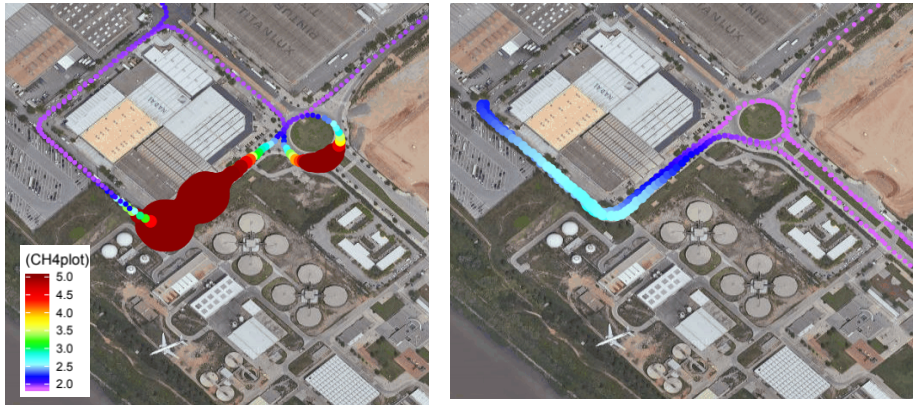


Emission of a Waste Treatment plant was estimated using mobile measurement, Gaussian modeling and comparison of ppm·m areas.
After 4 campaigns, methane emission at Sant Cugat Waste Treatment Plant were estimated to be **1.1 ± 0.3 *gCH$_4$/sec***



Emissions from WWTS EDAR El Prat

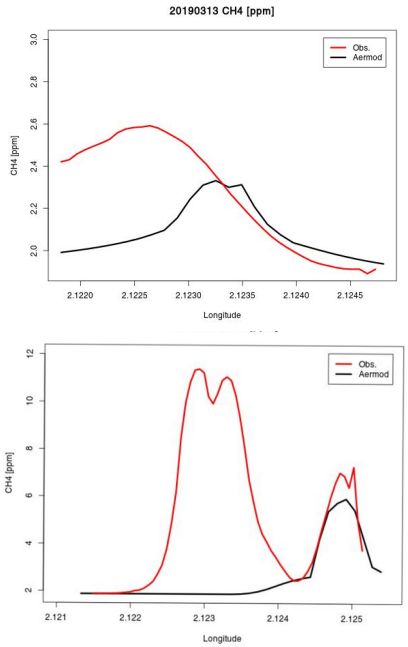
Multiple measurements at WWTS EDAR El Prat disclosed other emission focus: high methane emissions were detected from gasometers and cogeneration plant



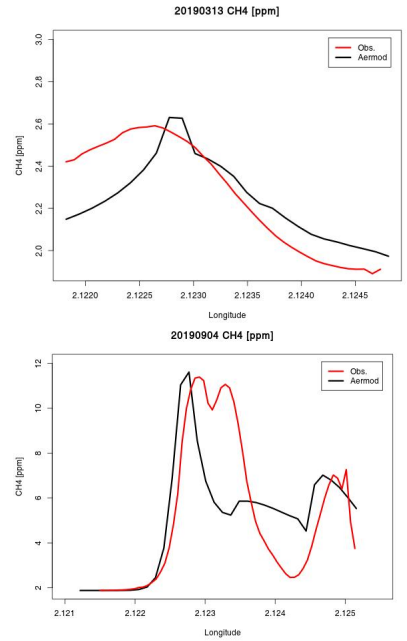
Measured CH4 concentrations

At WWTS ***EDAR El Prat*** concentrations measured could not be explained only by emissions from anaerobic **digesters, clarifiers** or basins even if the wind direction was wrong on the modeling. Measurements disclose a huge methane emission coming from the **gasometers** or the **cogeneration plant** (**~12 gCH_4/seg**).

