Messages from the VERIFY synthesis on AFOLU flux estimates (CO_2 and CH_4)

CHE AFOLU online workshop

26 November, 2020

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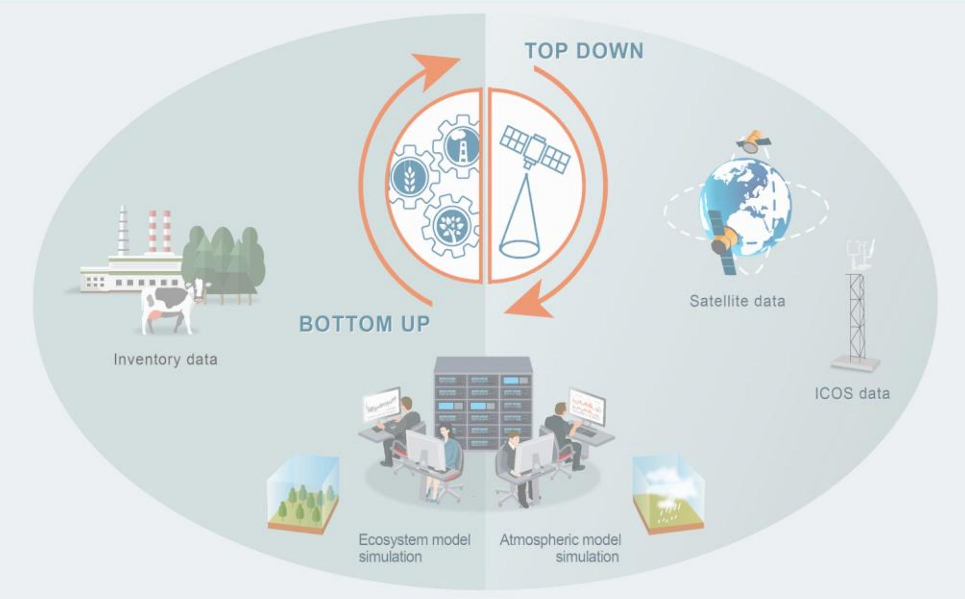
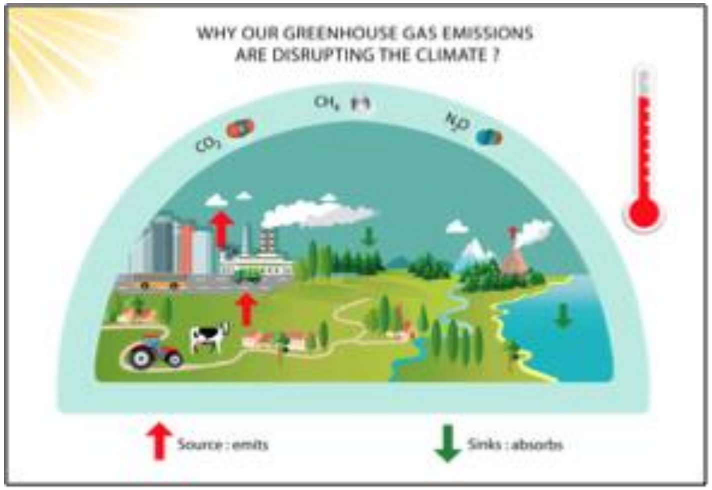
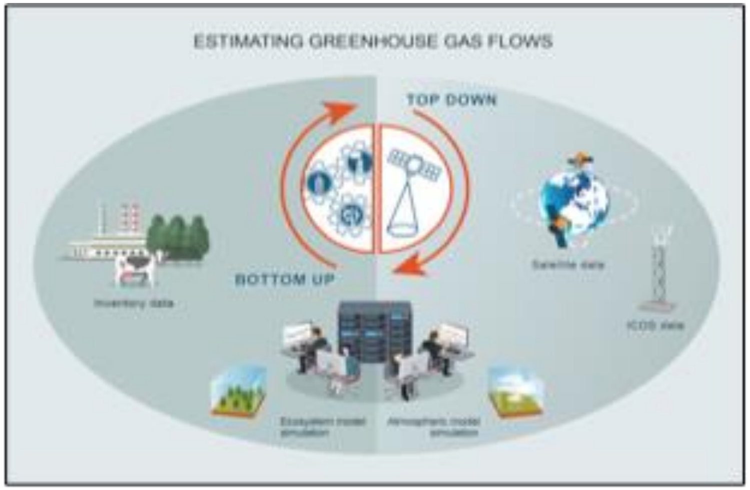


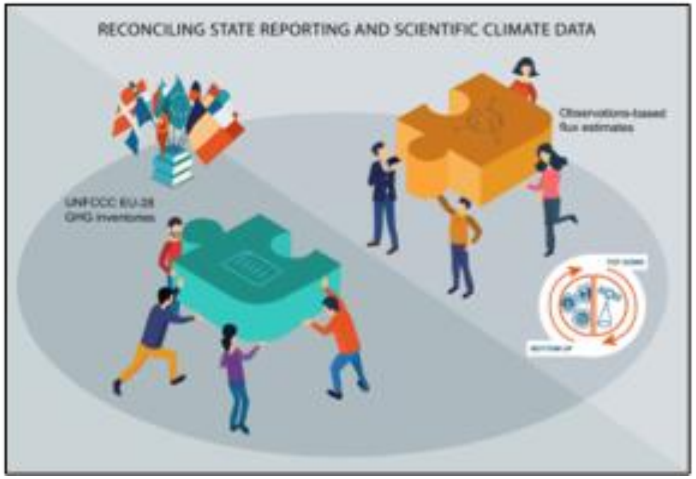
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776810

VERIFY: Observation-based system for monitoring - verification of GHGs

https://verify.lsce.ipsl.fr/







- Estimate CO_2 - CH_4 - N_2O GHG fluxes at European country scales from bottom-up / top-down observation-based approaches
- Compare observation-based estimates with the NGHGI data reported by each country to UNFCCC

KEY RESULTS FROM THE AFOLU PAPER

Earth Syst. Sci. Data, 12, 961–1001, 2020
https://doi.org/10.5194/essd-12-961-2020

