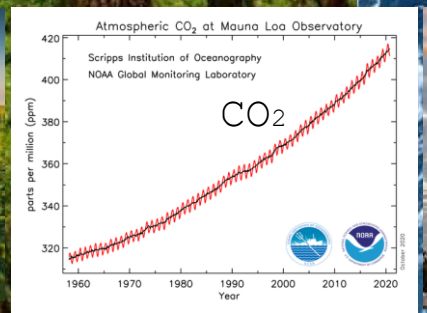
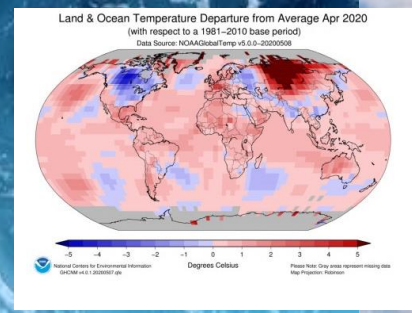
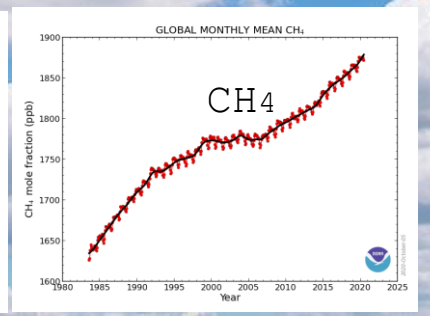
GLOBAL CARBON PROJECT

RECCAP2 – European chapter

Verify GA, May 11, 2022



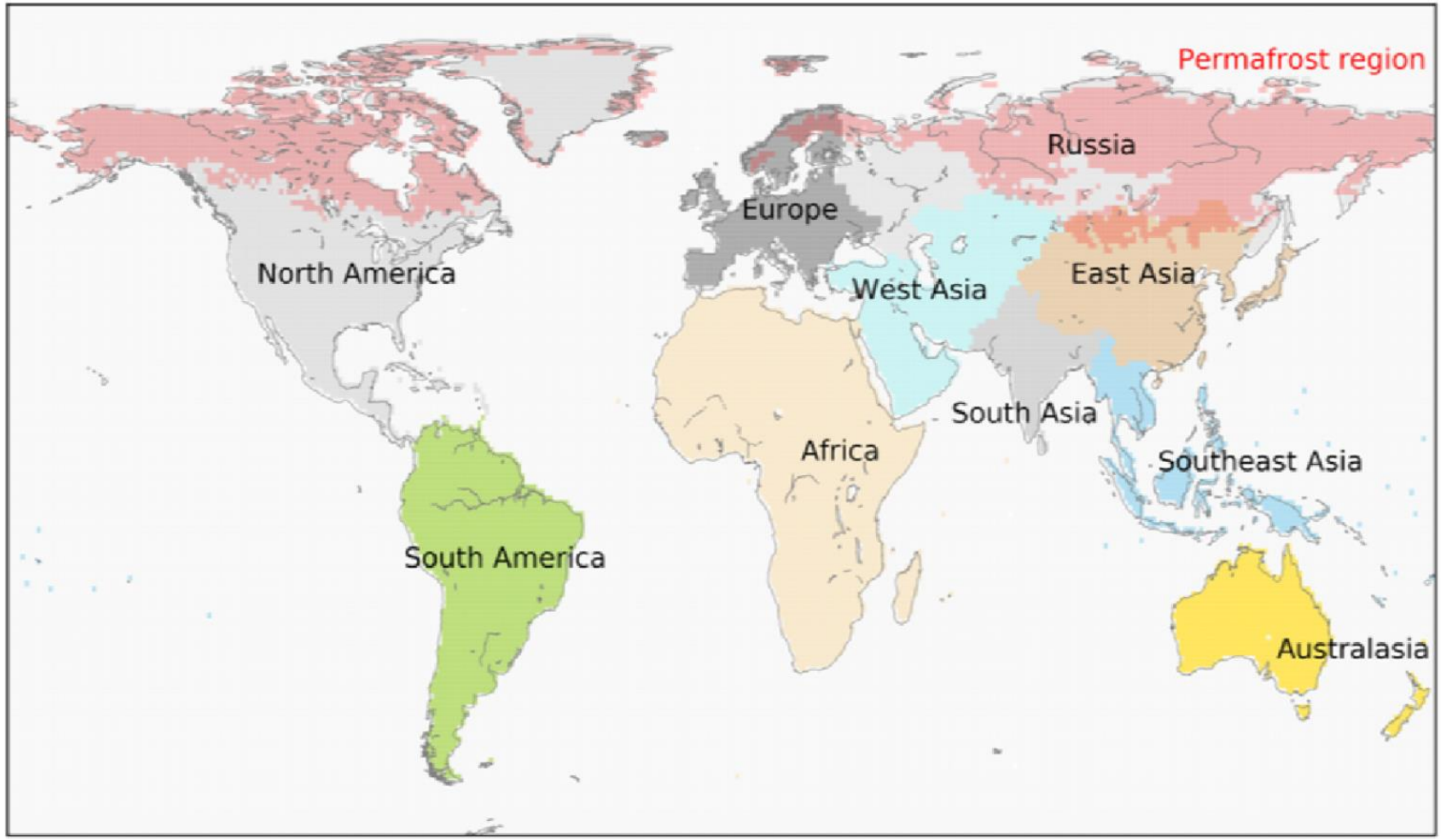




REgional Carbon Cycle Assessment and Processes Project (RECCAP-2)

Regional budgets of C & GHGs (CO_2, CH_4, N_2O), 2010-2019

- 10 land regions
- 5 ocean regions
- Several cross-cutting topics
  - Land-ocean continuum
  - Trade fluxes
  - Permafrost
  - Polar regions
  - Future projections
  - etc.



