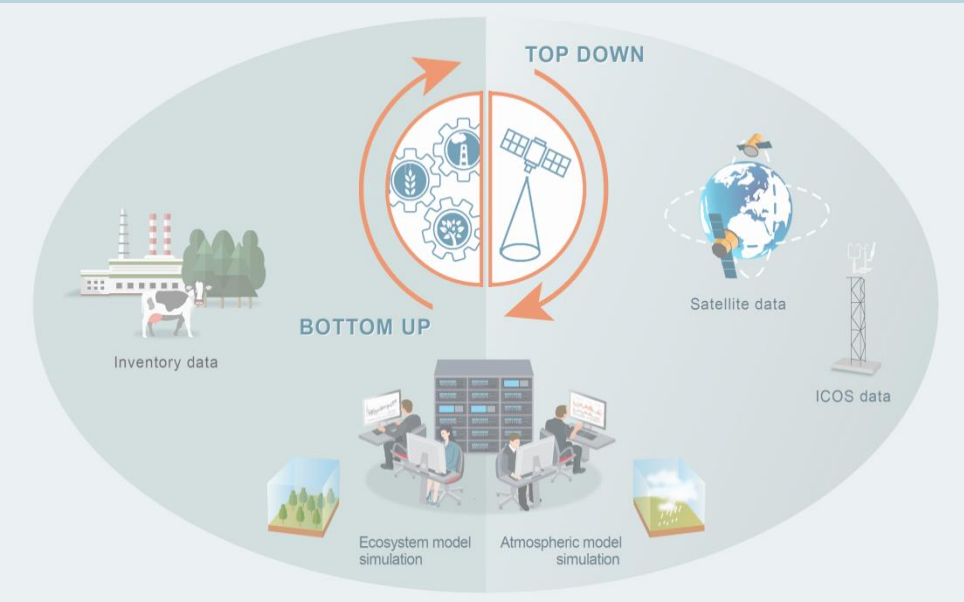
VERIFY General Assembly

Feedback from Italian Inventory Agency

May 9th -11th , 2022

Angela Fiore - ISPRA



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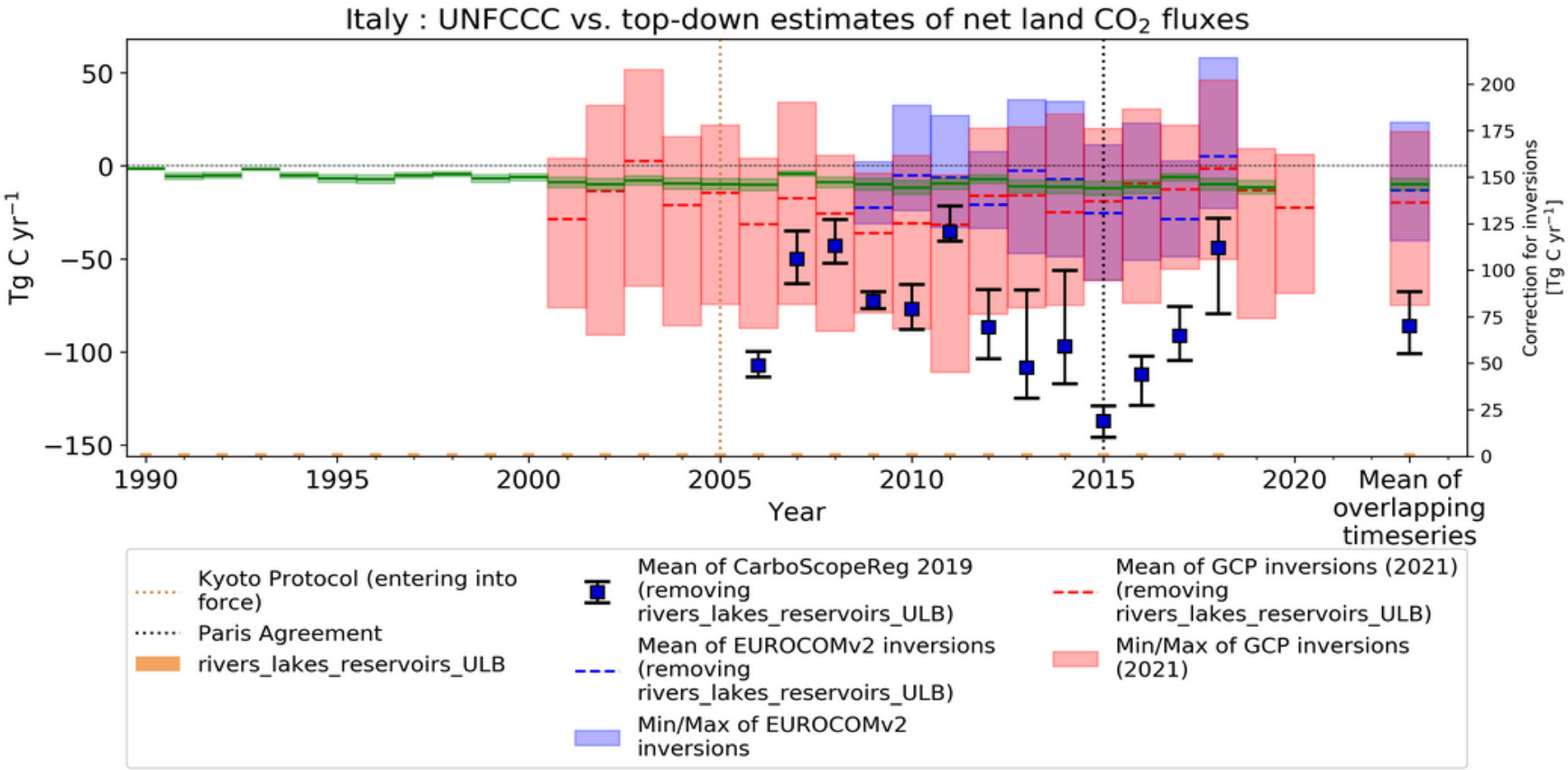
GENERAL COMMENTS

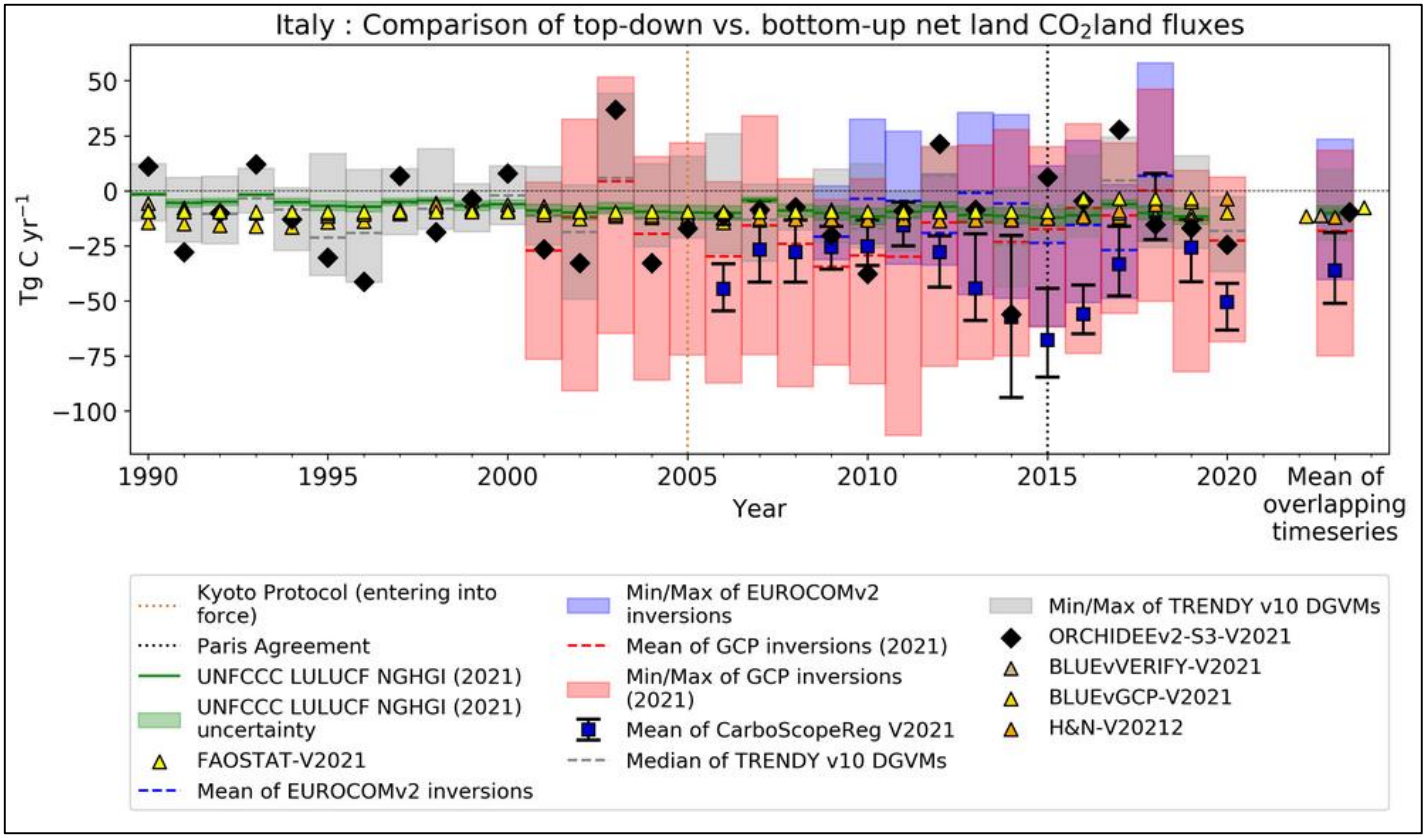
- Significative effort has been made to produce BU and TD estimates to be compared with our GHGI data
- We found not easy to retrieve information about which **datasets** were used as **input** for different modelling purpose
- It would have been helpful to compare **emission factors** arising from different models with the one used for national GHGI