Open Access Earth System Science Data

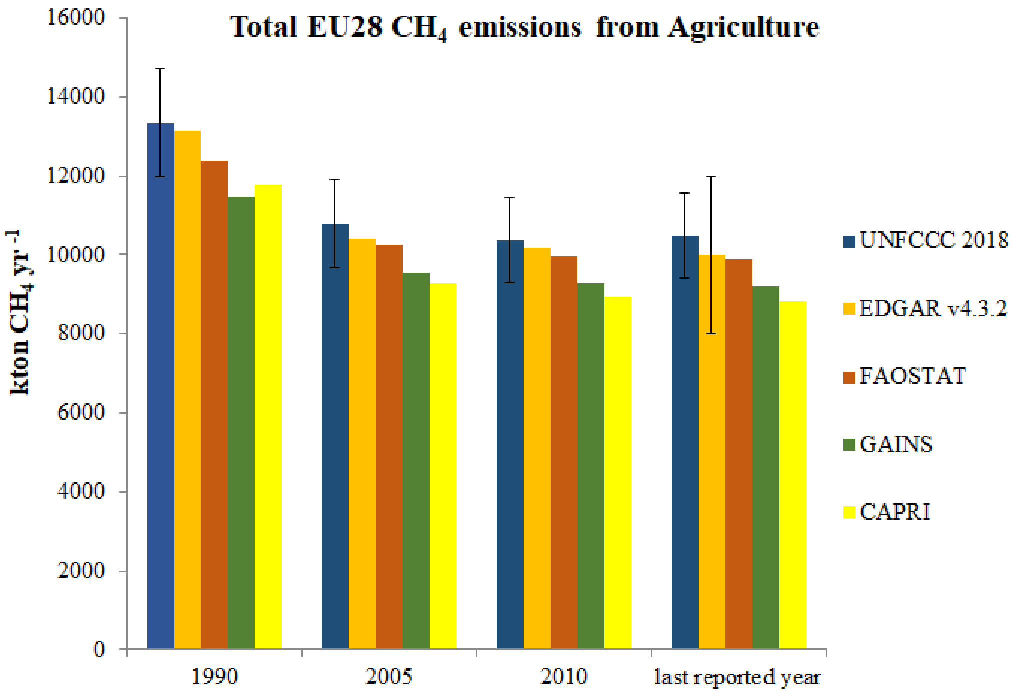
European anthropogenic AFOLU greenhouse gas emissions: a review and benchmark data

Ana Maria Roxana Petrescu[1], Glen P. Peters[2], Greet Janssens-Maenhout[3], Philippe Ciais[4], Francesco N. Tubiello[5], Giacomo Grassi[3], Gert-Jan Nabuurs[6], Adrian Leip[3], Gema Carmona-Garcia[3], Wilfried Winiwarter[7,8], Lena Höglund-Isaksson[7], Dirk Günther[9], Efisio Solazzo[3], Anja Kiesow[9], Ana Bastos[10], Julia Pongratz[10,11], Julia E. M. S. Nabel[11], Giulia Conchedda[5], Roberto Pilli[3], Robbie M. Andrew[2], Mart-Jan Schelhaas[6], and Albertus J. Dolman[1]

https://essd.copernicus.org/articles/12/961/2020/

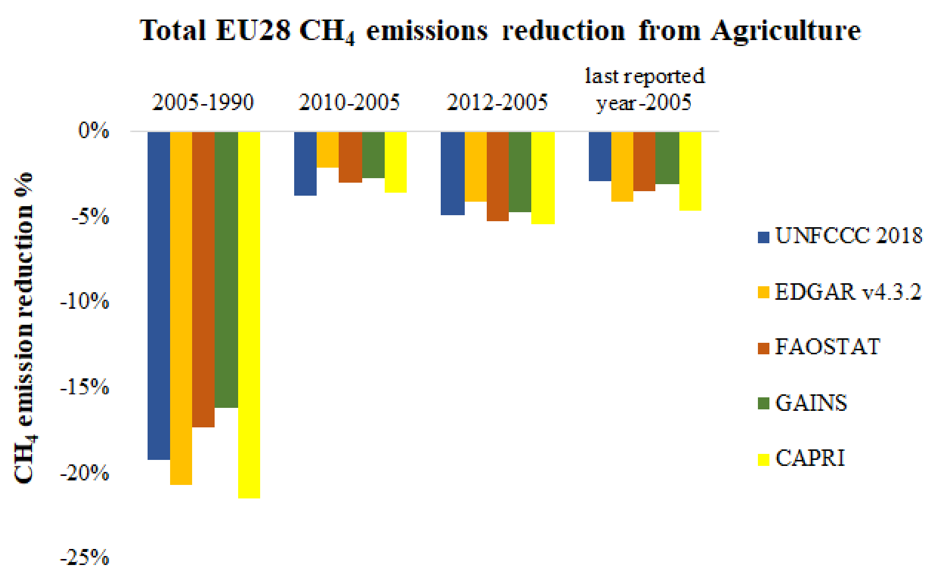
- It highlights the importance of reliable quantification of GHG emissions to support action under the Paris Agreement
- It provides an overview of existing BU data sets for AFOLU sector
- It identifies uncertainties related to the calculations of emissions, and their sources

AGRICULTURE: CH_4



53 % of the total CH_4 emissions in EU28 in 2016

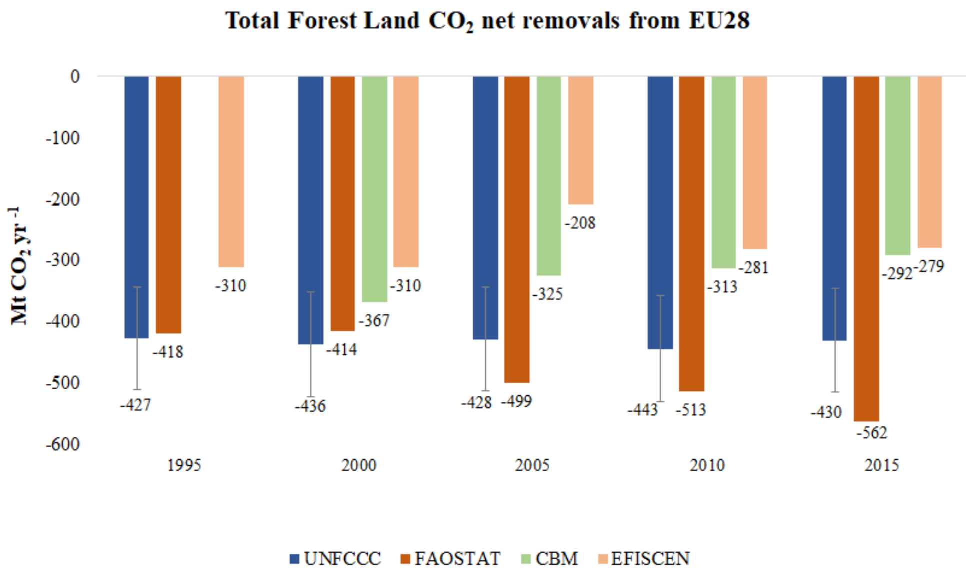
1990s implementation of European and country specific emission reduction policies on agriculture and environment



