VERIFY GA meeting #1

March 14, 2019

ECMWF

Reading, UK

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WP4 – Verification methods for CH_4 and N_2O emissions

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WP General Objectives

- Deliver estimates of CH_4 and N_2O fluxes, including anthropogenic as well as natural sources, and build this capacity into a pre-operational system
- Improve the understanding of the processes driving fluxes of CH_4 and N_2O, and **reduce the uncertainties in their budgets and trends** at national, regional and continental scales

WP4 – Main objectives M1-M12

- Compilation of atmospheric observations of CH_4 and N_2O
- Prepare BU estimates from statistical and process-based models
- Prepare atmospheric inversions for CH_4 and N_2O

WP4 – Main objectives until M24

- First proto-type of the Community Inversion Framework (CIF) working with at least one model
- Prepare emission estimates from BU models for CH_4 including $\delta^{13}C$ and ethane emissions
- Evaluation of TROPOMI CH_4 retrievals

T4.1 – Bottom-up estimates

Objectives, progress and achievements M1-M12

- 4.1.1. Agricultural emissions of CH_4 and N_2O: ready for 2000-2012, preliminary for 2013-2017
- 4.1.2. Non-agricultural anthropogenic emissions of CH_4 and N_2O: update to 2015 expected mid-2019
- 4.1.3. Uncertainty analysis of anthropogenic sources: ready for CH_4 and in progress for N_2O
- 4.1.4. Natural fluxes of CH_4: wetland fluxes available 1981-2017 and inland water fluxes available as climatology
- 4.1.5. Process-based modelling of N_2O: preliminary results for 2005-2015

T4.2 – Top-down estimates

Objectives, progress and achievements M1-M12

- 4.2.1. Compilation of input data: completed
- 4.2.2. Flux estimates using state-of-the-art inversions: N_2O completed for 2005-2016, CH_4 preliminary results available
- 4.2.3. Flux estimates using the CIF: a protocol document is completed and a first prototype of the code is implemented with a "dummy" model

T4.3 – Research and development

Objectives, progress and achievements M1-M12

- 4.3.1. A data assimilation system for wetland fluxes of CH_4: work started
- 4.3.2. Integrating new high-resolution satellite data into regional inversions: work started on reading and assimilation TROPOMI data in TM5
- 4.3.3. Supplementary atmospheric tracers: CTE-CH4 has been adapted to assimilate $\delta^{13}C$
- 4.3.4. Development of very high-resolution inversions: a proto-type framework is running coupling TM4-4DVAR and FLEXPART

WP4 – Status of Deliverables

DEL n°	DEL Title	Leader	Due date	Status	Comments
4.1	First CH_4 and N_2O fluxes from anthropogenic sources from BU models	JRC	M16	in progress	
4.4	First CH_4 fluxes from wetlands and water bodies from BU models	FMI	M16	in progress	
4.7	First CH_4 and N_2O fluxes from selected inversion frameworks	EMPA	M18	in progress	