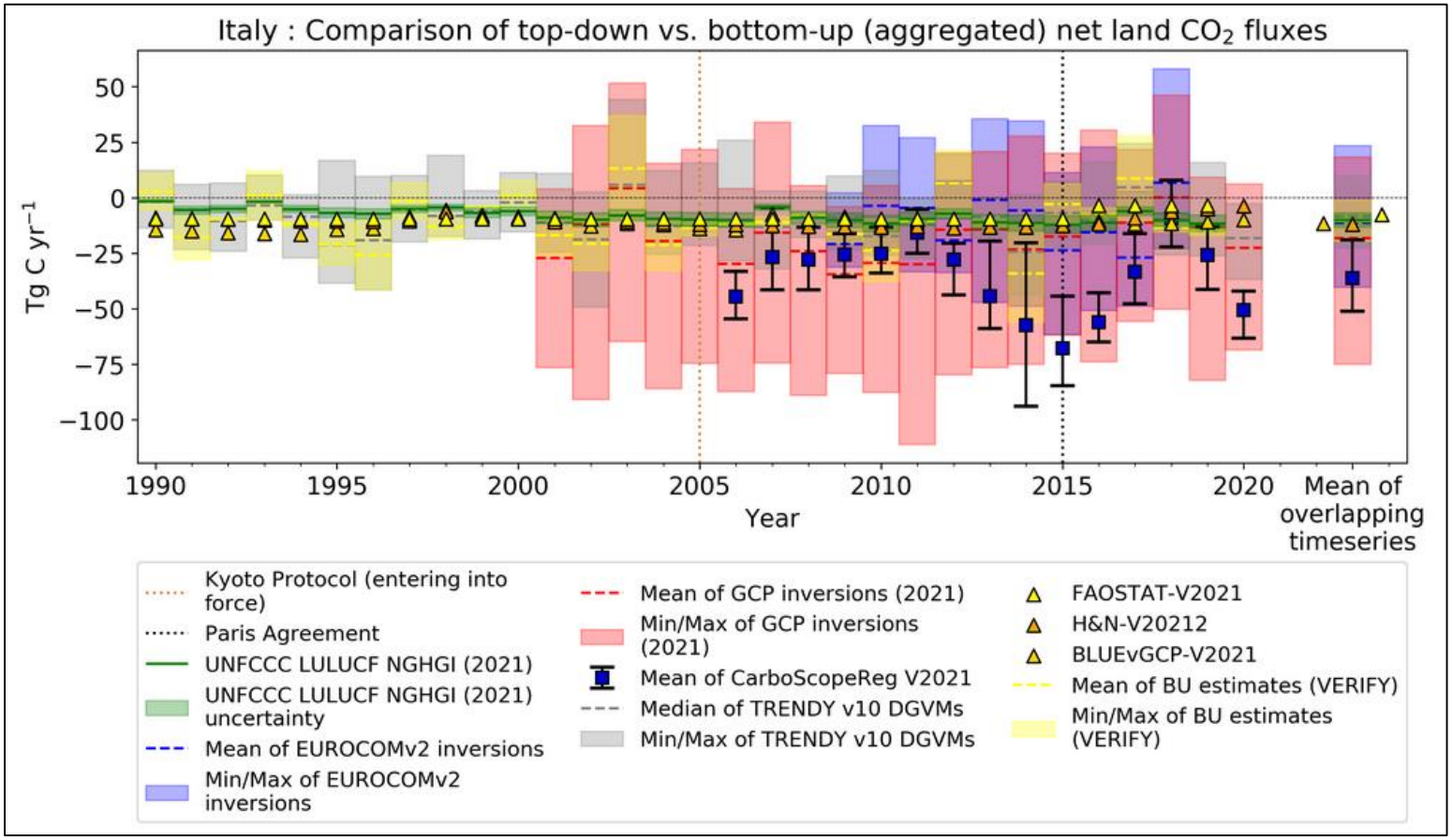
GENERAL COMMENTS: UNCERTAINTY

- The lack of **uncertainty data** of **BU** models' results (except for net LULUCF fluxes estimated with TRENDY) is problematic, resulting in a challenging comparison with GHGI data and related uncertanties (estimated on the basis of uncertainties of emission factors and activity data).

- Reported **uncertainties** of **top-down** estimates are much larger than the uncertainties estimated for the inventories, so it is not really usable it for verification purpose


Italy : UNFCCC vs. top-down estimates of net land CO_2 fluxes
Tg C yr^{-1}
Correction for inversions [Tg C yr^{-1}]
50
0
−50
−100
−150
200
175
150
125
100
75
50
25
0
1990
1995
2000
2005
2010
2015
2020
Mean of overlapping timeseries
Year
Kyoto Protocol (entering into force)
Paris Agreement
rivers_lakes_reservoirs_ULB
Mean of CarboScopeReg 2019 (removing rivers_lakes_reservoirs_ULB)
Mean of EUROCOMv2 inversions (removing rivers_lakes_reservoirs_ULB)
Min/Max of EUROCOMv2 inversions
Mean of GCP inversions (2021) (removing rivers_lakes_reservoirs_ULB)
Min/Max of GCP inversions (2021)