Good agreement between the BU data and NGHGI, within the 10-20% reported uncertainty

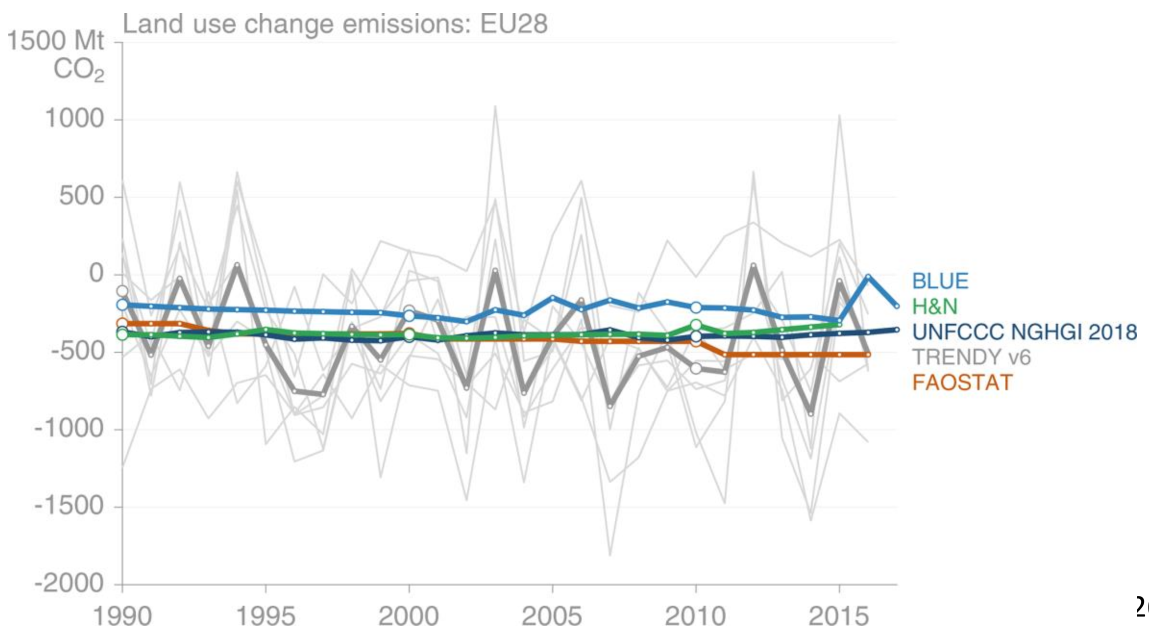
CHE AFOLU work

LULUCF (FOLU): CO_2



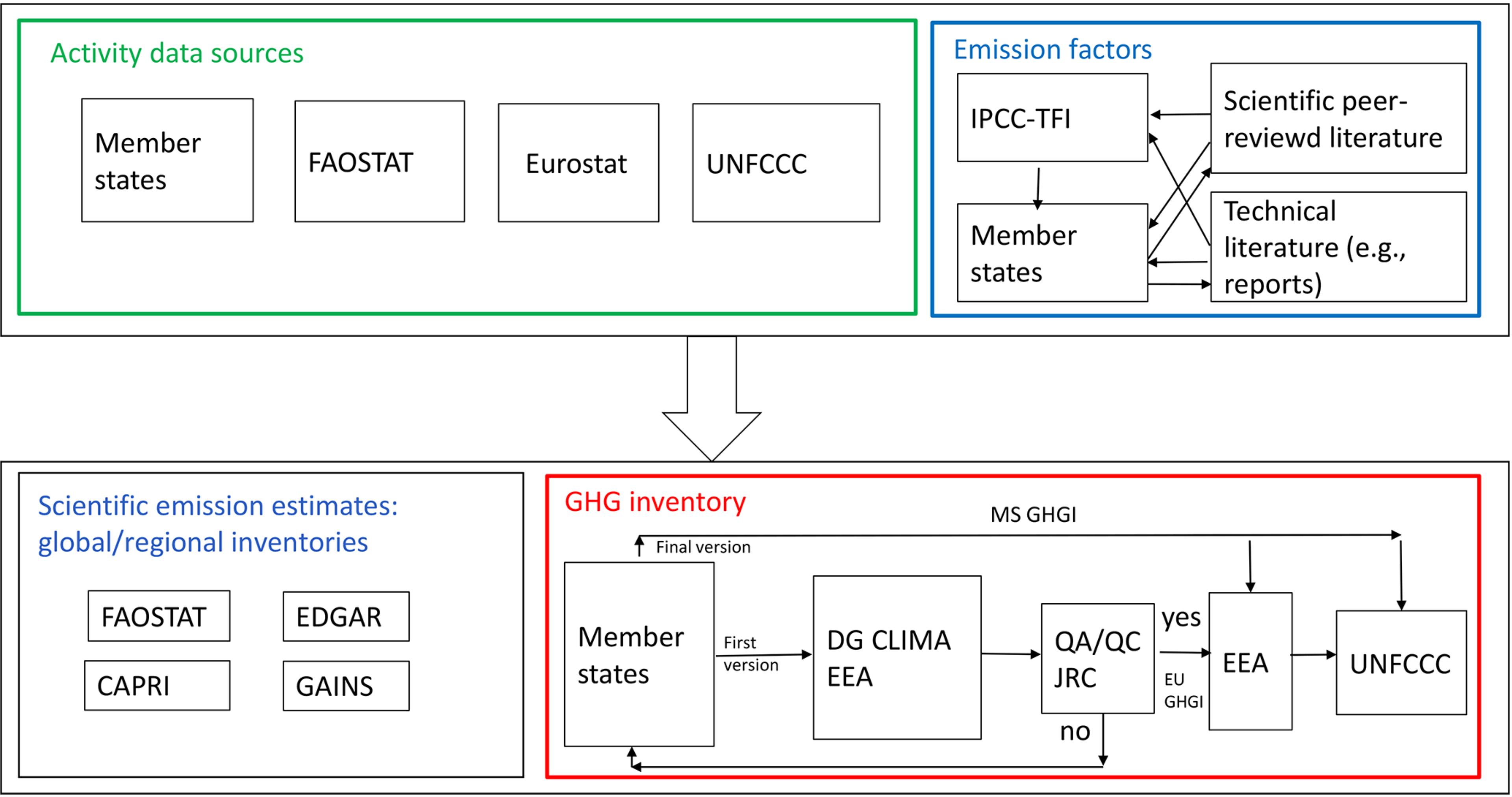
Net CO_2 removals from forest land (FL) as reported by NGHGI, FAOSTAT, EFISCEN and CBM

At EU level 19.6 %, with uncertainty increasing to 25 %–50 % when analysed at the country level