A. Taking in consideration only emission plumes from anaerobic digesters



B. Taking in consideration emission plumes from anaerobic digesters, gasometers and cogeneration plant



Results

Summary of estimation of emissions:

	08/03/2019	28/03/2019
WTS Sant Cugat	0.89 gCH_4/sec	1.33 gCH_4/sec

	Inventoried emissions	17/02/2019	28/02/2019
WWTS Rubí	0.177 gCH_4/sec	5.5 gCH_4/sec	5.4 gCH_4/sec

	Inventoried emissions	08/03/2019	28/03/2019	05/07/2019
WWTS Sant Feliu de Llobregat	0.48 gCH_4/sec	0,51 gCH_4/sec	0.49 gCH_4/sec	4.67 gCH_4/sec

	Inventoried emissions	11/03/2019	13/03/2019	28/03/2019	04/07/2019	04/09/2019
WWTS El Prat de Llobregat	2,5-3.5 gCH_4/sec	9.36 gCH_4/sec	2.55 gCH_4/sec + 3gCH_4/sec (from cog.)	0.72 gCH_4/sec	2.02 gCH_4/sec	2.55 gCH_4/sec + 3gCH_4/sec (from cog.)

Posterior emissions are estimated using a Newton's method and recalculation of plumes

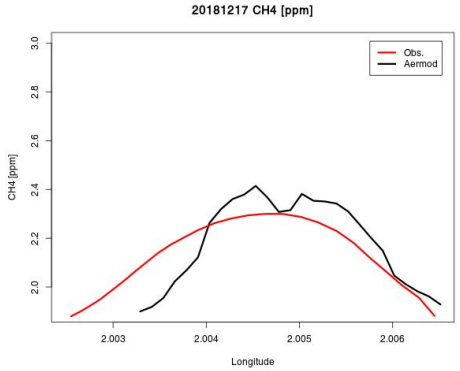
Conclusions

- Mobile methane measurements coupled with Gaussian models have been proved useful to pinpoint and estimate emissions from Waste and WasteWater Treatment Stations.

- Multiple passes-through allow us to detect emissions in a higher resolution, improving detection and accuracy.

- Higher emissions than expected have been found in some of the WWTS of the Llobregat basin. These emissions have been related to leakages from the cogeneration plant or in the gasometer tank.

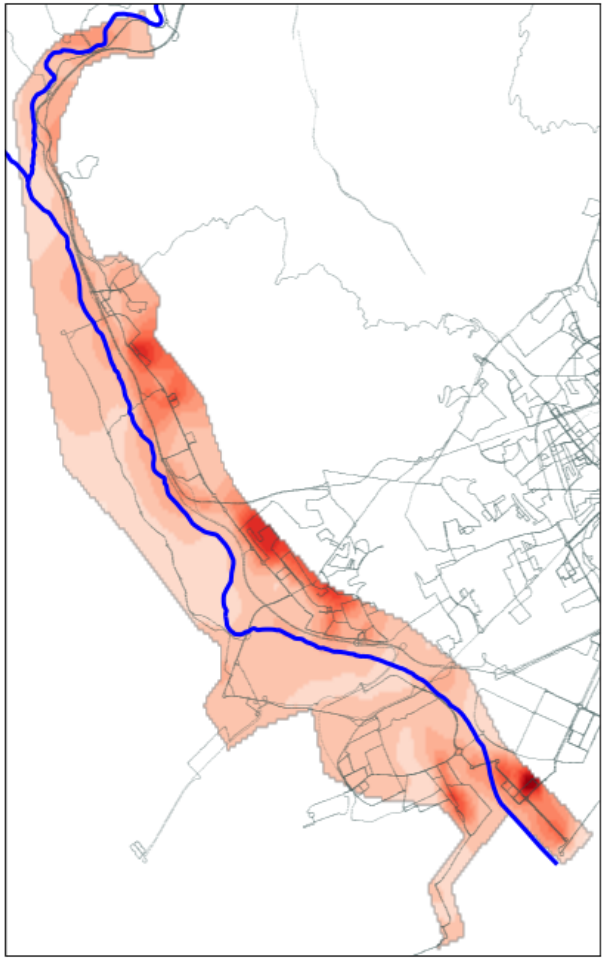
- This methodology could be reproduced to estimate emissions in other type of methane emitters as landfills, gas refilling stations, natural gas compressor stations, etc.



Acknowledgments

Thank you!

This work was funded under the Climate and Clean Air Coalition (CCAC) Oil and Gas Methane Science Studies (MSS), hosted by the United Nations Environment Programme. Funding was provided by the Environmental Defense Fund, Oil and Gas Climate Initiative, European Commission, and CCAC



Contact: roger.curcoll@uab.cat / josepanton.morgui@uab.cat