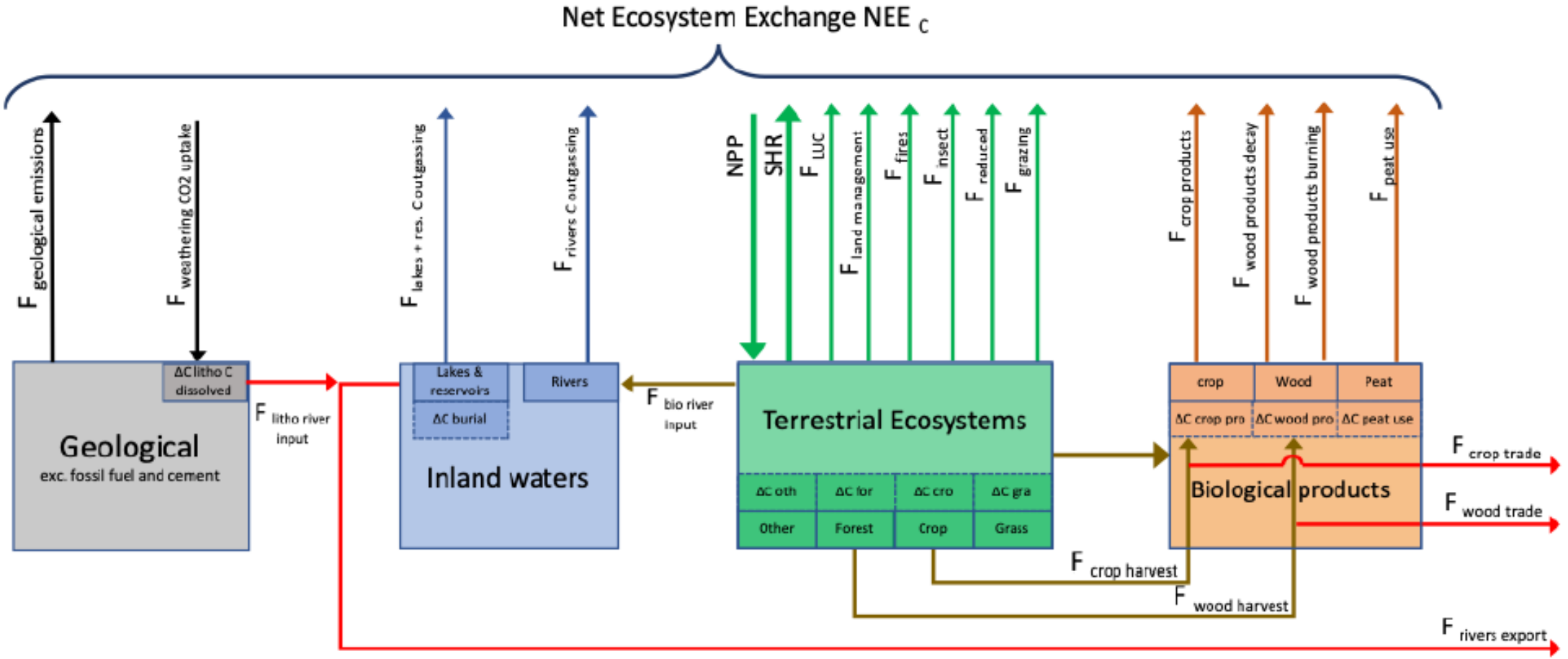
Objectives

European budgets for C and CO_2, CH_4, N_2O over period 2010-2019

IAV of greenhouse gas budgets and its climatic drivers

Drivers of long-term trends in C budgets, location of land C sink

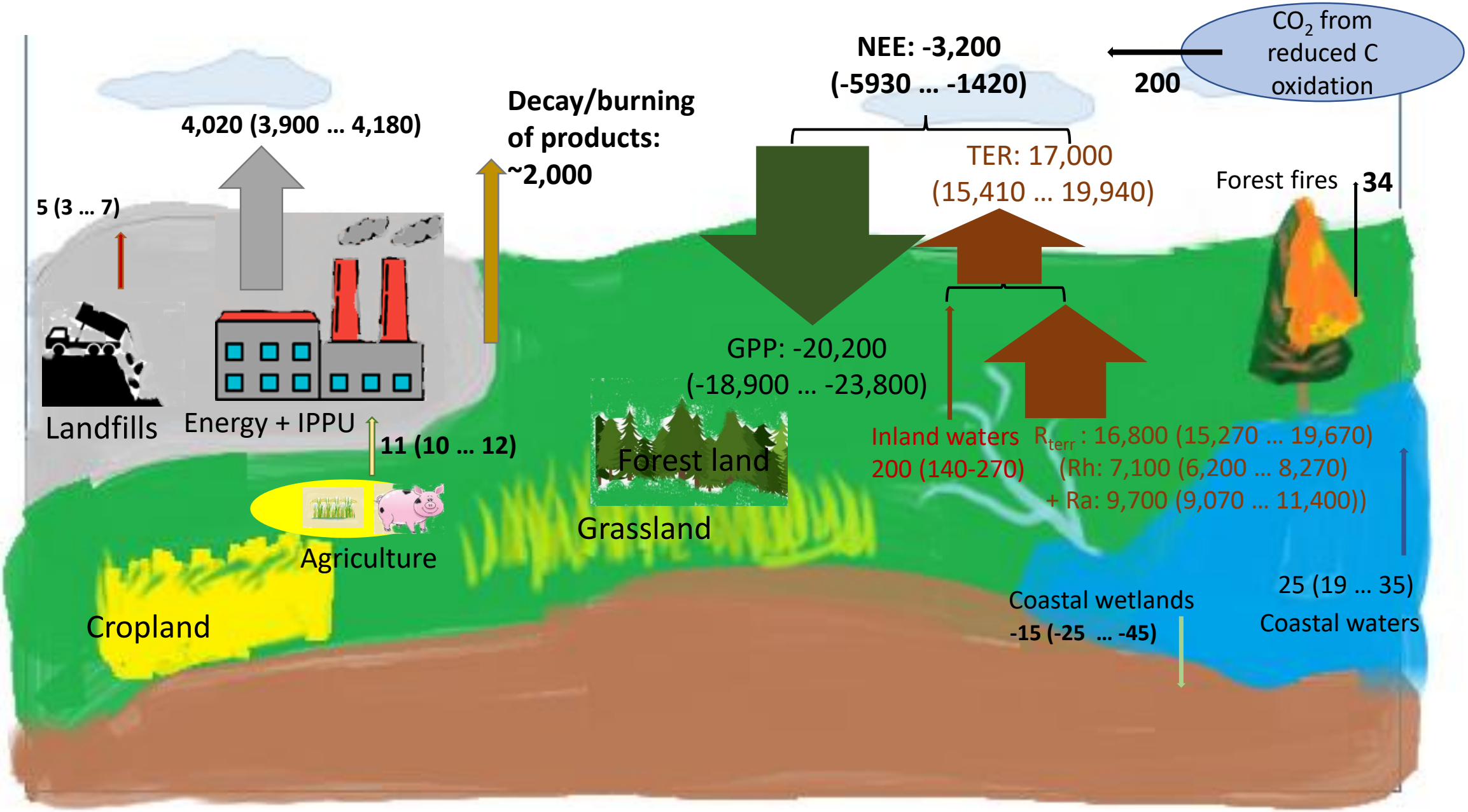
Objectives – C budget



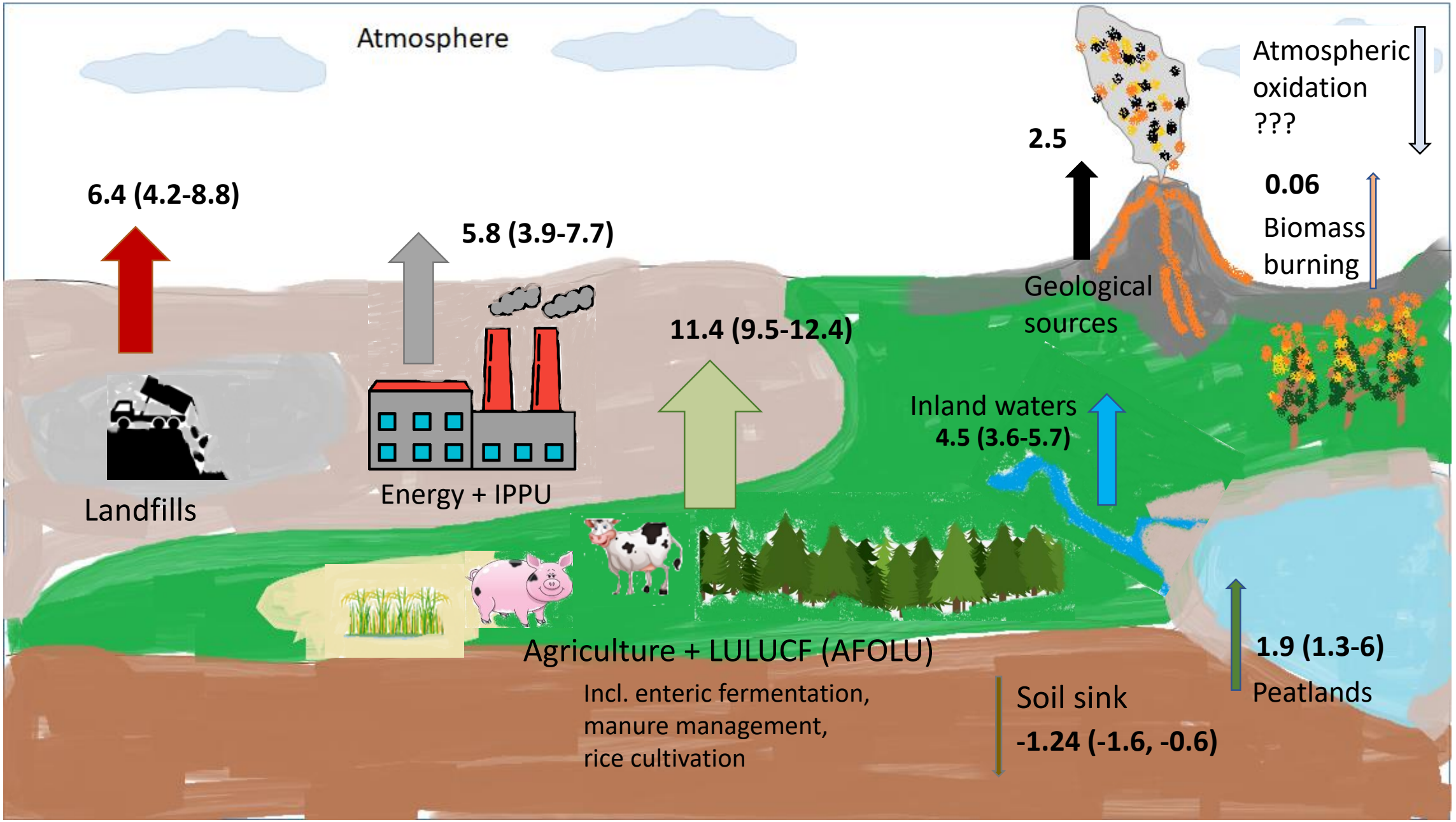
$F_{geological\ emissions}$	= Geological natural emissions	NPP	= Net Primary Production	$F_{crop\ products}$	= Crop products oxidation C emissions
$F_{weathering\ CO2\ uptake}$	= Weathering CO_2 uptake	SHR	= Soil Heterotrophic Respiration	$F_{wood\ products\ decay}$	= Wood products oxidation C emissions