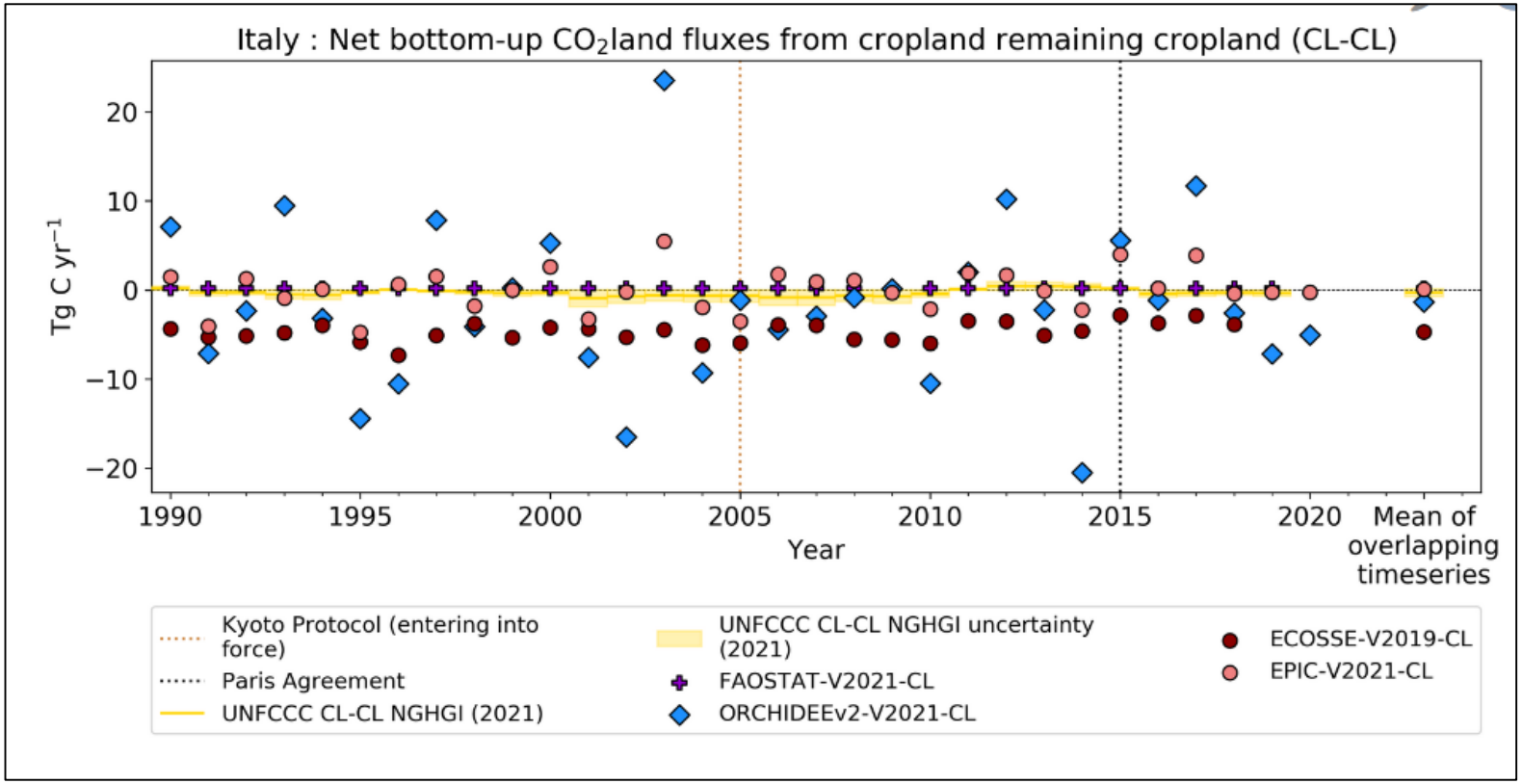

Italy : Comparison of top-down vs. bottom-up net land CO_2land fluxes
Tg C yr^{-1}
50
25
0
−25
−50
−75
−100
1990
1995
2000
2005
2010
2015
2020
Mean of overlapping timeseries
Year
Kyoto Protocol (entering into force)
Paris Agreement
UNFCCC LULUCF NGHGI (2021)
UNFCCC LULUCF NGHGI (2021) uncertainty
FAOSTAT-V2021
Mean of EUROCOMv2 inversions
Min/Max of EUROCOMv2 inversions
Mean of GCP inversions (2021)
Min/Max of GCP inversions (2021)
Mean of CarboScopeReg V2021
Median of TRENDY v10 DGVMs
Min/Max of TRENDY v10 DGVMs
ORCHIDEEv2-S3-V2021
BLUEvVERIFY-V2021
BLUEvGCP-V2021
H&N-V20212


Italy : Comparison of top-down vs. bottom-up (aggregated) net land CO_2 fluxes
Tg C yr^{-1}
50
25
0
−25
−50
−75
−100
1990
1995
2000
2005
2010
2015
2020
Mean of overlapping timeseries
Year
Kyoto Protocol (entering into force)
Paris Agreement
UNFCCC LULUCF NGHGI (2021)
UNFCCC LULUCF NGHGI (2021) uncertainty
Mean of EUROCOMv2 inversions
Min/Max of EUROCOMv2 inversions
Mean of GCP inversions (2021)
Min/Max of GCP inversions (2021)
Mean of CarboScopeReg V2021
Median of TRENDY v10 DGVMs
Min/Max of TRENDY v10 DGVMs
FAOSTAT-V2021
H&N-V20212
BLUEvGCP-V2021
Mean of BU estimates (VERIFY)
Min/Max of BU estimates (VERIFY)

LAND REPRESENTATION

- A consistent land representation is key for LULUCF estimation of GHG emissions and removals: the **EO** could be more than needed to address this challenge.
- **e.g.** *CORINE LAND COVER* is not suitable to be used as basis for land representation (due to minimum mapping unit CLC 25 ha vs FAO forest definition at least 0,5 ha + problems in mountains areas => forest underestimated 30% in Italy in respect to Forest Inventory). A CLC for LULUCF for 2018 has been prepared by MMSS at the end of 2021.

CL-CL

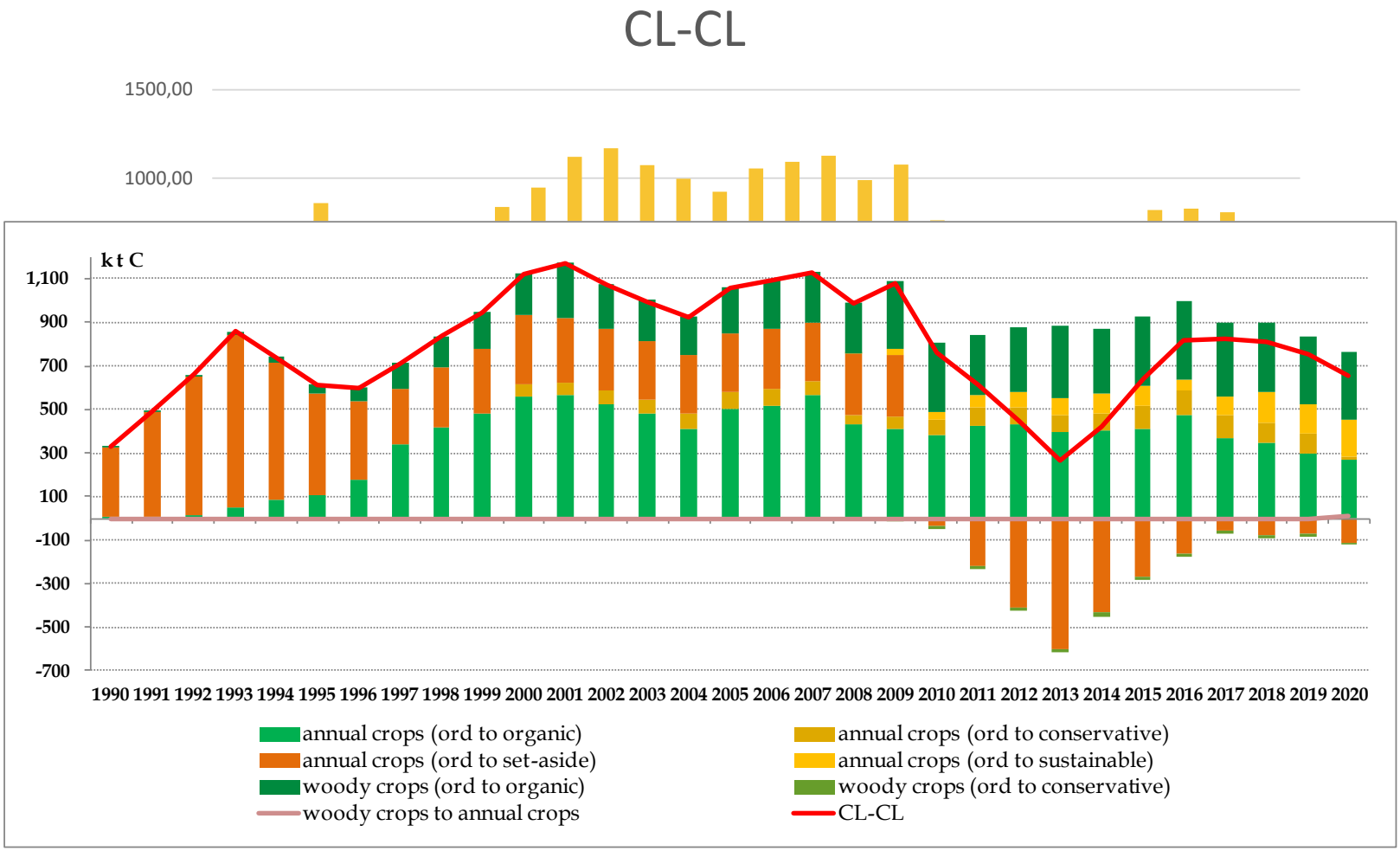


- Are the changes of **management practices** considered?

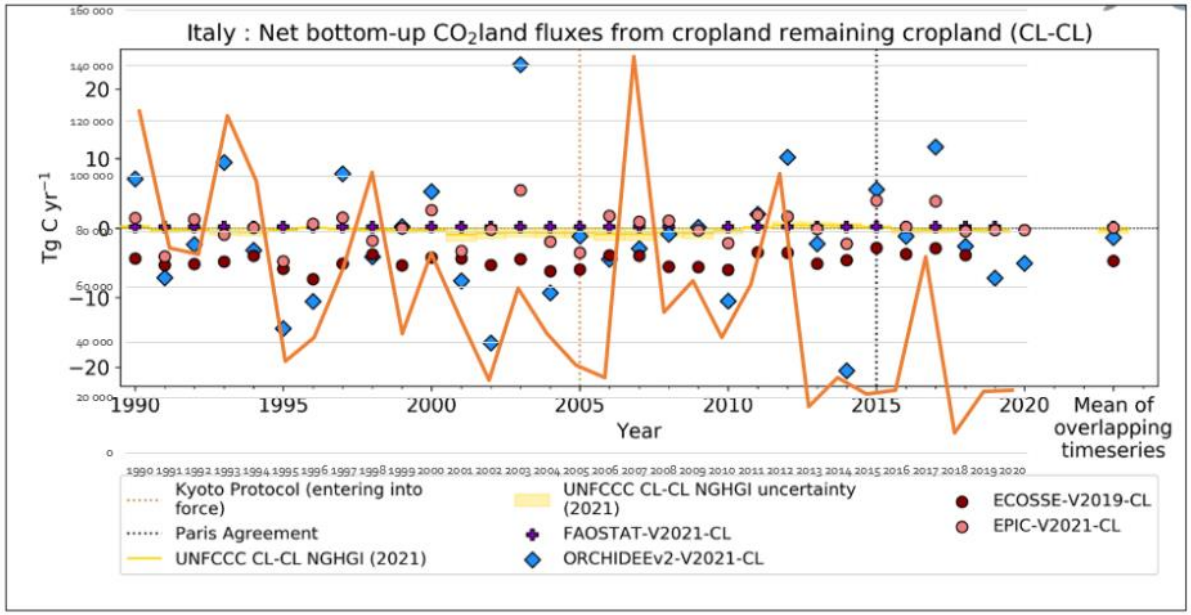
  In the Italian GHGI a relevant amount of the CO2 emissions and removals, under CL-CL, is due to the **soils C stock changes**, in relation to a change in management practices, with a stock increasing trend due to expansion of sustainable management practices.