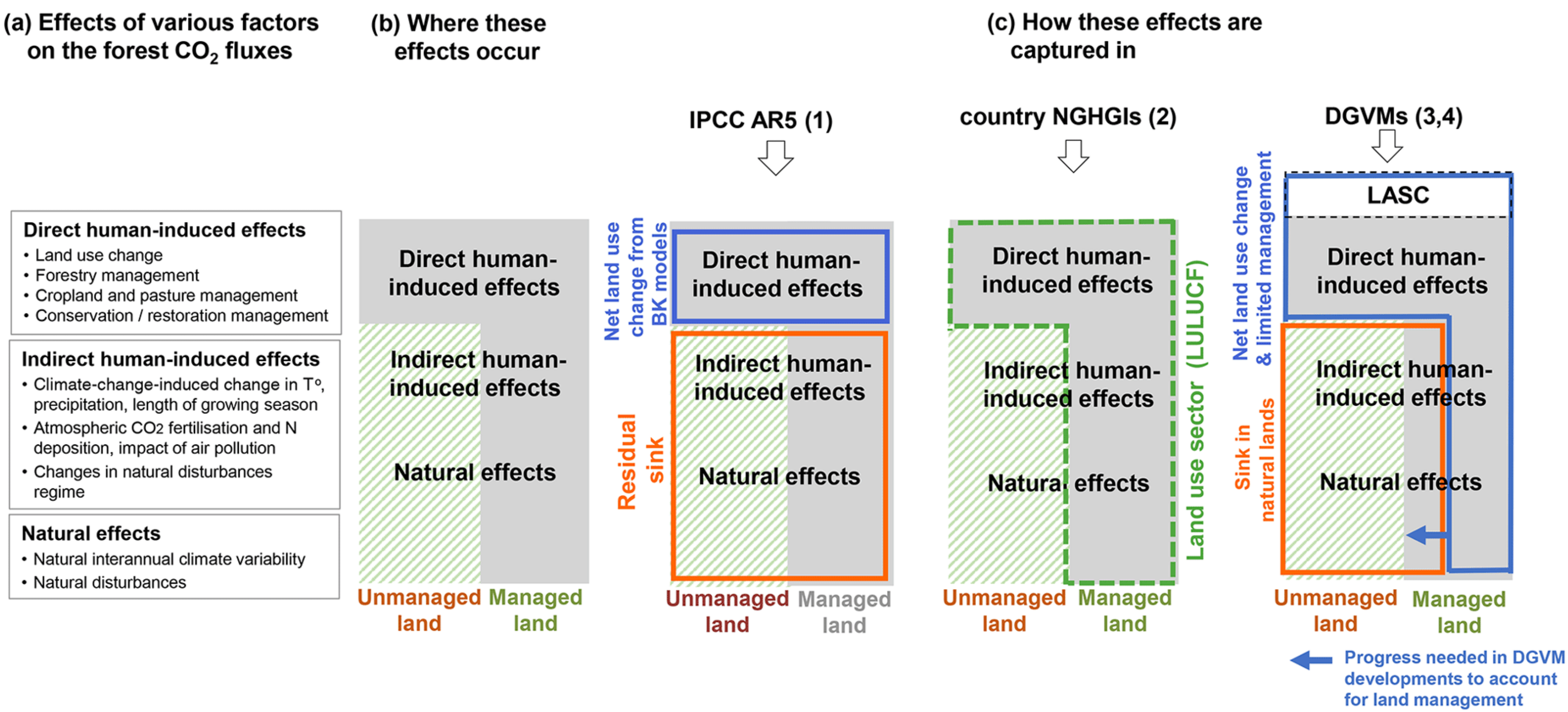


land use change flux in the EU28 from NGHGI, FAO and 3 models output

Main AD, EFs and emission estimates flow in the EU based on IPCC regulations



BOUNDARY ISSUES IN DEFINING CO_2 LAND



(1) In IPCC AR5, the residual sink is inferred as a difference between FF emissions + net land use – growth rate – ocean uptake, and thus matches the observed CO_2 growth rate by construction. In this method, a bias on net land use change is transferred to the inferred residual sink.

(2) In NGHGI, the LULUCF C balance only covers direct management actions and does not match the CO2 growth rate. Any difference with the CO2 growth rate can be attributed to errors in NGHGI estimates and / or fluxes on unmanaged lands.

(3) In DGVMs, net land use change includes a source corresponding to the loss of additional sink capacity (LASC). Some models include limited land management (wood harvest, crop harvest). Nonmodeled management from forestry, cropland and pasture management, conservation / restoration management, being in the grey area part of the orange box.

(4) DGVMs have parameterizations and structural uncertainties, and their net land flux does not match the global CO2 growth rate, leading to a global BIM (budget imbalance).