$F_{lakes+res.\ C\ outgassing}$	= Lakes & reservoirs C outgas	F_{LUC}	= Net Land Use Change flux	$F_{wood\ products\ burning}$	= Wood products burning C emissions
$F_{rivers\ C\ outgassing}$	= River C outgassing	$F_{land\ management}$	= Net land management flux	$F_{peat\ use}$	= Peat extraction
		F_{fires}	= Fires total C emissions	$F_{crop\ trade}$	= Crop trade lateral C flux
		F_{insect}	= Grazing & disturbance C emissions	$F_{wood\ trade}$	= Wood trade lateral C flux
		$F_{reduced}$	= Reduced C compounds emissions	$F_{rivers\ export}$	= River C export to estuaries
		$F_{grazing}$	= C emissions from grazing mammals		

Ciais et al. 2022, GMD

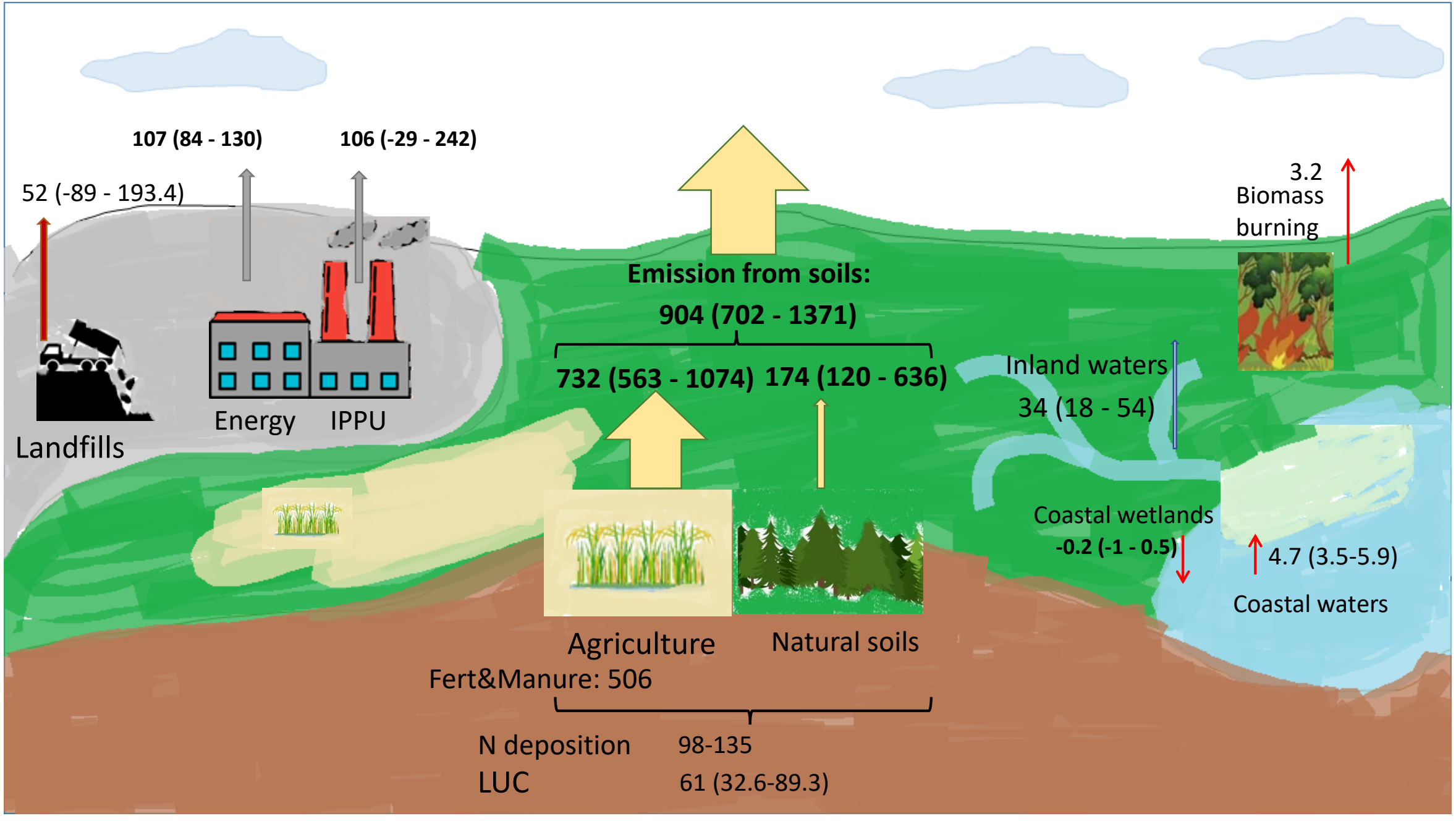
GHG budgets 2010-2019: European CO_2 budget (Tg CO_2 yr^{-1})