- **Perennial crops**: the GHG estimates take into account the mean age and harvest/maturity cycle of the orchards. Biomass removed (and related CO2 emissions) when the orchard is removed.

CL-CL


CL-CL
1500,00
1000,00
k t C
1,100
900
700
500
300
100
-100
-300
-500
-700
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
annual crops (ord to organic)
annual crops (ord to conservative)
annual crops (ord to set-aside)
annual crops (ord to sustainable)
woody crops (ord to organic)
woody crops (ord to conservative)
woody crops to annual crops
CL-CL

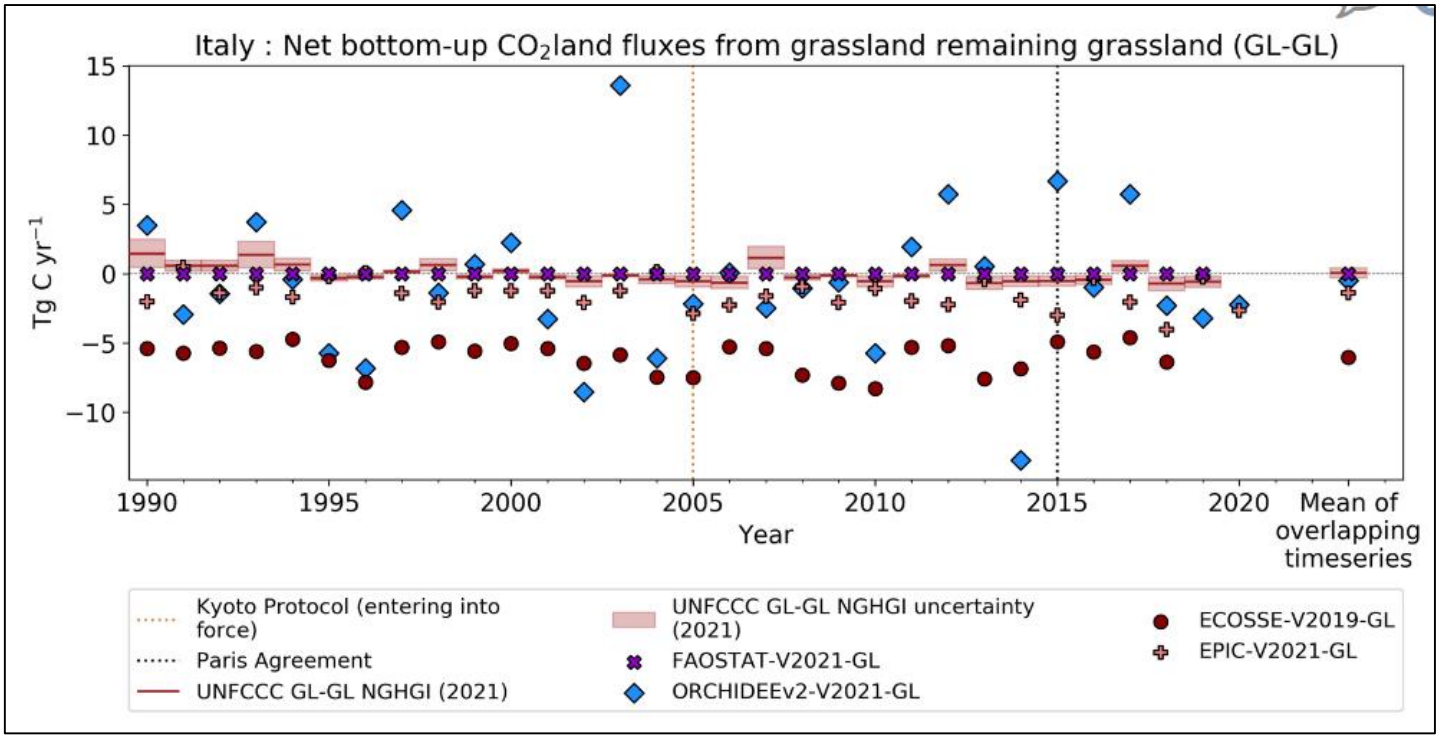
CL-CL



- **ORCHIDEE** simulation is affected by a large interannual variability: why?

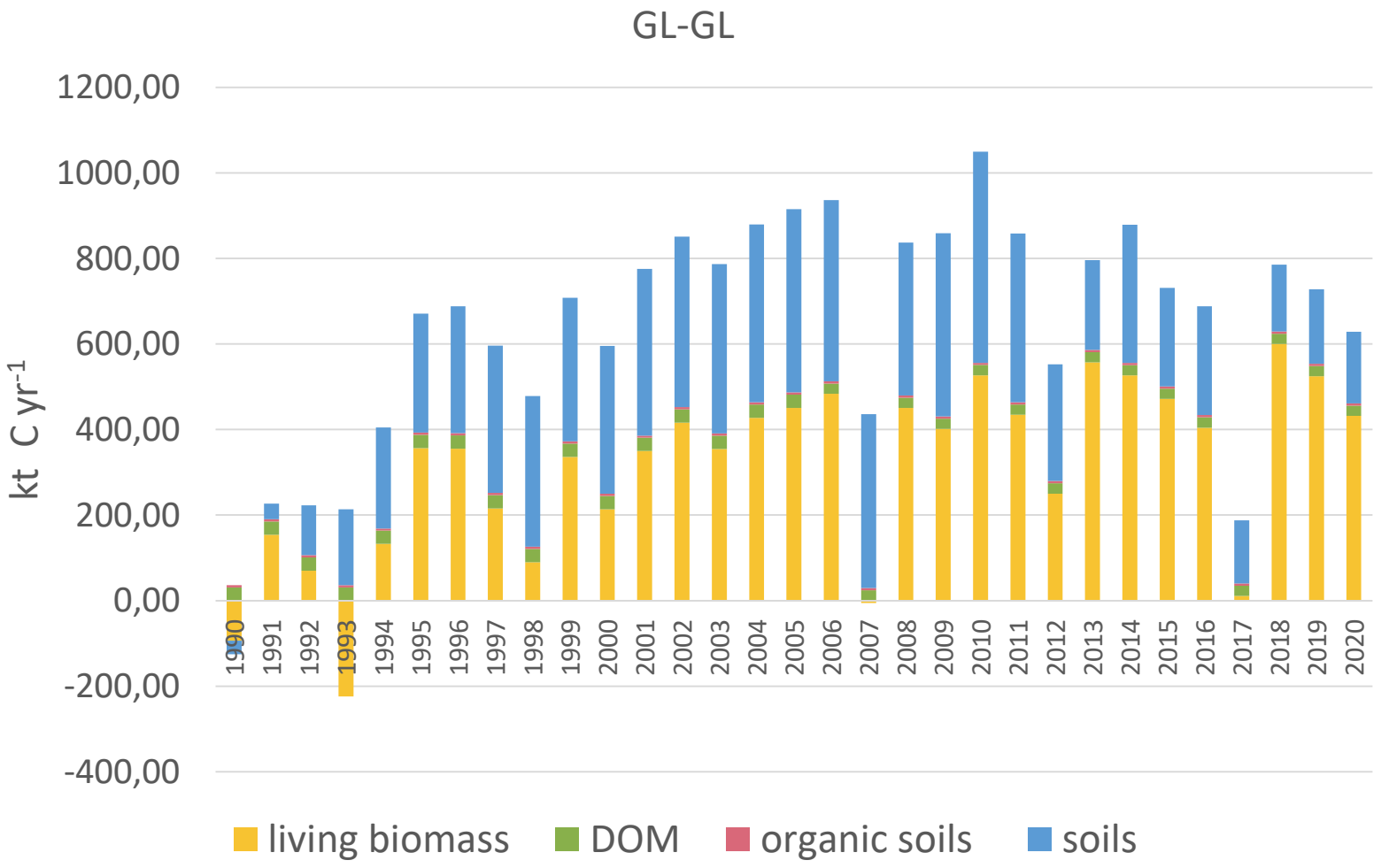
- Are **fires** considered for cropland in BU VERIFY elaborations? Could emission peaks be explained with fires? Fires are included in our inventory, using data on burned area and emissions factors related to woody crops to estimate GHG emissions. The orange line represent burned cropland area (kha): some peaks correspond, but others don't (e.g. 2005 and 2015).