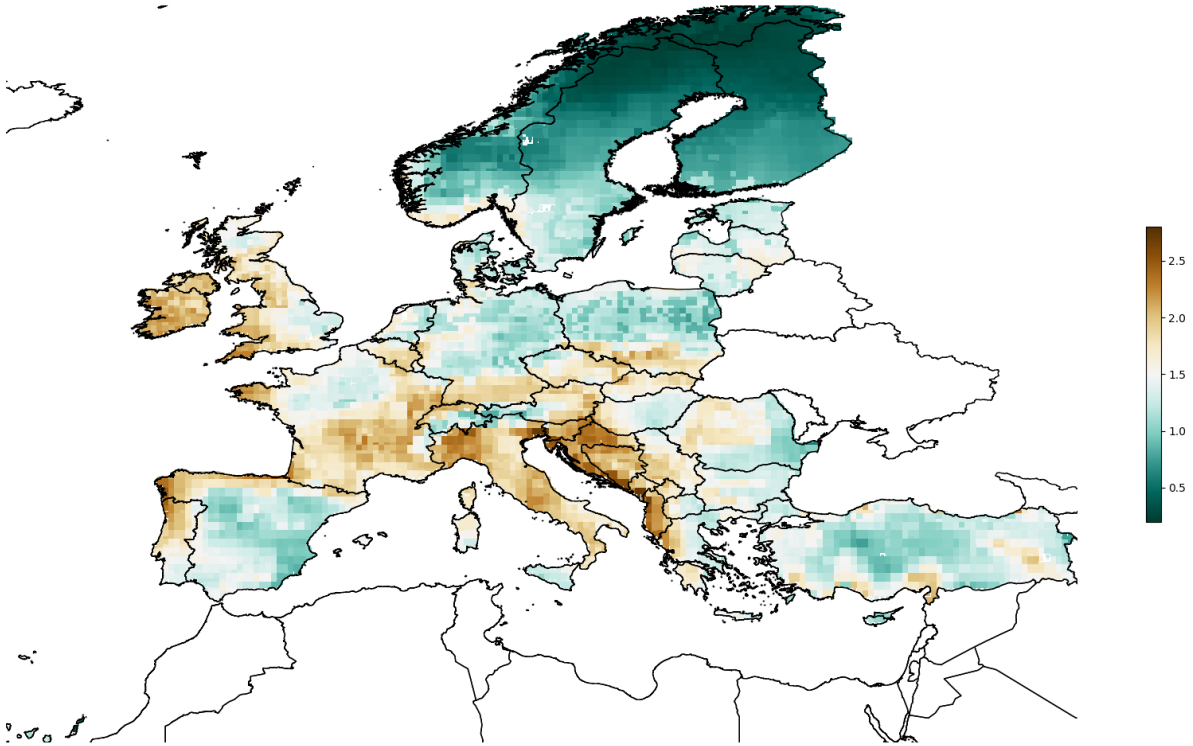
WP4 – Status of Milestones

MIL n°	MIL Title	Leader	Due date	Status	Comments
MS20	Compilation of atmospheric observations and uncertainties	CEA	6	complete	
MS21	Design of the CIF and plan for its development	CEA	6	complete	
MS24	Prepare emission estimates from BU models for δ13C and ethane	FMI	18	underway	
MS25	Prototype of CIF working for at least one global and one regional model	NILU	18	underway	
MS26	Comparison of TROPOMI XCH4 retrievals with TCCON and AirCore data	VU	24	underway	

WP4 – Highlights

Process-based modelling of N_2O using ECOSSE

N_2O emissions for cropland (annual average 2005-2015)



Model approach is still under development - for example:

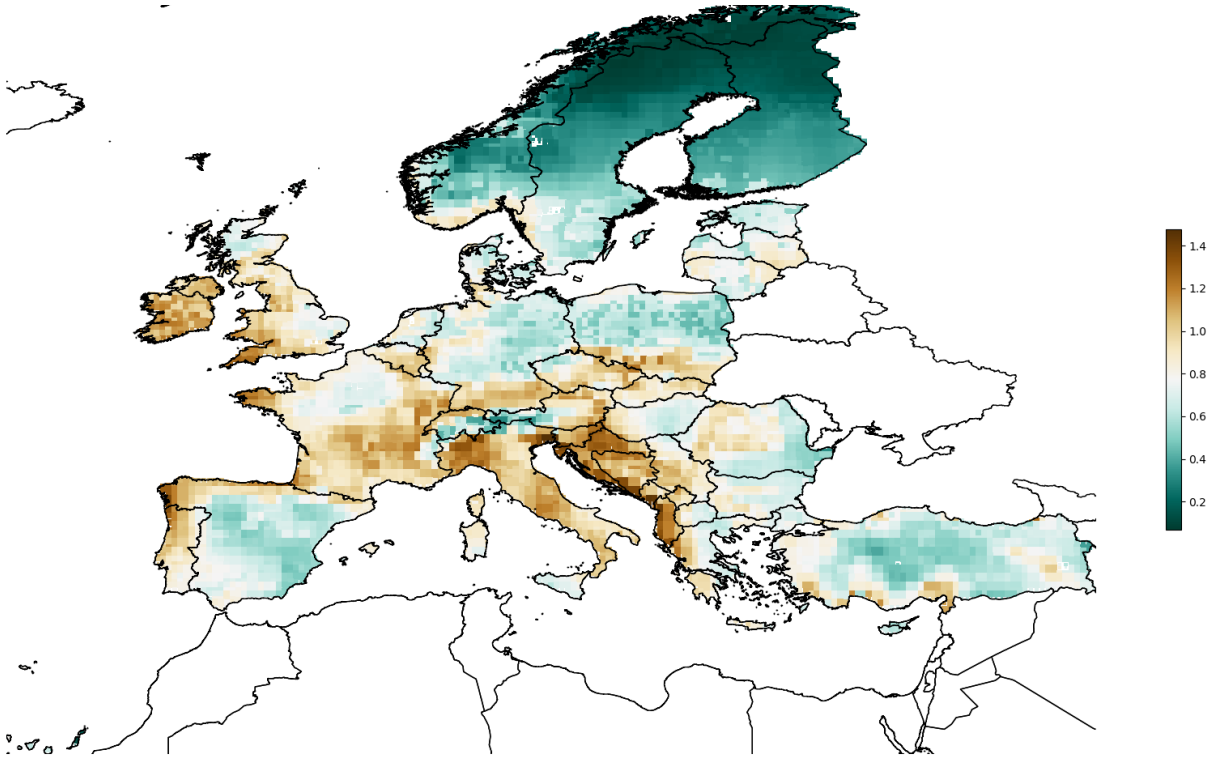
Problem:
Emissions in Central (e.g. NL) and Western Europe too low