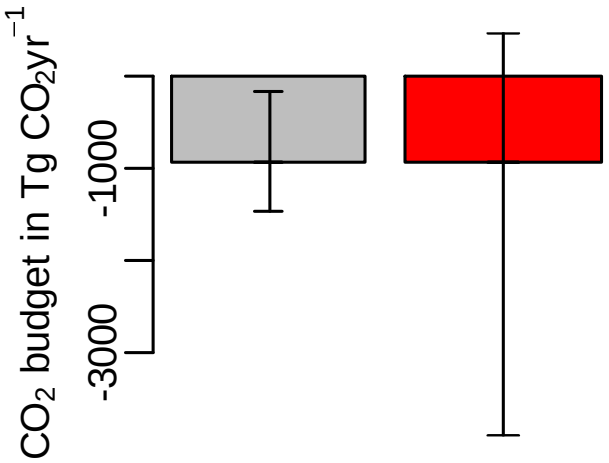
GHG budgets 2010-2019: European CH_4 budget (Tg CH_4 yr^{-1})



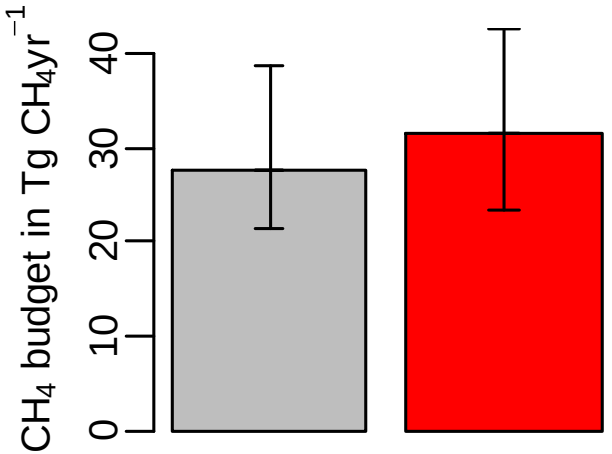
GHG budgets 2010-2019: European N_2O budget (Gg N_2O yr^{-1})



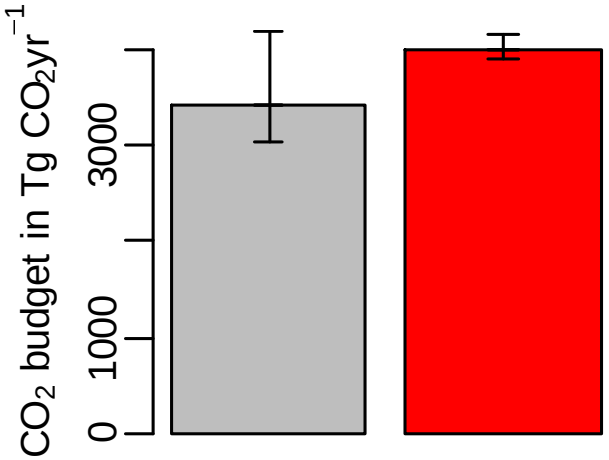
GHG budgets 2010-2019: Bottom-up vs. top-down