ESSD Petrescu et al., 2020

MAIN FINDINGS

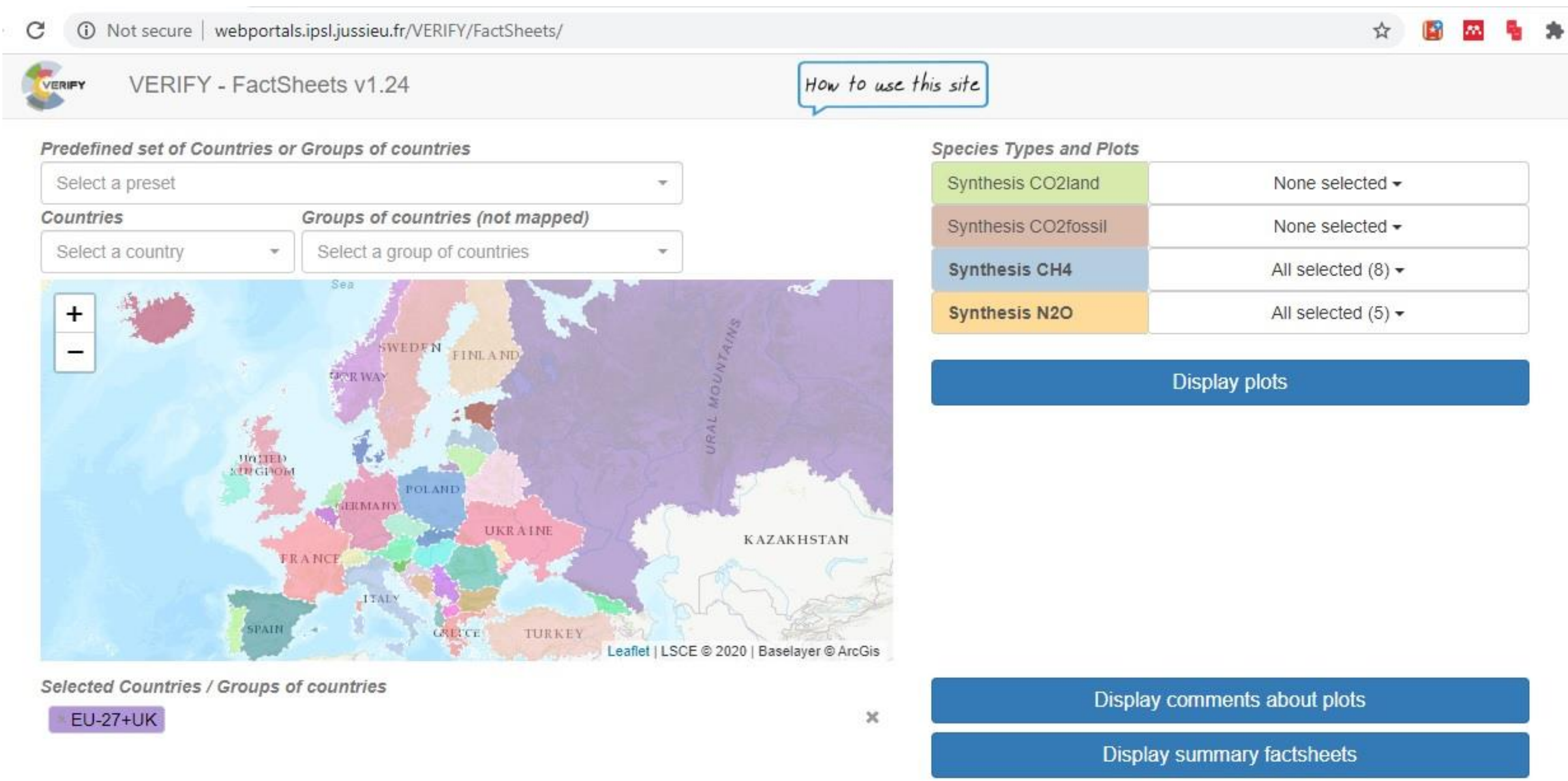
- For CH_4 the main differences between NGHGI reports and models are the use of tiers and methodologies (for both emissions and uncertainty calculation)
- One detected similarity between all sources is the use of EFs, as almost all sources make use of the IPCC defaults.
- AD is shared, often data sources rely on the same basic activity data (FAOSTAT or MS) but there is some complexity to it - Future verification of AD using high resolution remote sensing data (Sentinels)?
- For CO_2 and LULUCF sector, there is the need to reduce the gap between inventories and models by defining common definitions in land use reporting

RESULTS FROM THE CURRENT VERIFY SYNTHESES

VERIFY

http://webportals.ipsl.jussieu.fr/VERIFY/FactSheets/

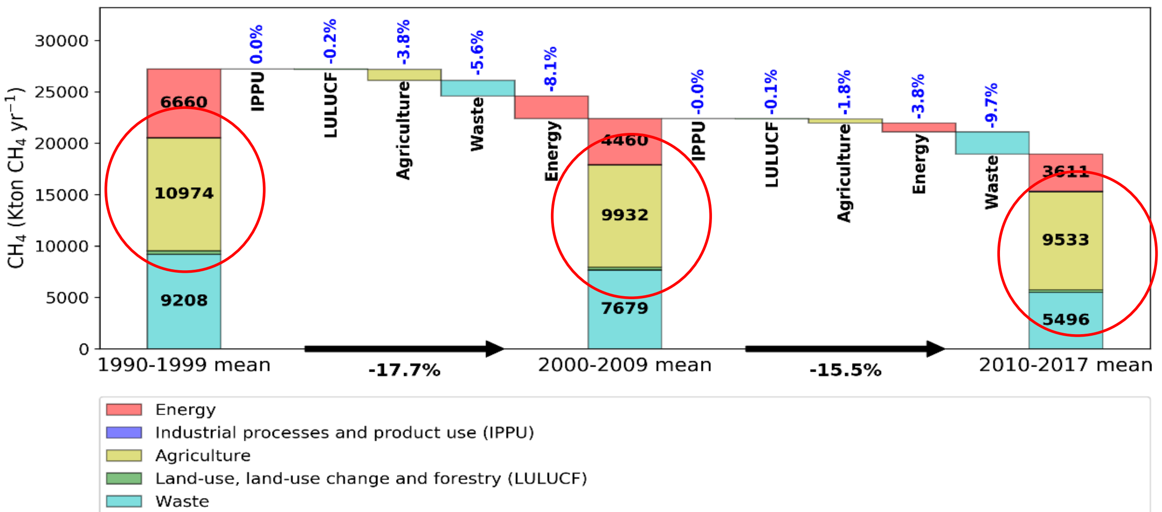
login: verify_guest   passw: Verify_2020



We thank Patrick Brockmann, Matt McGrath and Philippe Peylin for the design and help with the web portal
We thank Matt McGrath, Chunjing Qiu and Robbie Andrew for the work on the plots