Solution:
Fertilizer application needs to be changed from fertilizer demand to actual application rate

WP4 – Highlights

Process-based modelling of N_2O using ECOSSE

N_2O emissions for grassland (annual average 2005-2015)

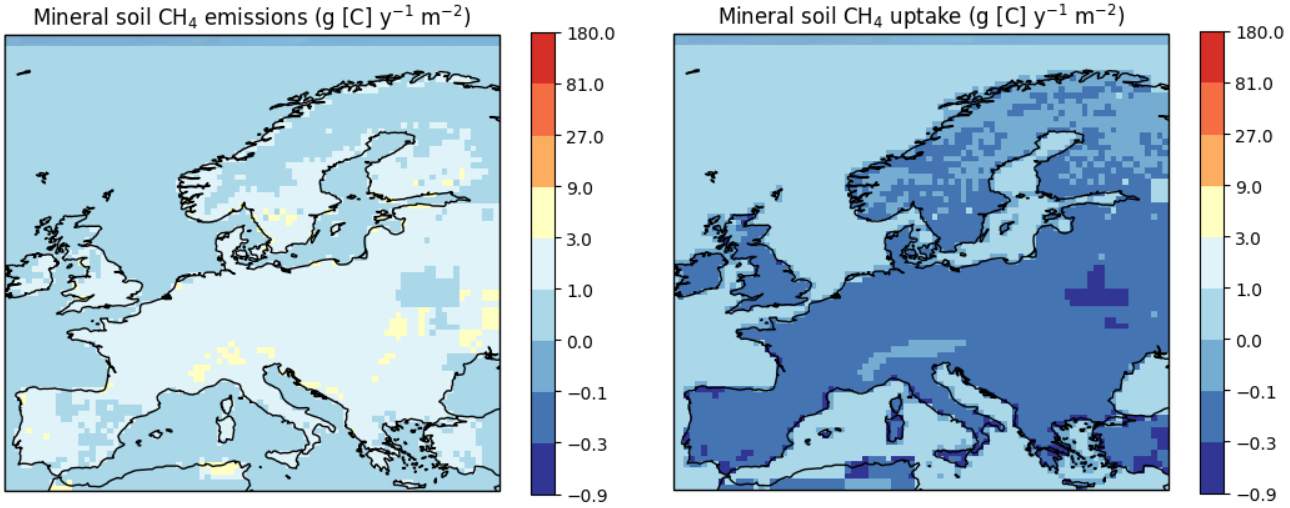


Results are not yet analysed or validated.

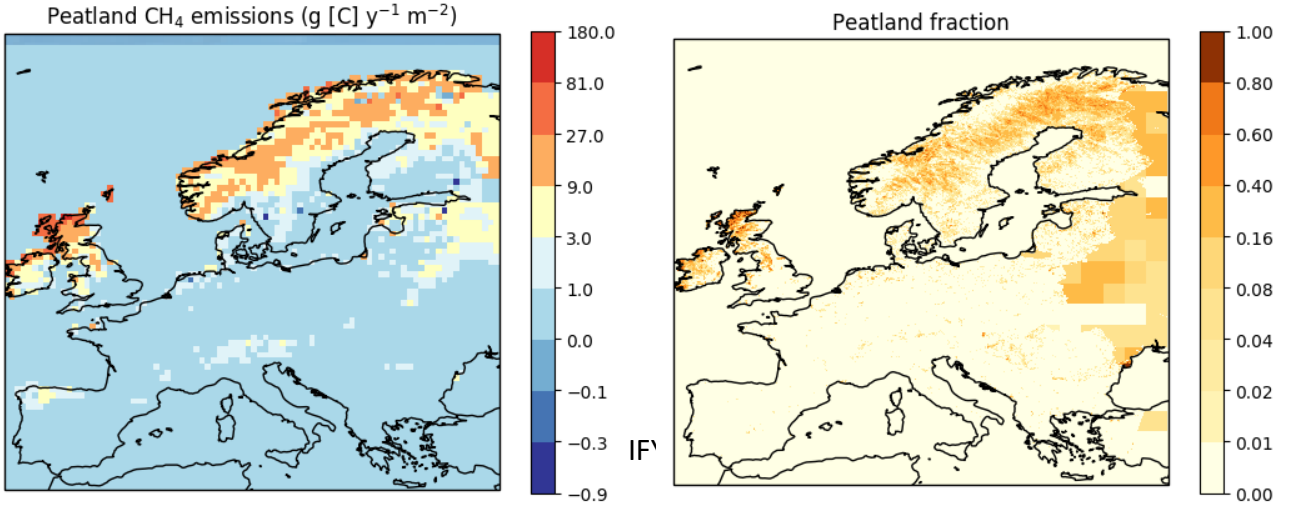
In the actual assumptions management is not considered.