GL-GL

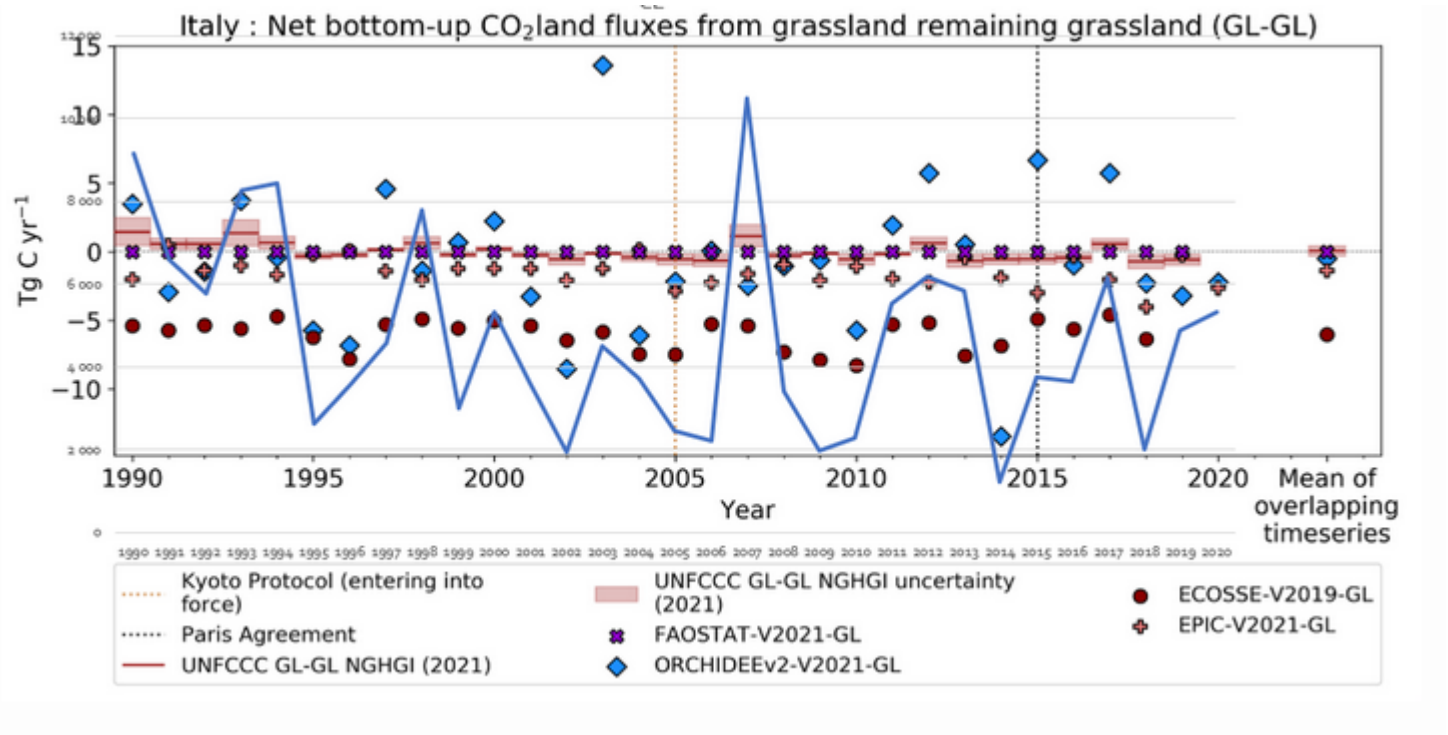


- Are the changes of management practices considered? Also for grassland increasing trend of soil carbon stock **SOC change** due to a change in management practices (e.g. expansion of sustainable management practices)

- **Gradual woody encroachment:** from grazing land to other wooded land due to abandonment of rural lands. Increasing living biomass.

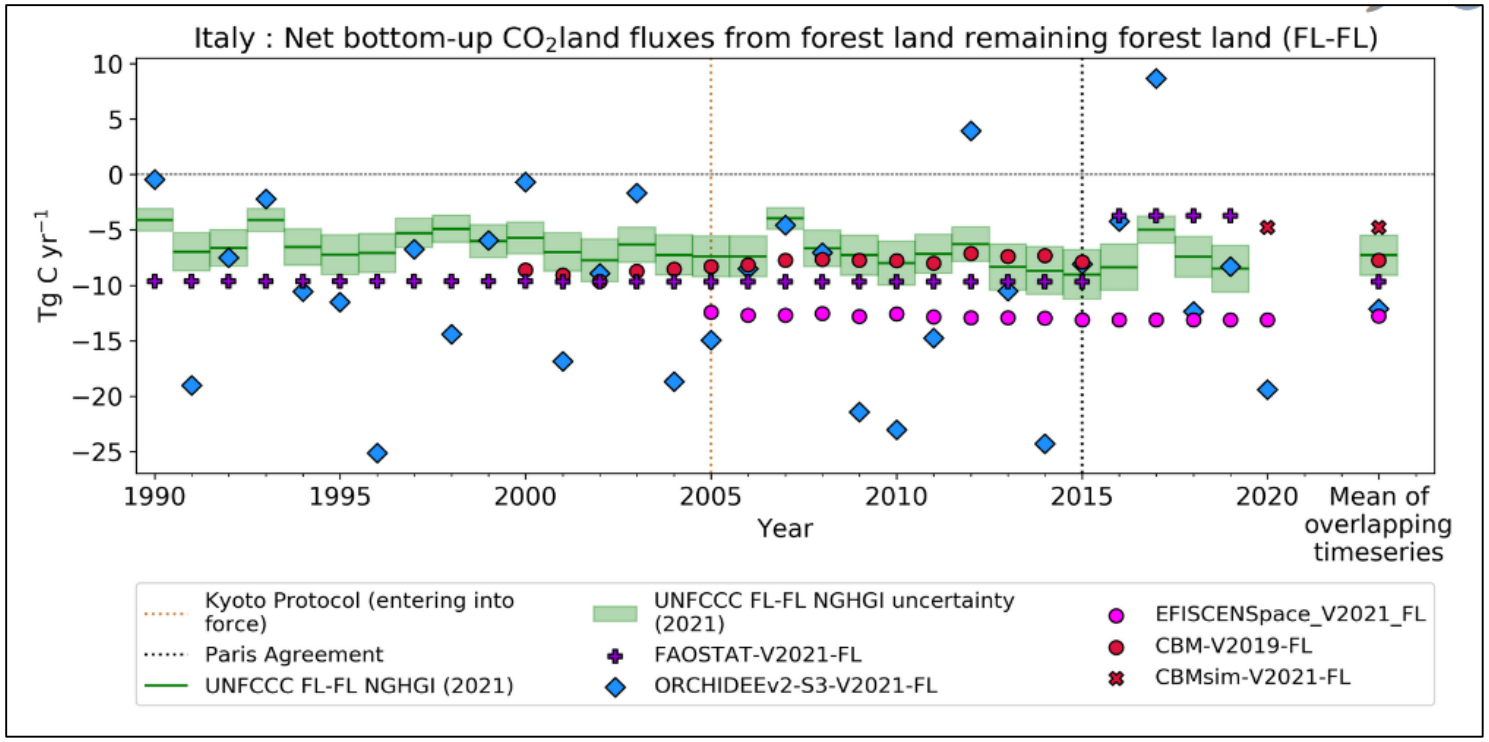

GL-GL
1200,00
1000,00
800,00
600,00
400,00
200,00
0,00
-200,00
-400,00
kt C yr-1
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
living biomass
DOM
organic soils
soils