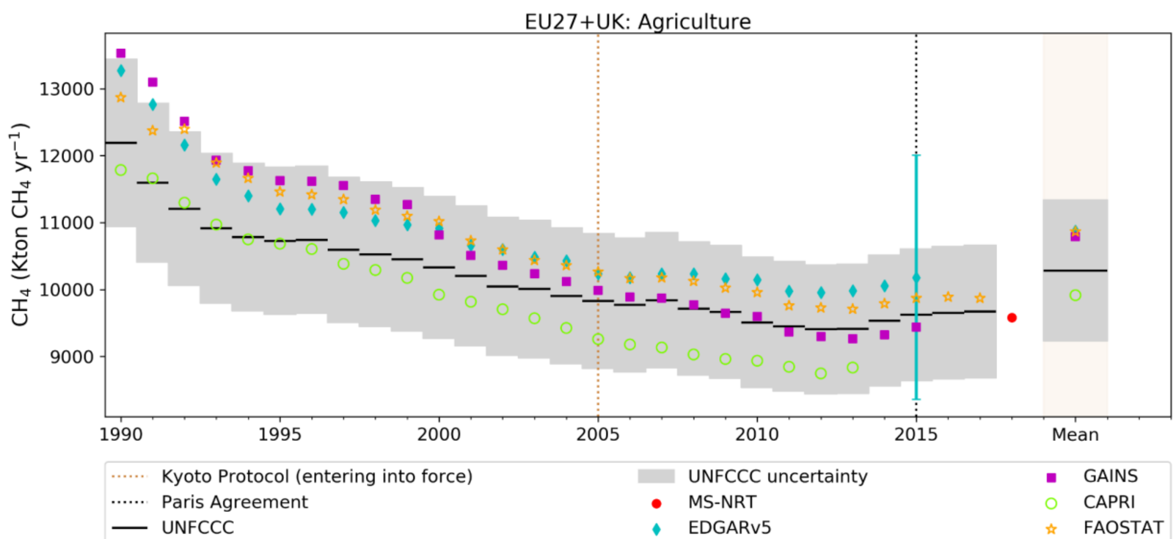
AGRICULTURE: CH_4

CH_4 emissions decadal changes from UNFCCC NGHGI (2019) for EU27 + UK

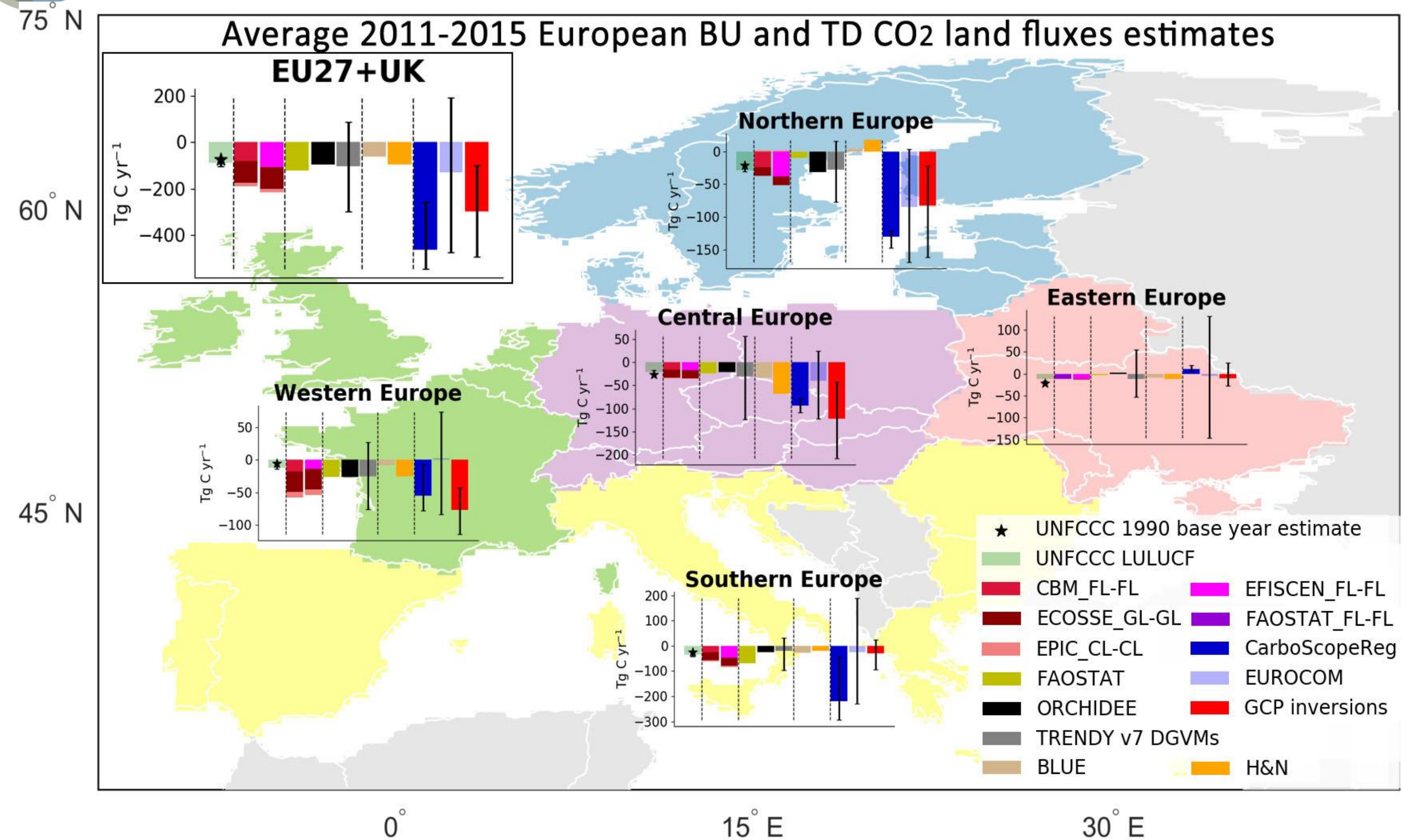


In 2017 52 % (± 10 %) of the total EU27 + UK CH_4 emissions

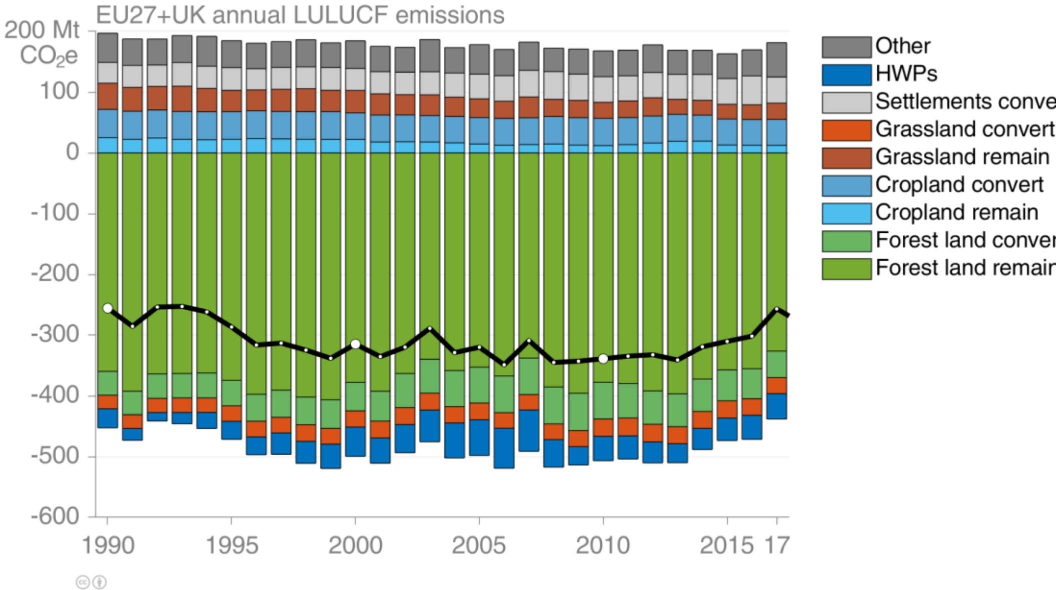
Total BU anthropogenic CH_4 emissions from Agriculture