WP4 – Highlights

Estimates of CH_4 fluxes using JS-BACH-HIMMELI



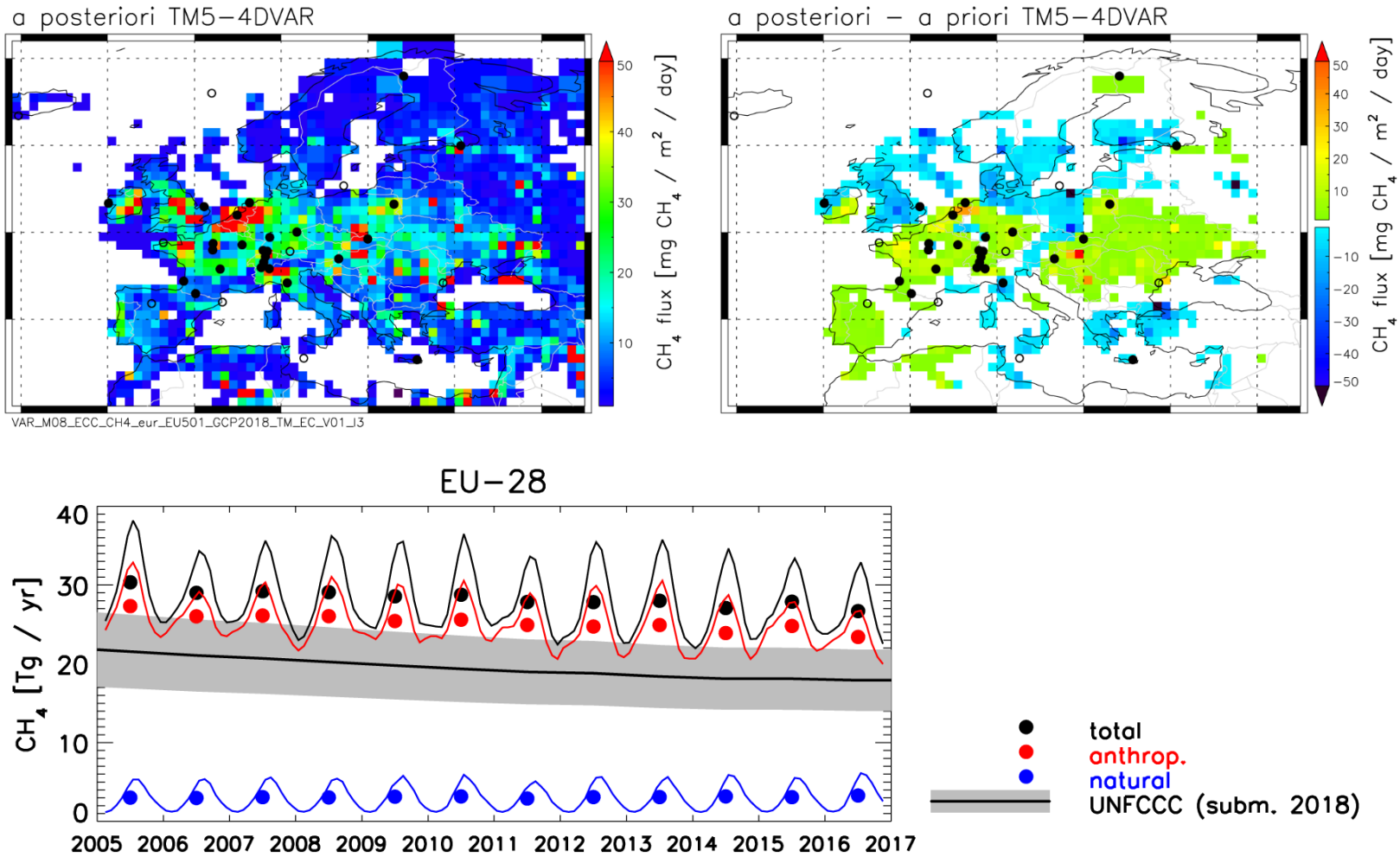
Mineral soils both emit and take up methane