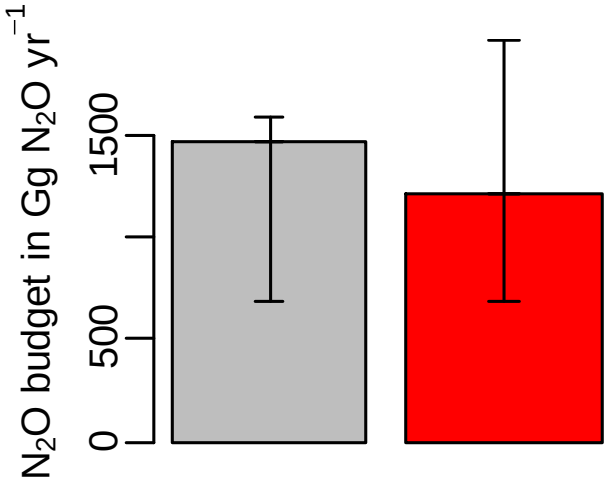
Land-CO_2



CH_4



Fossil fuel CO_2



N_2O

Top-down

Bottom-up

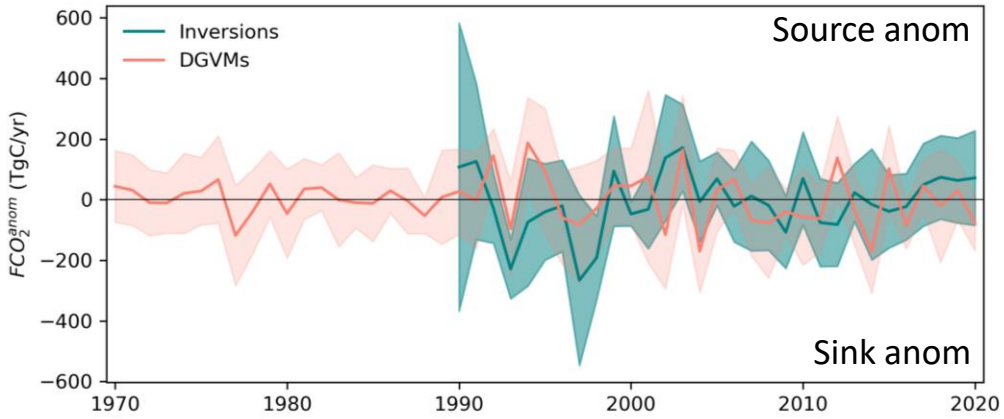
GHG budgets: IAV and climatic drivers

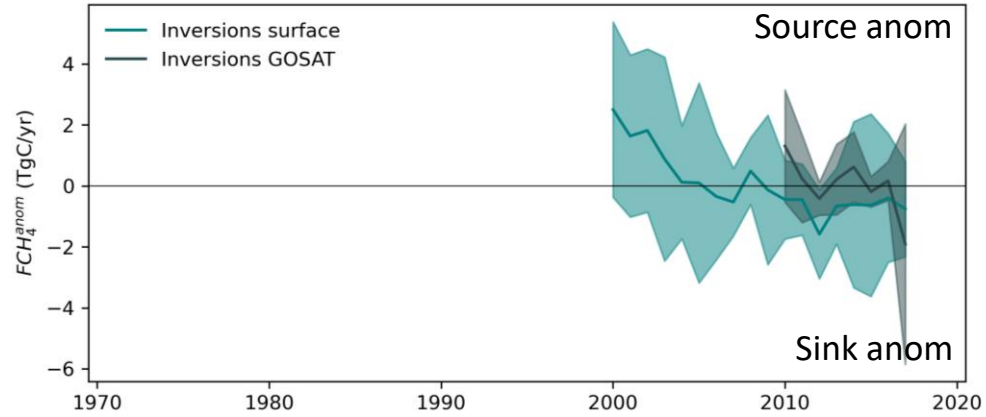
Datasets included so far:

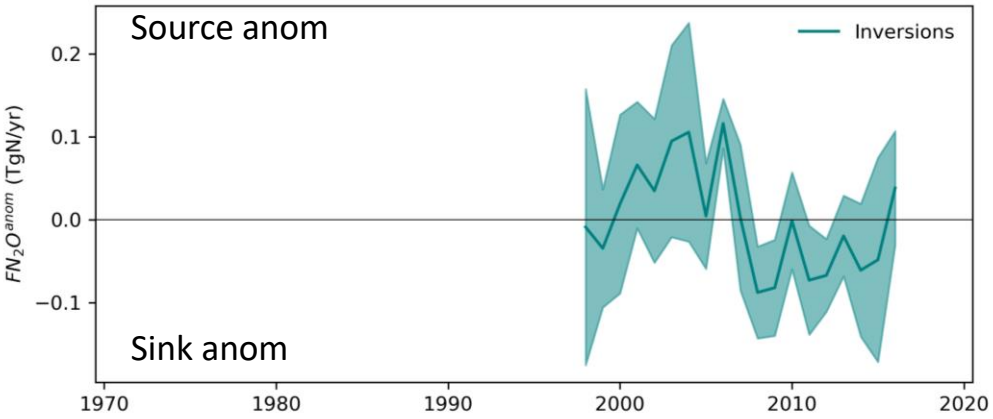
CO_2
Net flux from Atmospheric inversions from GCB2021 (Ingrid data, adjusted) and TRENDYv10 models.

CH_4
Net flux from atmospheric inversions from GMB2018.

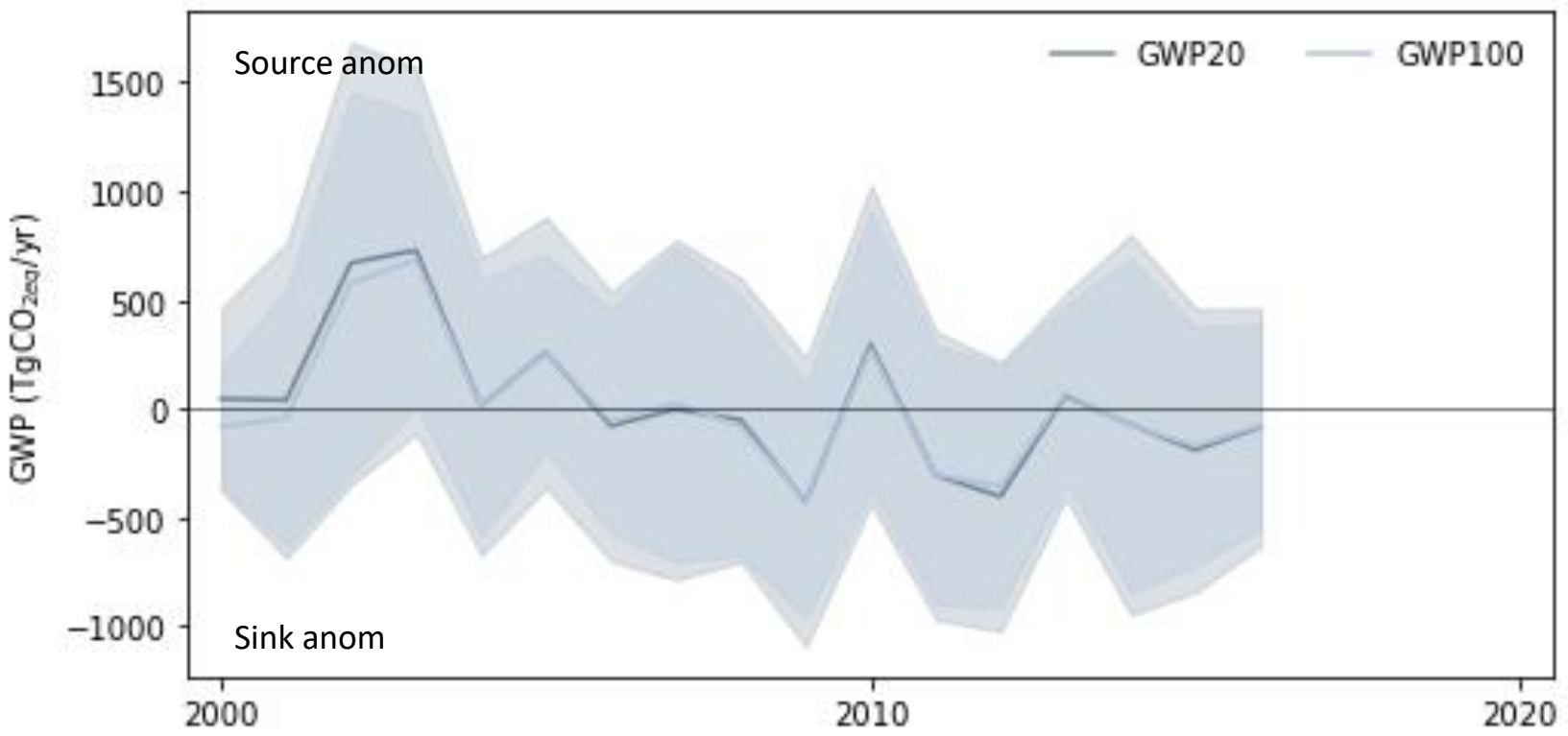
N_2O
Net flux from atmospheric inversions and soil emissions from DGVMS from the Global N_2O budget.