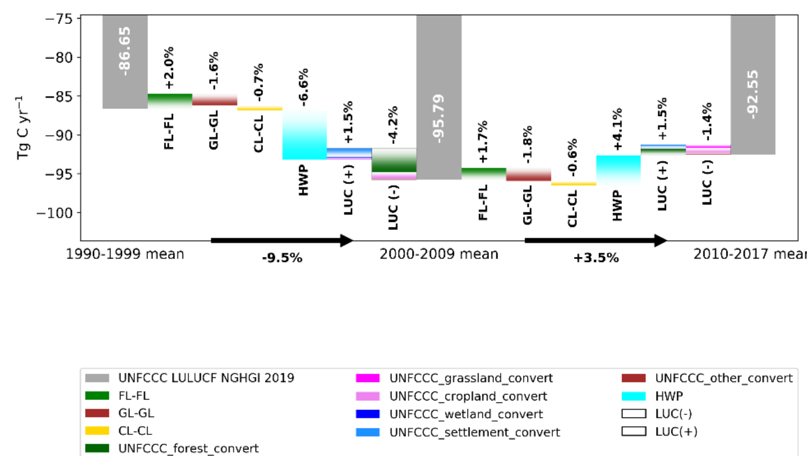
LULUCF: Overall European CO_2 land fluxes



TRENDS IN CO_2 LAND FOR NGHGI (2019)

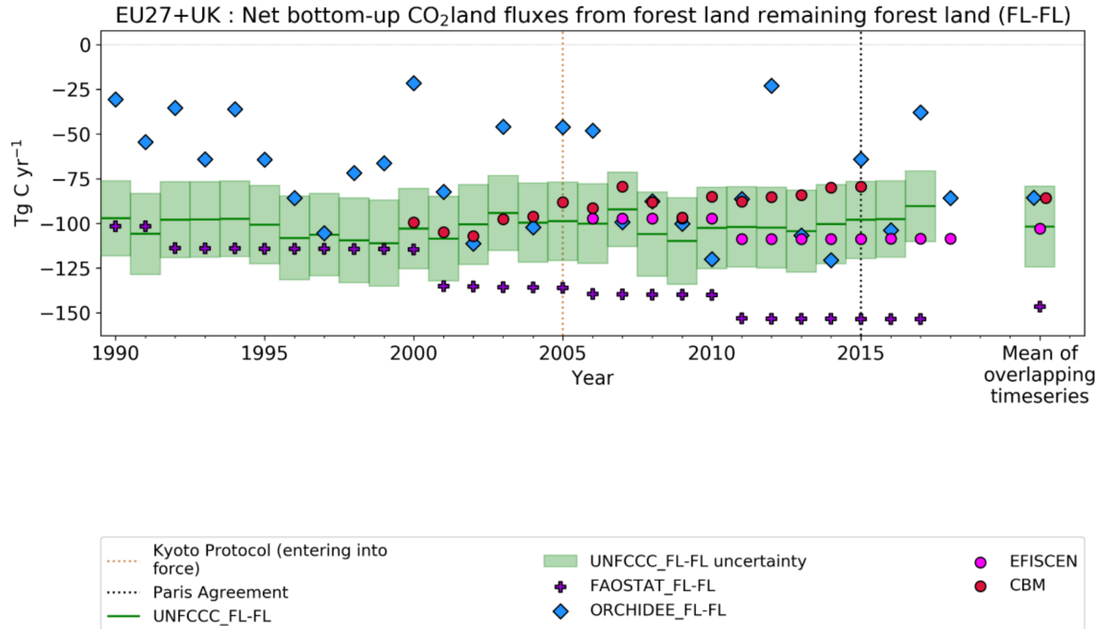


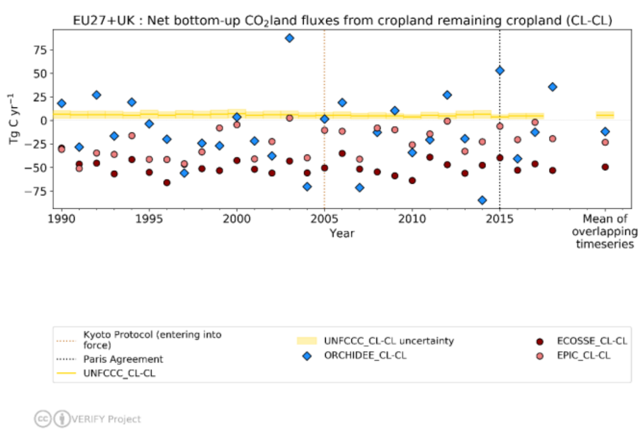
Total EU27+UK annual LULUCF fluxes from UNFCCC NGHGI (2019)