Peatland emissions are predominantly in northern Europe

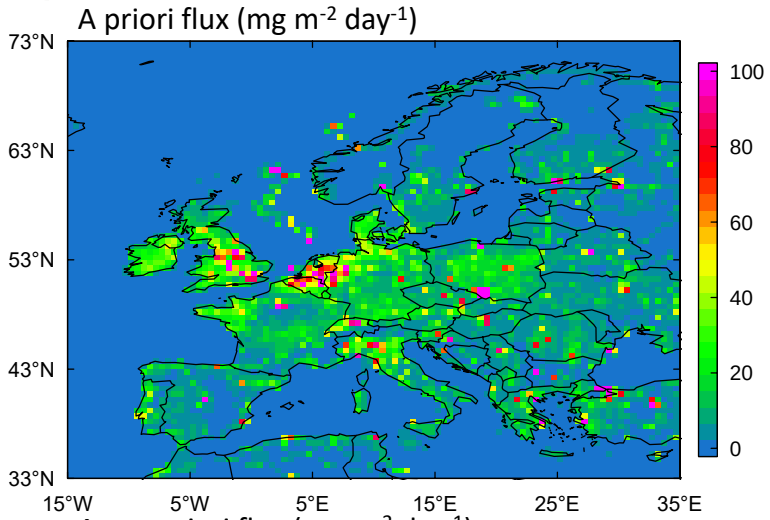
WP4 – Highlights

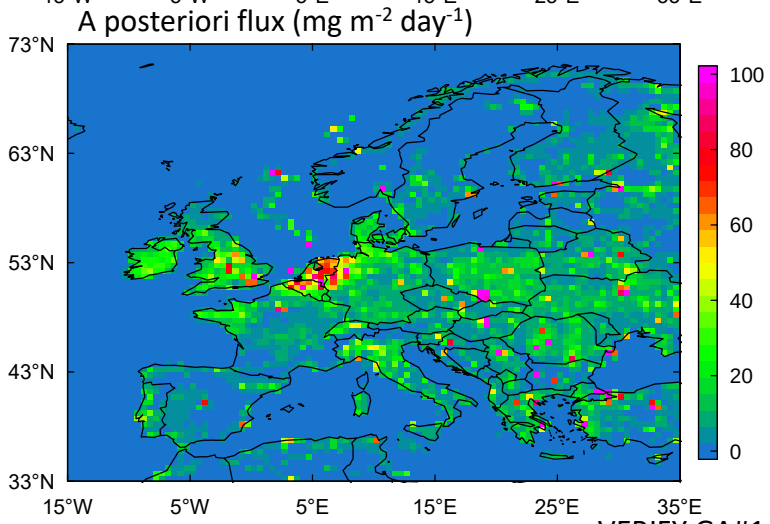
First inversion results for CH_4 from TM5-4DVAR



WP4 – Highlights

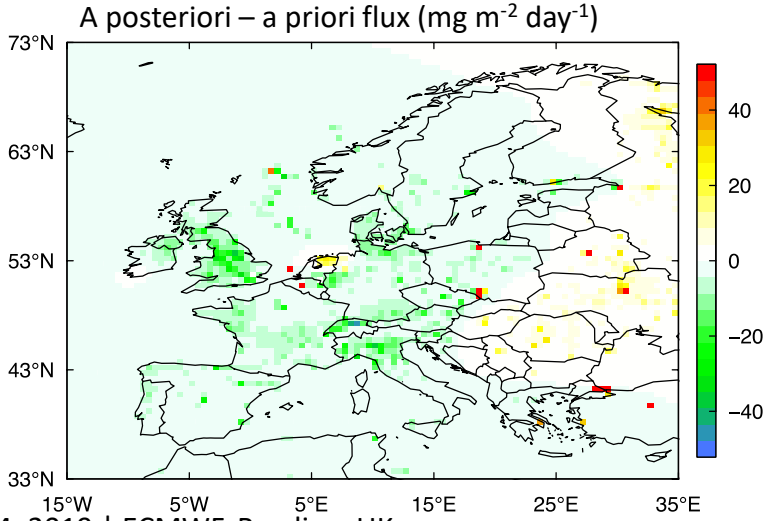
First inversion results for CH_4 using Flexpart-ExKF