GL-GL

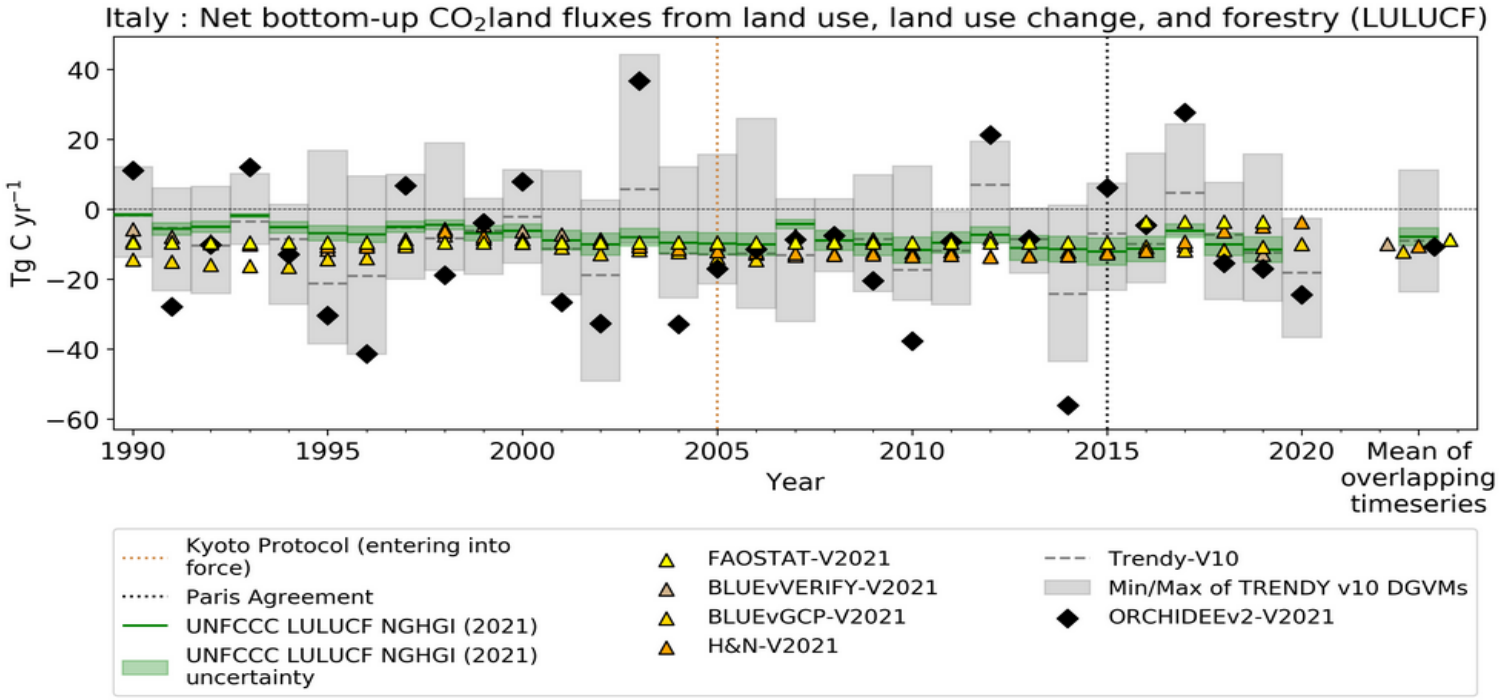


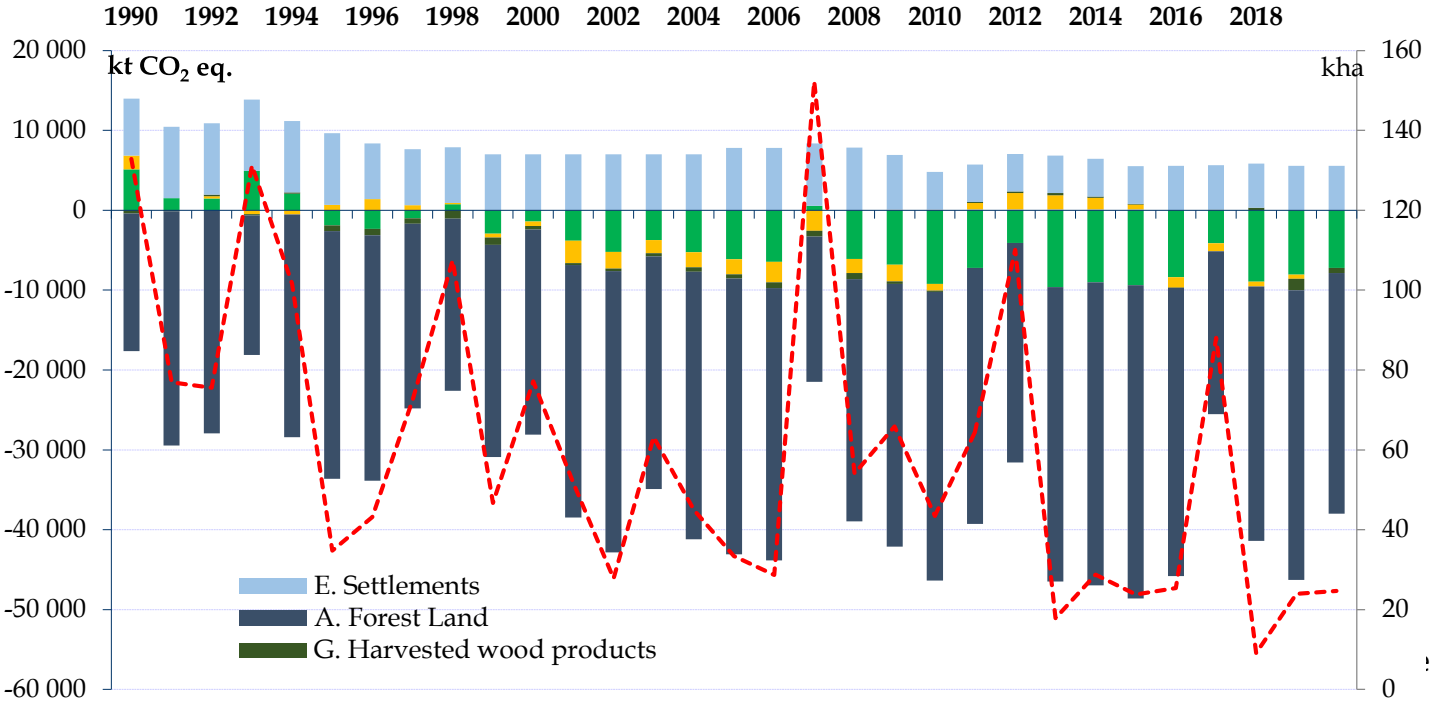
- **ORCHIDEE** simulation is affected by a large interannual variability: why?
- The blue line represents burned grassland areas (kha): no correlation is noticeable

FL-FL



- **FAOSTAT** data shows a nice match with the GHGI data (the FL data in FAOSTAT comes from FAO-FRA country report);
- Also considering previous experience with use of **EFISCEN** model (i.e. the Forest Management Reference Level set by JRC/IIASA/EFI), the key issues are:
  - which data input has been used for the forest area?
  - how model used fellings (removals + residues) as model inputs?
  - Has Age class structure been considered? Only for even aged forest?
- **CMB**: the model is parameterized for Canada; has CBM re-parameterized for europe? Or for each country? which data input has been used for the forest area? Has Age class structure been considered? How harvest has been considered?


Italy : Net bottom-up CO_2land fluxes from land use, land use change, and forestry (LULUCF)
Tg C yr^{-1}
40
20
0
−20
−40
−60
1990
1995
2000
2005
2010
2015
2020
Year
Mean of overlapping timeseries
Kyoto Protocol (entering into force)
Paris Agreement
UNFCCC LULUCF NGHGI (2021)
UNFCCC LULUCF NGHGI (2021) uncertainty
FAOSTAT-V2021
BLUEvVERIFY-V2021
BLUEvGCP-V2021
H&N-V2021
Trendy-V10
Min/Max of TRENDY v10 DGVMs
ORCHIDEEv2-V2021