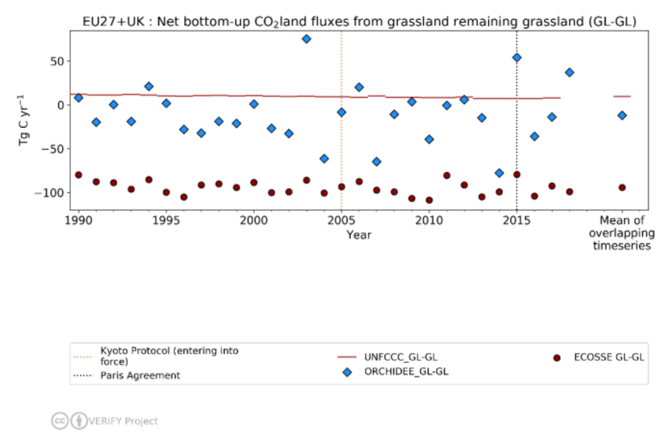


CO_2 LULUCF flux decadal change from UNFCCC NGHGI (2019) for EU27 + UK

FORESTLAND, CROPLAND AND GRASSLAND NGHGI AND OTHER BOTTOM-UP FLUXES

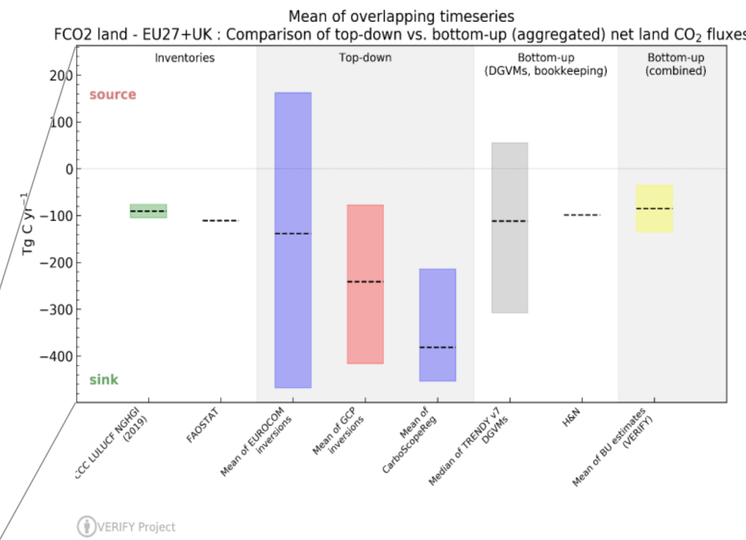


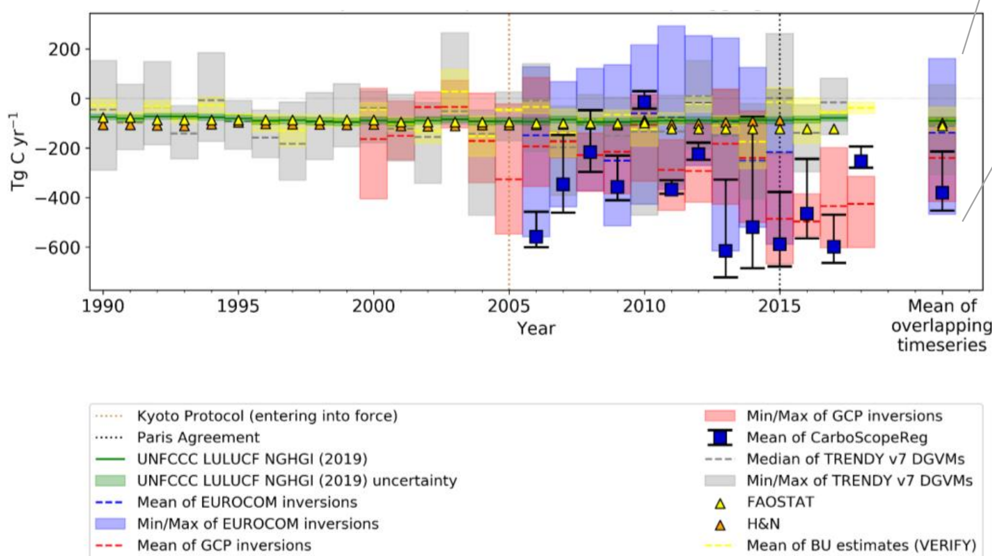




BOTTOM-UP AND TOP-DOWN CO_2 LAND ESTIMATES FOR OVERLAPPING PERIOD 2006-2015

Total CO_2 flux from NGHGI, BU and TD estimates for EU27+UK



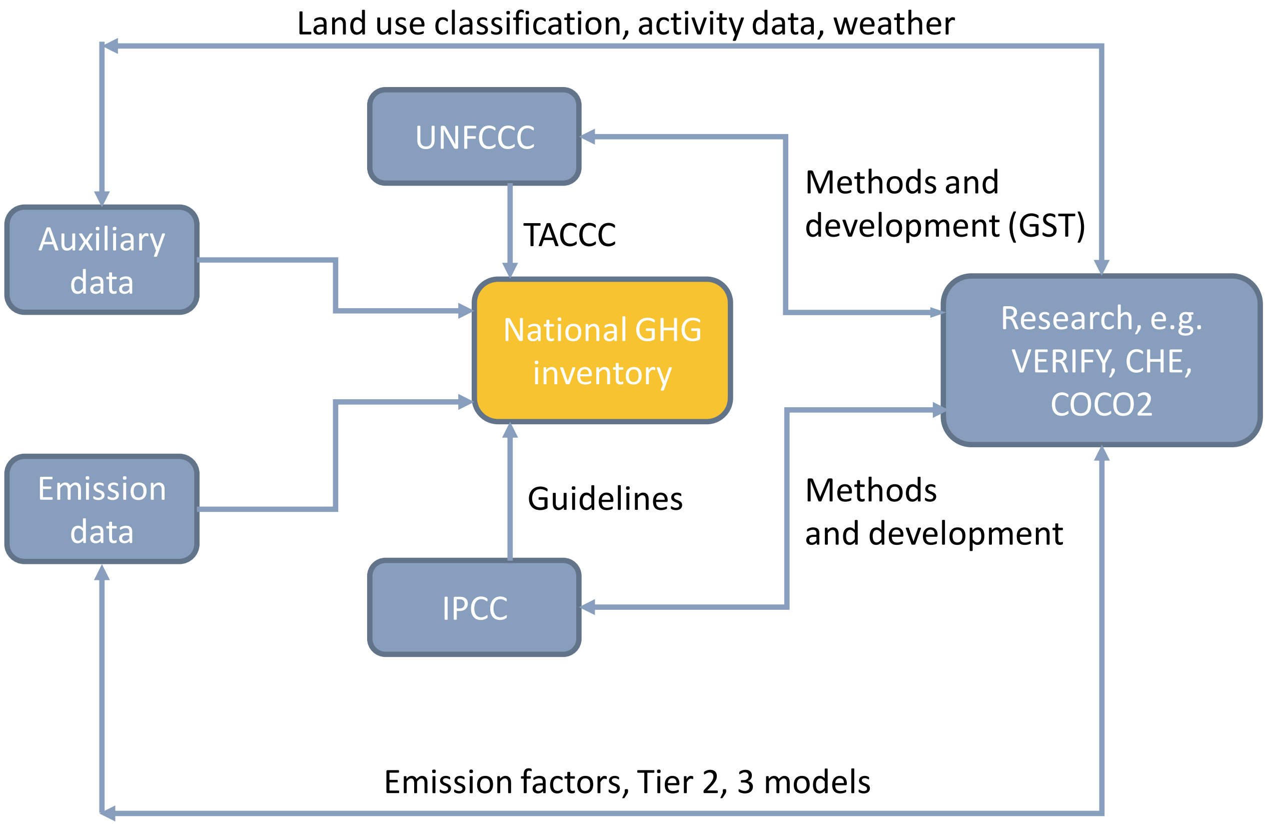


BU estimates (VERIFY) include ORCHIDEE and BLUE

MAIN FINDINGS – CH_4 AND CO_2

- CH_4 bottom-up estimates from agriculture are, in general, within the uncertainty range of the NGHGI data
- The main differences are caused by the application of different tiers and methods used in calculating emissions (see flow diagram)
- The top-down ensemble estimates of CO_2 show large variability: regional EUROCOM ensemble mean seems to be the closest to the NGHGI but highly variable
- For CO_2 and LULUCF sector, there is the need to reduce the gap between inventories and models by defining common definitions in land use reporting

INVENTORIES AND RESEARCH PROJECTS



CO2M is aiming to cover all aspects of the chain

Thank you for your attention

For questions/comments please send an email to:
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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776810