GHG budgets: IAV and climatic drivers



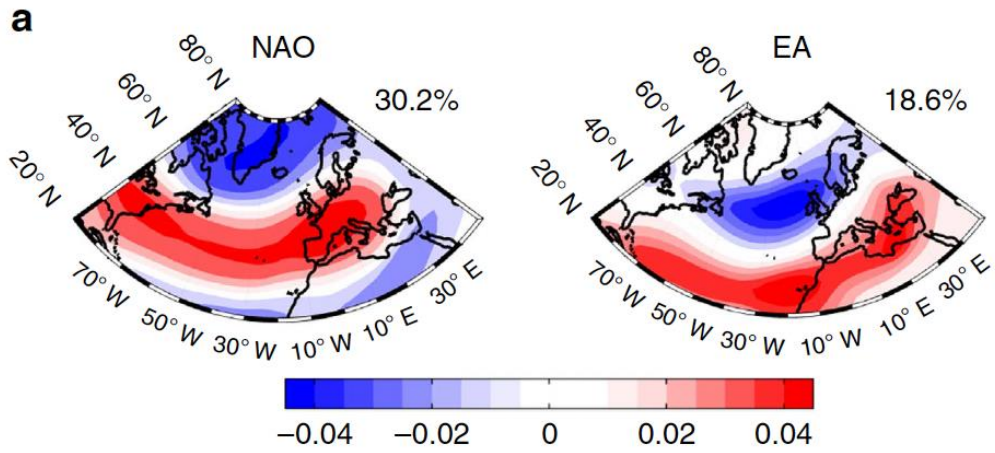
GWP calculation:

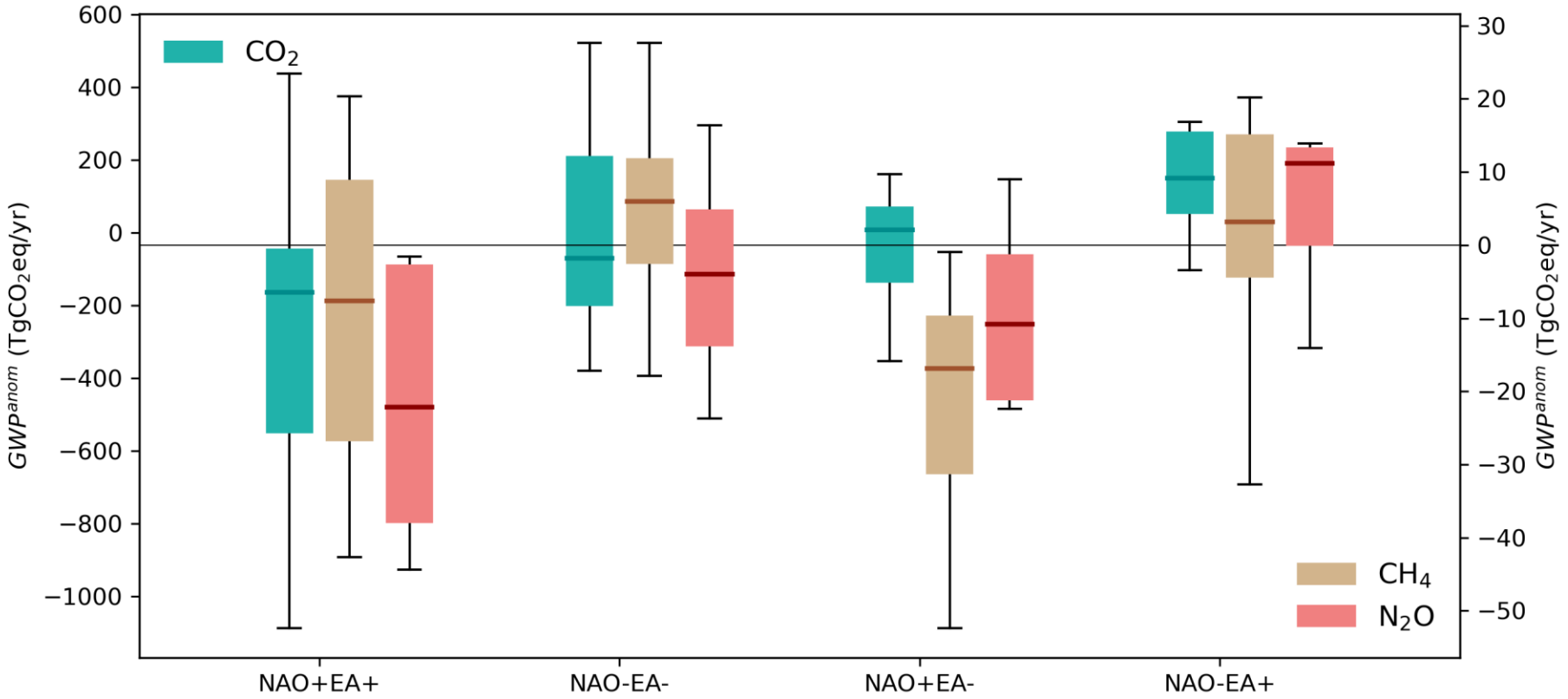
	20Y	100Y
CH_4	86	34
N_2O	268	298

IAV (1σ) of net fluxes (mean of all inversions):
CO_2: 101.5 TgC/yr → **373** $TgCO_2eq/yr$
CH_4: 0.99 TgCH4/yr
(85 $TgCO_2eq/yr$ for GWP20, 34 $TgCO_2eq/yr$ for GWP100)
N_2O: 0.06 TgN2O/yr (17 $TgCO_2eq/yr$ for GWP20, 19 $TgCO_2eq/yr$ for GWP100)