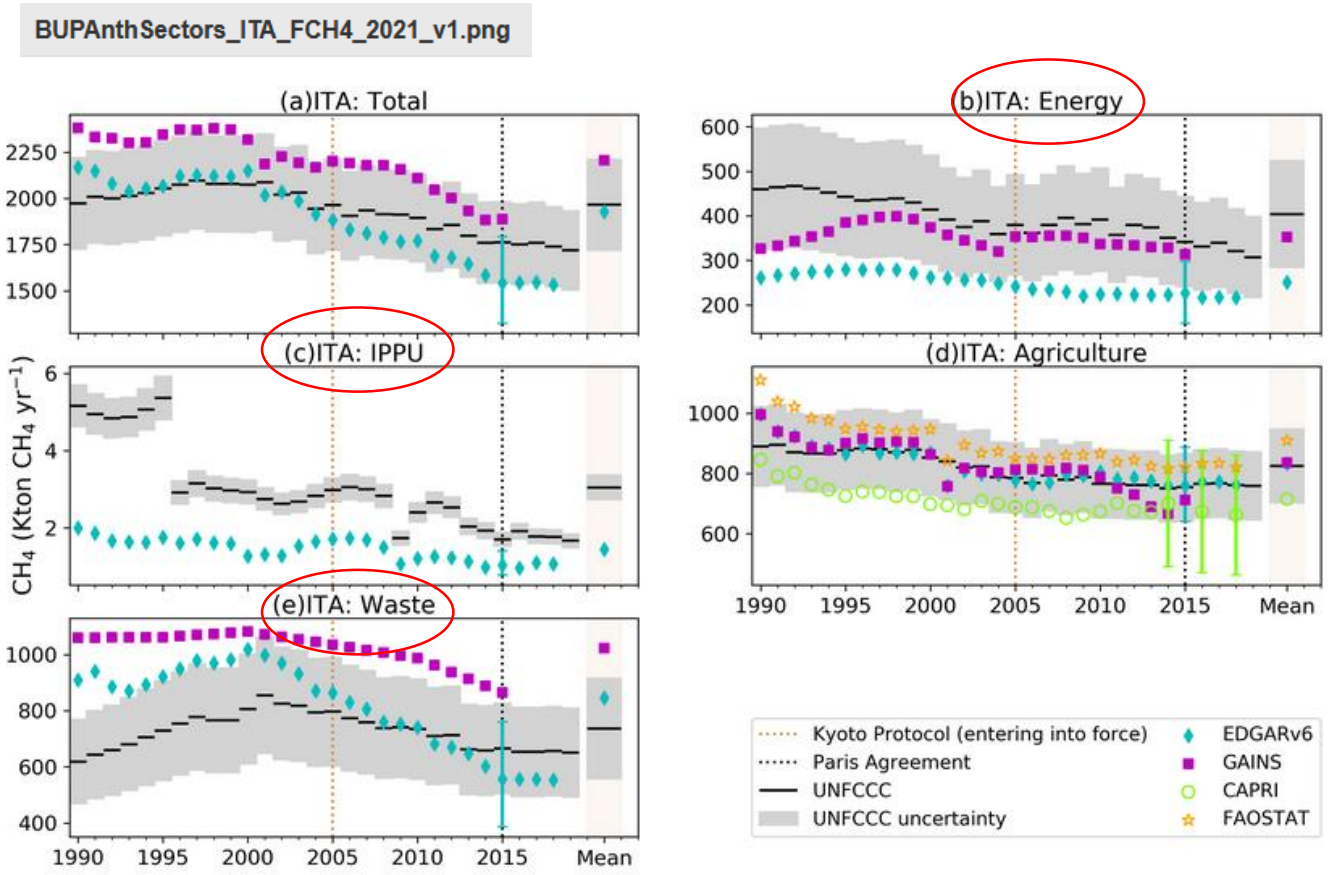

1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
kt CO_2 eq.
kha
20 000
10 000
0
-10 000
-20 000
-30 000
-40 000
-50 000
-60 000
160
140
120
100
80
60
40
20
0
E. Settlements
A. Forest Land
G. Harvested wood products

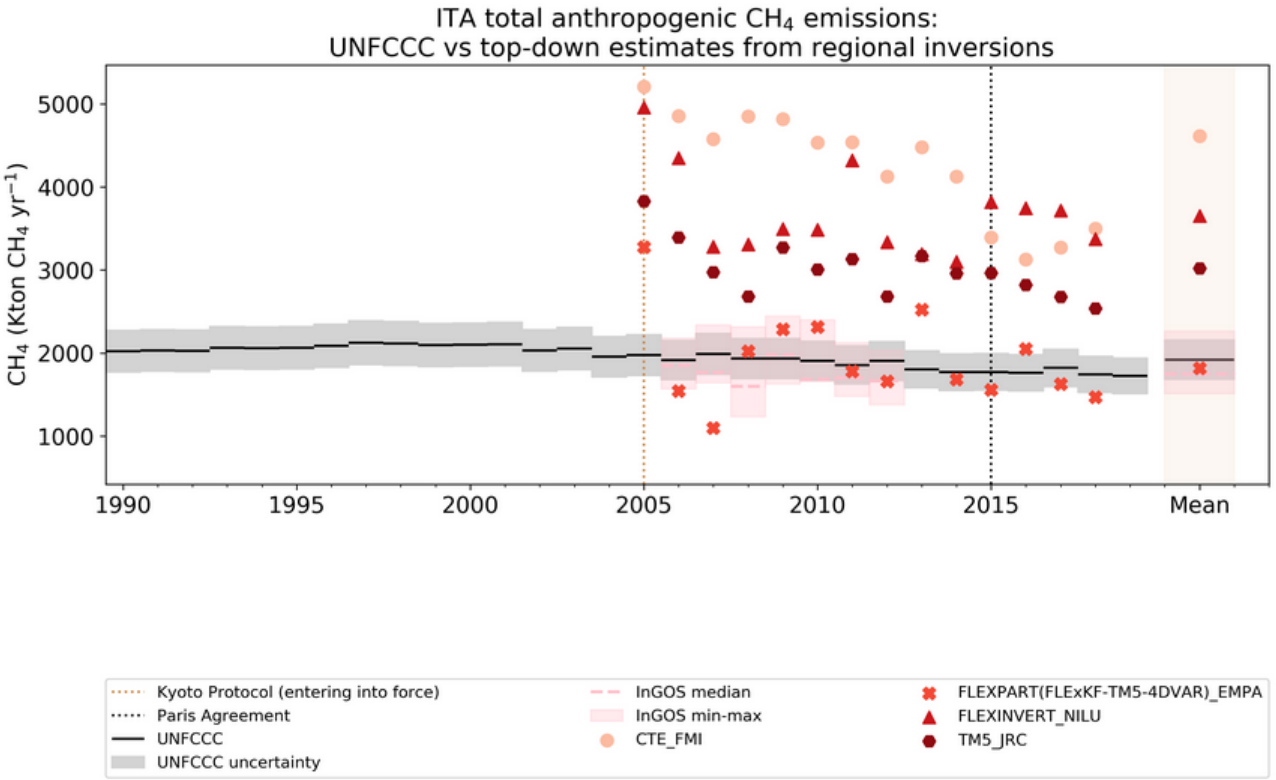
CH_4

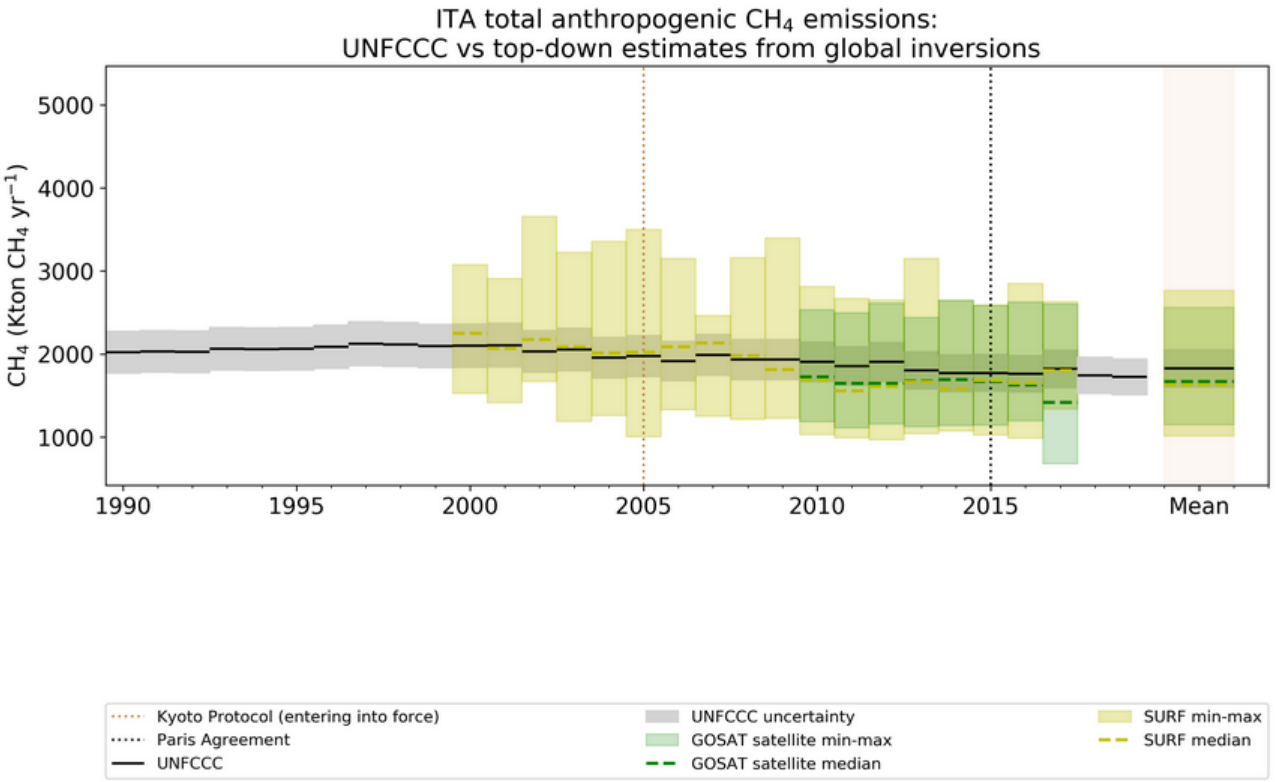
- Global inversions higher variability range (min-max) than inventory uncertainty values

- 3/5 regional inversions provides considerably higher CH4 estimates than the national GHGI: TM5, Flexinvert, CTE_FMI. Which sector? Explicable with models' features? Fugitive emissions from energy sector or waste?