Preliminary results

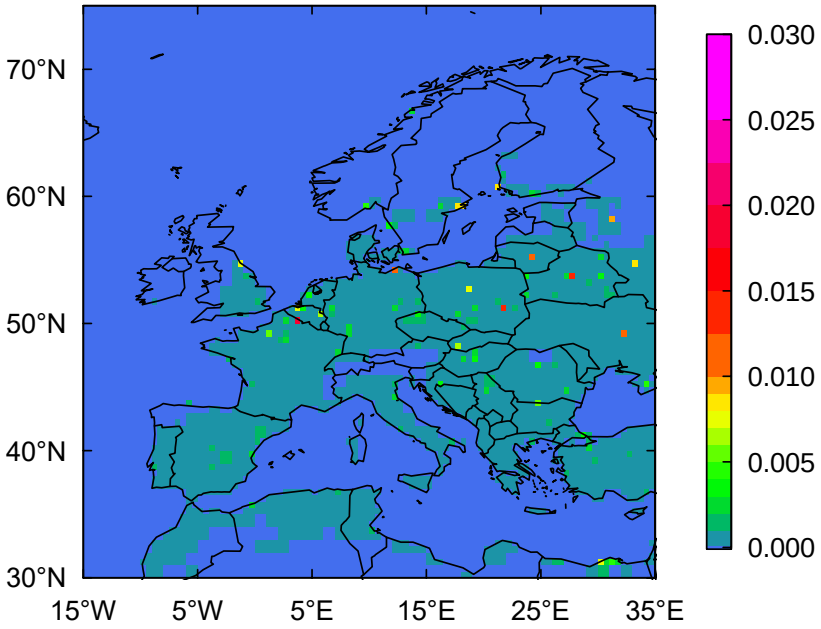
- Model: FLEXPART-ExtKF
- Resolution: 0.5°×0.5°
- Period: 2005-2016 (shown for 2010)
- Priori estimate: based on EDGAR



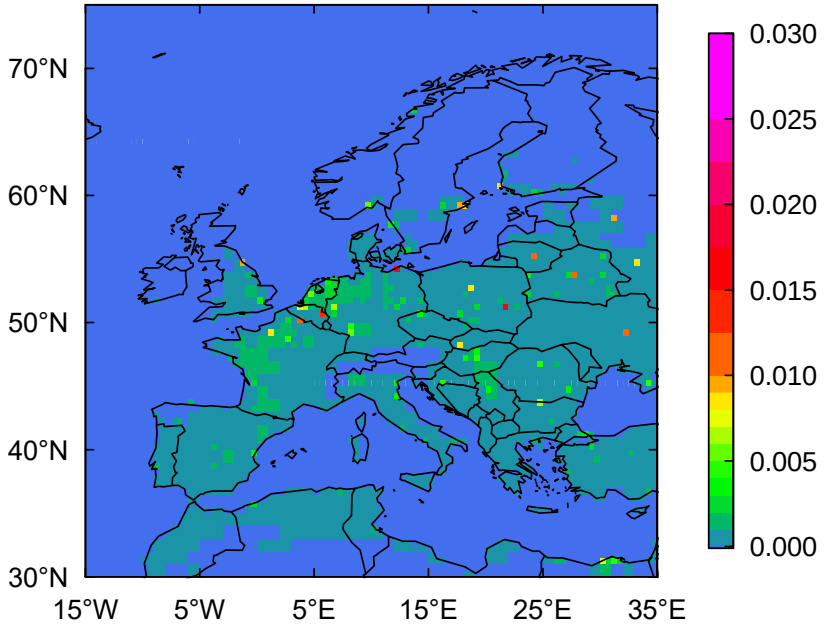
WP4 – Highlights

First inversion results for N_2O from FlexInvert

Mean prior emissions (gN m^{-2} d^{-1})



Mean posterior emissions (gN m^{-2} d^{-1})



WP4

Dissemination activities on WP level

- Plan to prepare 2 papers examining effects of 2018 drought on CH_4 and N_2O, respectively, using both process-models and inversions

WP4

Conclusions and critical/open issues

- WP4 is progressing well
- No foreseen delays with deliverables

Thank you for your attention.