IAV (1σ) of combined GWP:
GWP20: **319** $TgCO_2eq/yr$
GWP100: 296 $TgCO_2eq/yr$

GHG budgets: IAV and climatic drivers

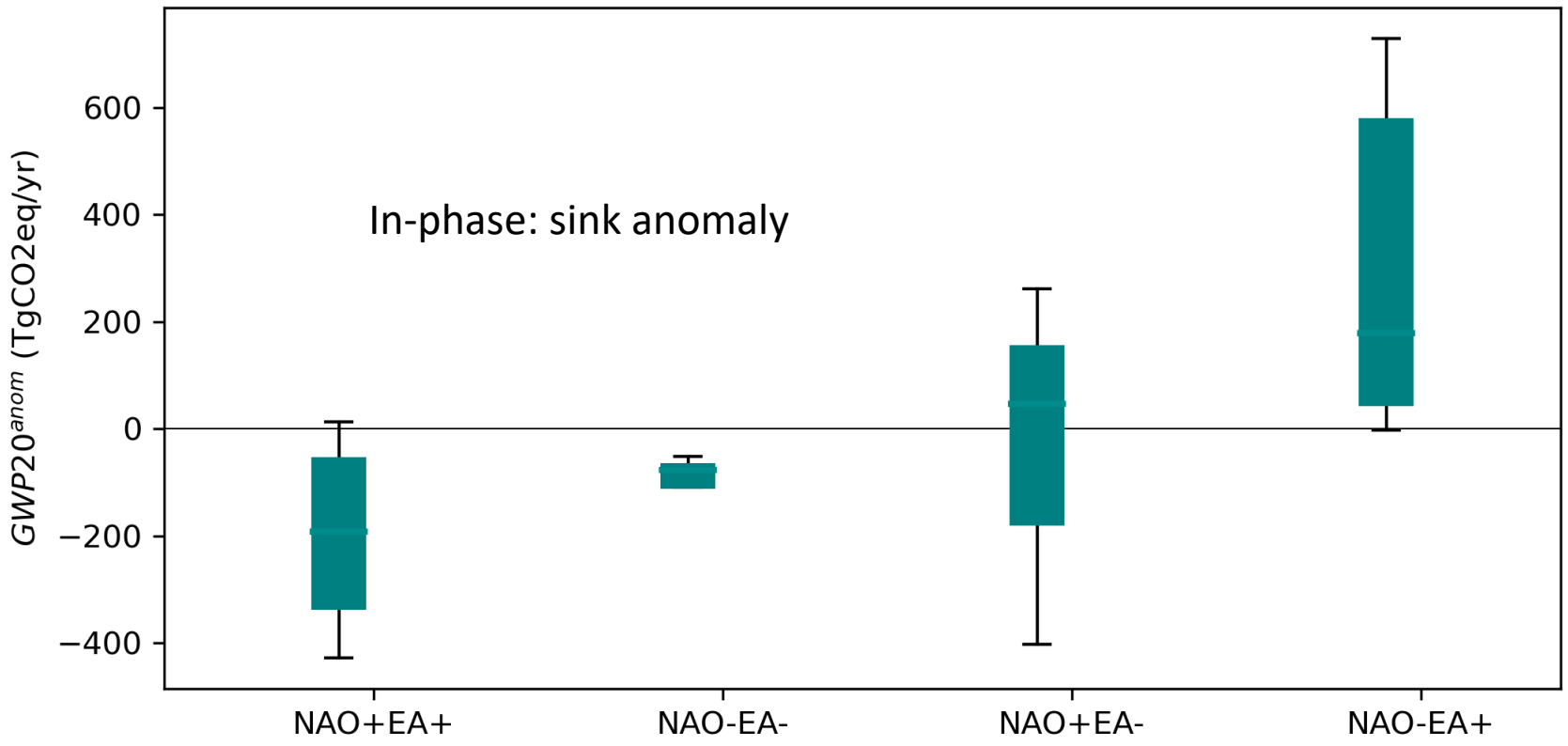




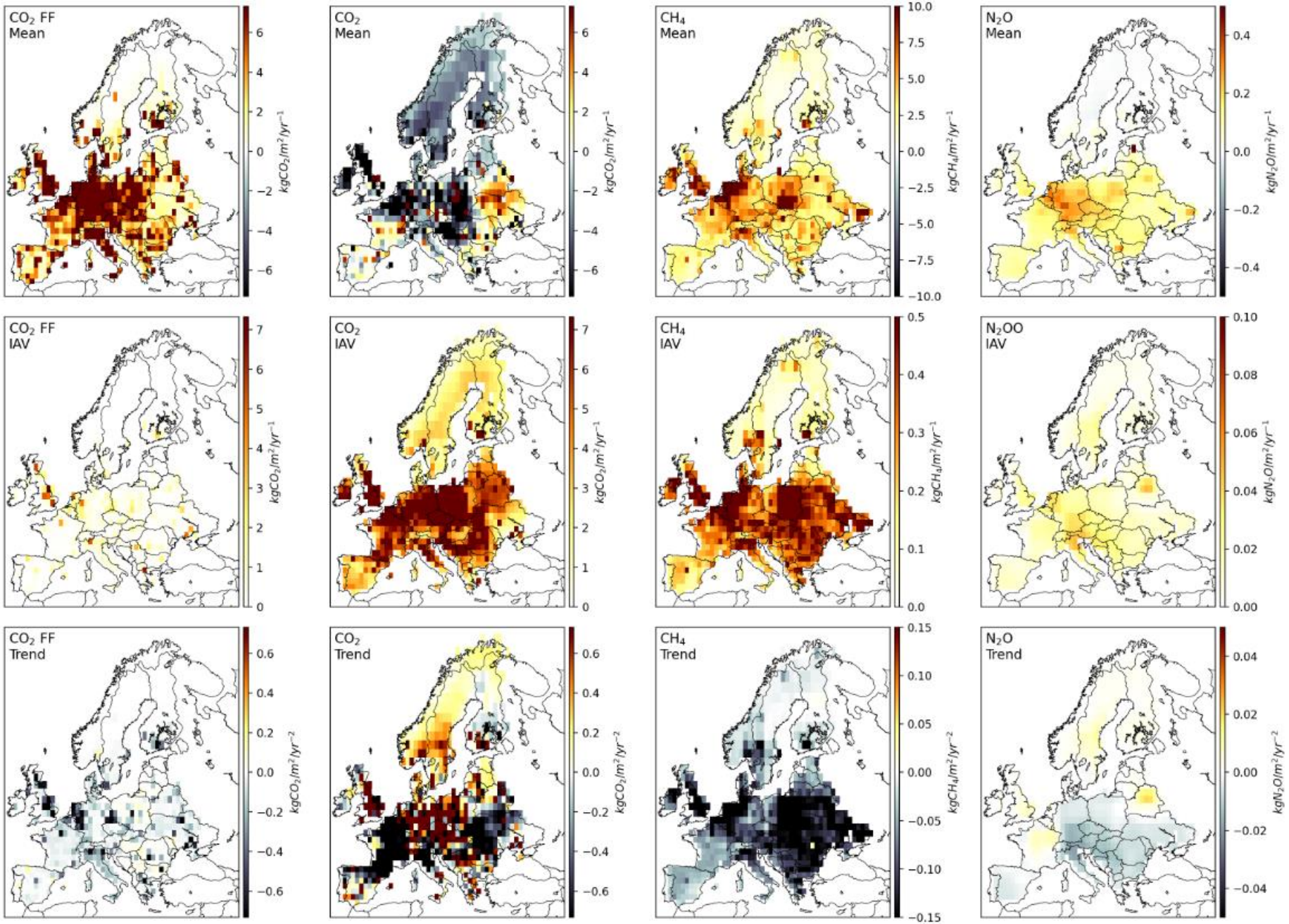
Source anom

Sink anom

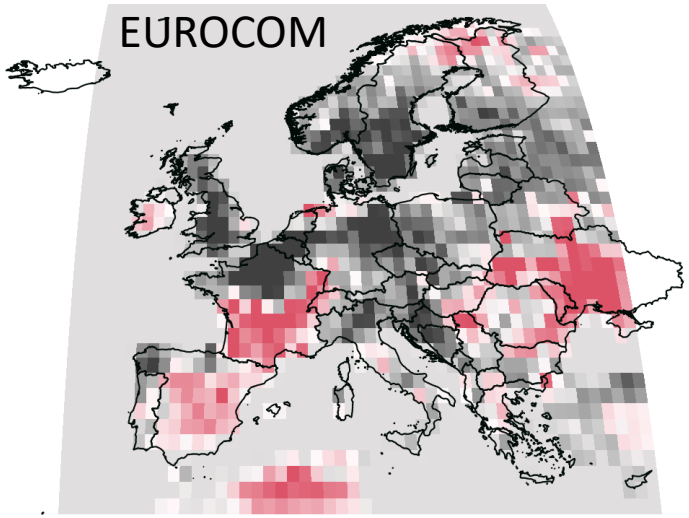
GHG budgets: IAV and climatic drivers

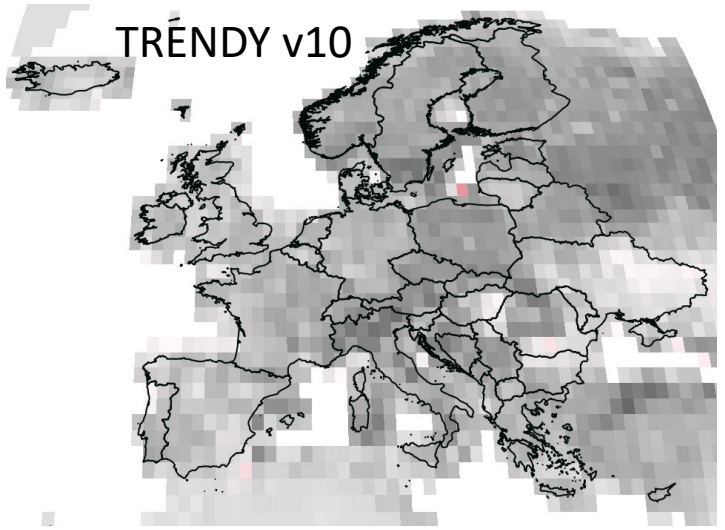


GHG budgets: spatial patterns



Drivers and location of the land C sink – C budgets 2010-2019