- CH4 from LULUCF (biomass burning) could be represented separately in BUPA graphs, as the reporte total UNFCCC value include LULUCF (156 – 1511 t CO_{2eq})


BUPAnthSectors_ITA_FCH4_2021_v1.png
(a)ITA: Total
(b)ITA: Energy
(c)ITA: IPPU
(d)ITA: Agriculture
(e)ITA: Waste
CH4 (Kton CH4 yr−1)
1990
1995
2000
2005
2010
2015
Mean
Kyoto Protocol (entering into force)
Paris Agreement
UNFCCC
UNFCCC uncertainty
EDGARv6
GAINS
CAPRI
FAOSTAT


ITA total anthropogenic CH_4 emissions:
UNFCCC vs top-down estimates from regional inversions
CH_4 (Kton CH_4 yr^{-1})
5000
4000
3000
2000
1000
1990
1995
2000
2005
2010
2015
Mean
Kyoto Protocol (entering into force)
Paris Agreement
UNFCCC
UNFCCC uncertainty
InGOS median
InGOS min-max
CTE_FMI
FLEXPART(FLExKF-TM5-4DVAR)_EMPA
FLEXINVERT_NILU
TM5_JRC


ITA total anthropogenic CH_4 emissions:
UNFCCC vs top-down estimates from global inversions
CH_4 (Kton CH_4 yr^{-1})
5000
4000
3000
2000
1000
1990
1995
2000
2005
2010
2015
Mean
Kyoto Protocol (entering into force)
Paris Agreement
UNFCCC
UNFCCC uncertainty
GOSAT satellite min-max
GOSAT satellite median
SURF min-max
SURF median

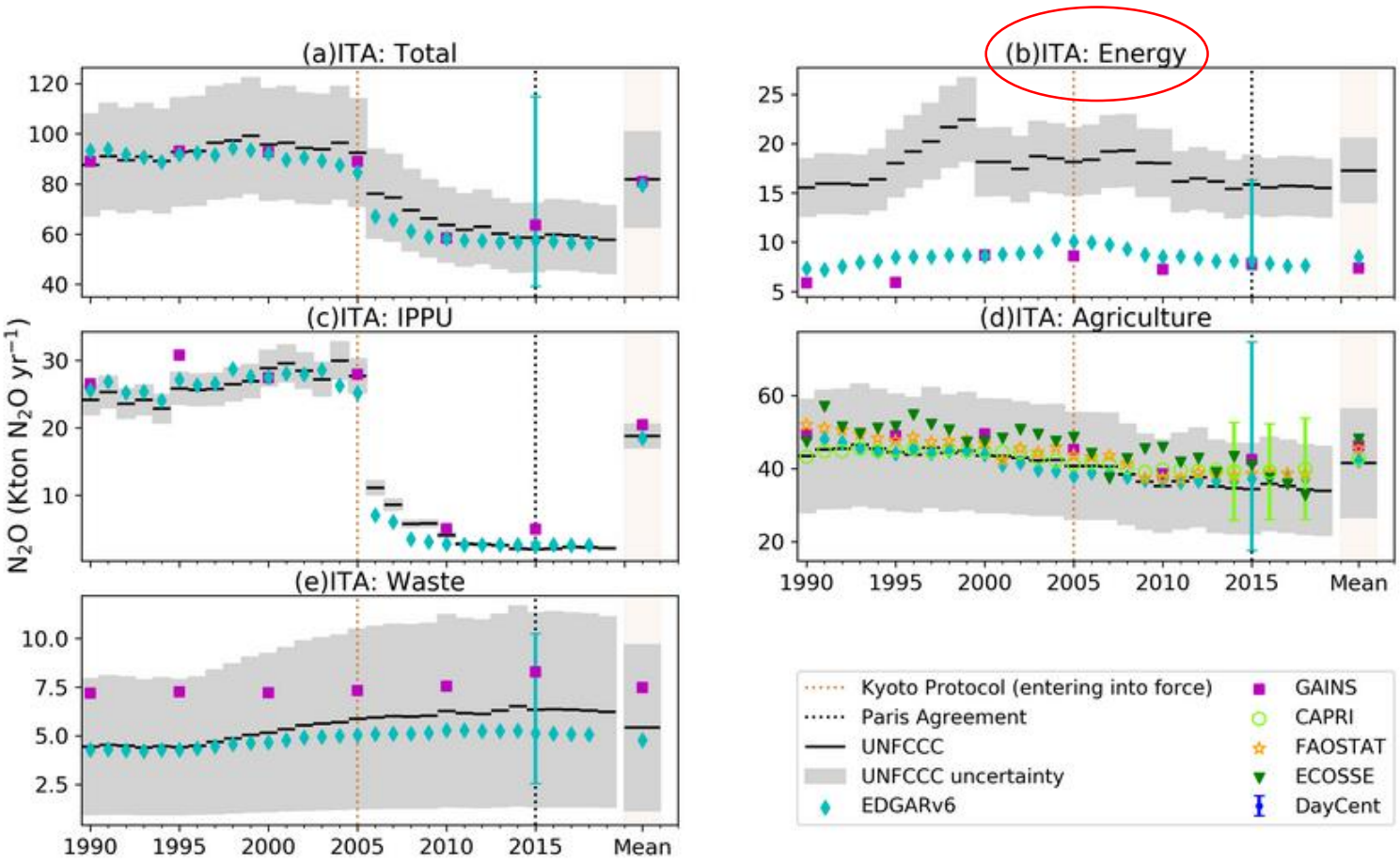
N_2O

- 2/4 regional inversions provides higher N_2O estimates than the national GHGI: MACTM JAMSTEC, TOMCAT LEEDS. Which sector? Explicable with models' features?

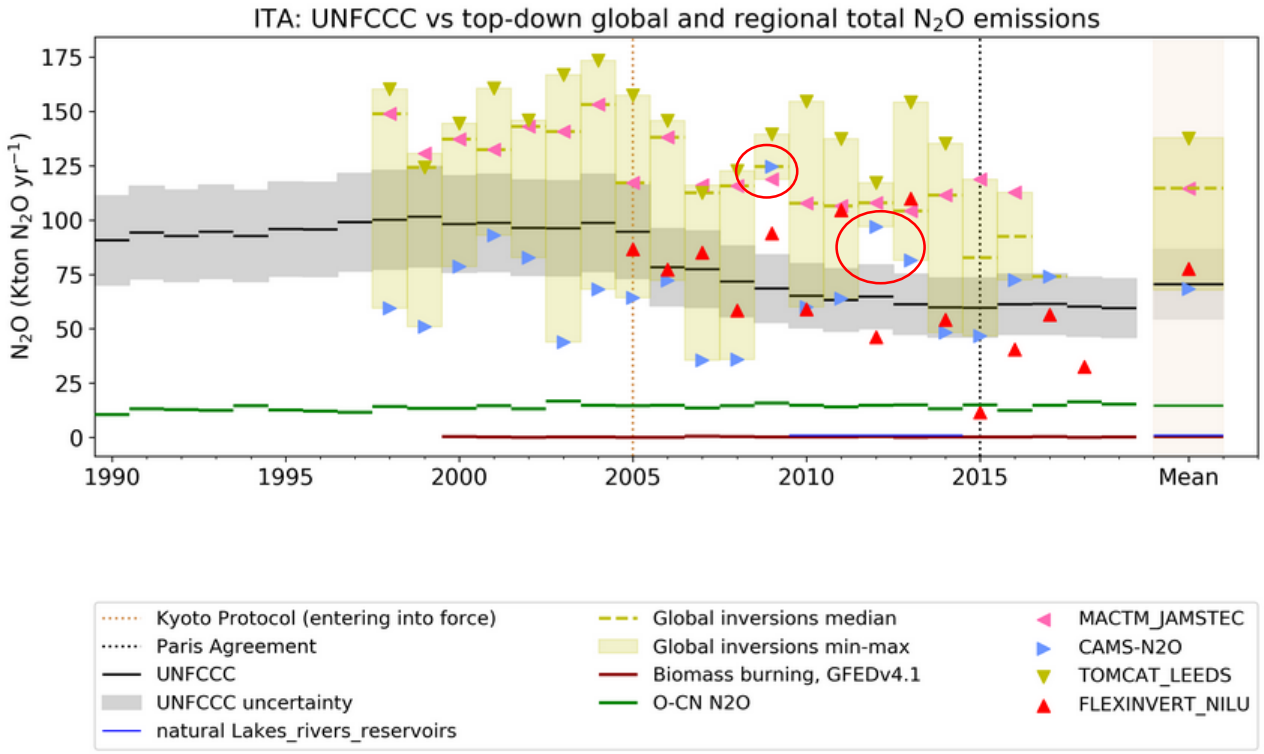
- CAMS-N2O considerable interannual variability for years 2009,2012, 2013. How it can be explained?

- **N_2O from LULUCF** (biomass burning, indirect N_2O resulting from change of land use or management on mineral soils in all land use categories except for cropland remaining cropland) could be represented separately in BU graphs, as the reported UNFCCC total value includes LULUCF (328-1048 t CO_{2eq})

BUPAnthSectors_ITA_FN2O_2021_v1.png



UNFCCCvsVERIFTvsGCP_ITA_FN2O_2021_v1.png



THANKS FOR YOUR ATTENTION

angela.fiore@isprambiente.it

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

Sistema Nazionale per la Protezione dell'Ambiente