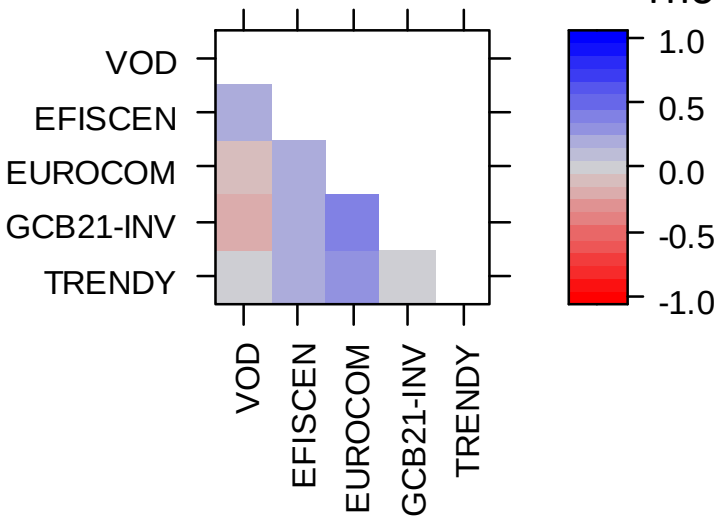


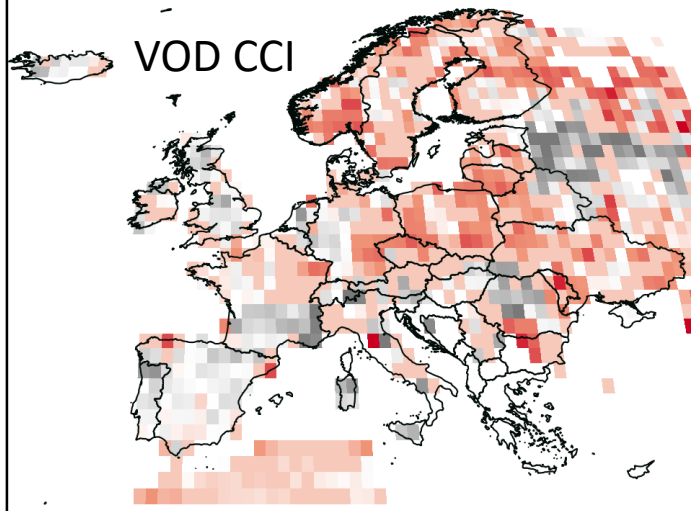


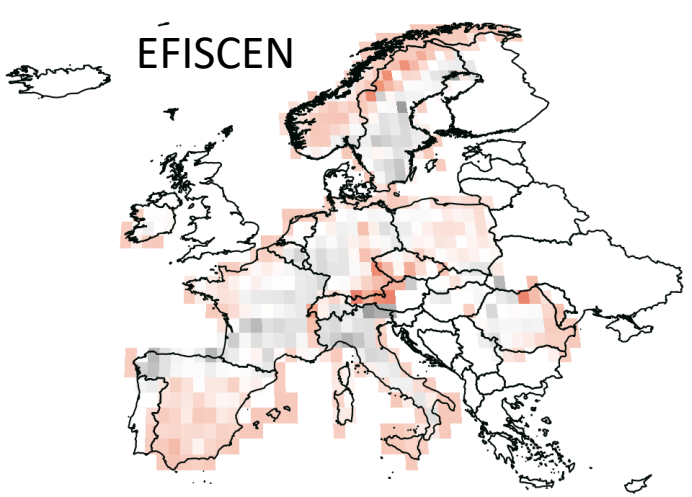
C-emission [gC $m^{-2}yr^{-1}$]

- < -100
- < -50
- < -10
- -10 ... 10
- > 10
- > 50
- > 100

Spearman-rank correlations among spatial patterns ($p < 0.05$)







ΔC-trees [gC $m^{-2}yr^{-1}$]

- < -100
- < -50
- < -10
- -10 ... 10
- > 10
- > 50
- > 100

GLOBAL CARBON PROJECT

Thanks for your attention!