



Co-ordinated by  
**ECMWF**



**CoCO2**

Prototype system for a  
Copernicus CO<sub>2</sub> service

# LAND ATMOSPHERE CO<sub>2</sub> FLUXES DRIVEN BY LATERAL PROCESSES

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CoCO2 1<sup>st</sup> General Assembly

16/11/2021



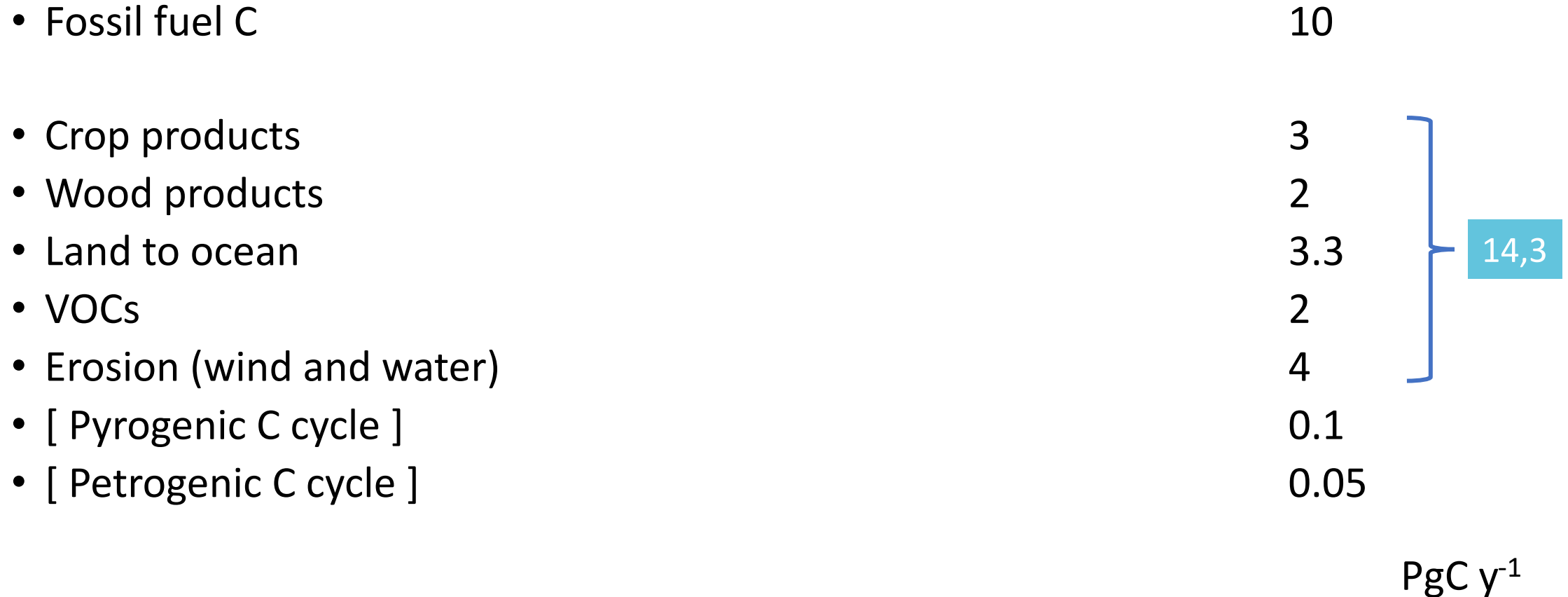
# Lateral fluxes

- We are interested mainly by carbon transport at long distances
- Lateral C fluxes that have consequences for land atmosphere CO<sub>2</sub> exchange
  - ✓ Crop harvest and processing and commodity transport - => crop products
  - ✓ Wood harvest, processing, transport and storage => wood products
  - ✓ Biofuels harvest, processing, transport and use => biofuels } CoCo2 WP2 mandatory
  - ✓ Land-Ocean-Atmosphere continuum, including weathering => river loop
- VOCs } Another time
- Erosion (wind and water) }
- Lateral C fluxes that don't
  - Pyrogenic C cycle
  - Petrogenic C cycle

This talk



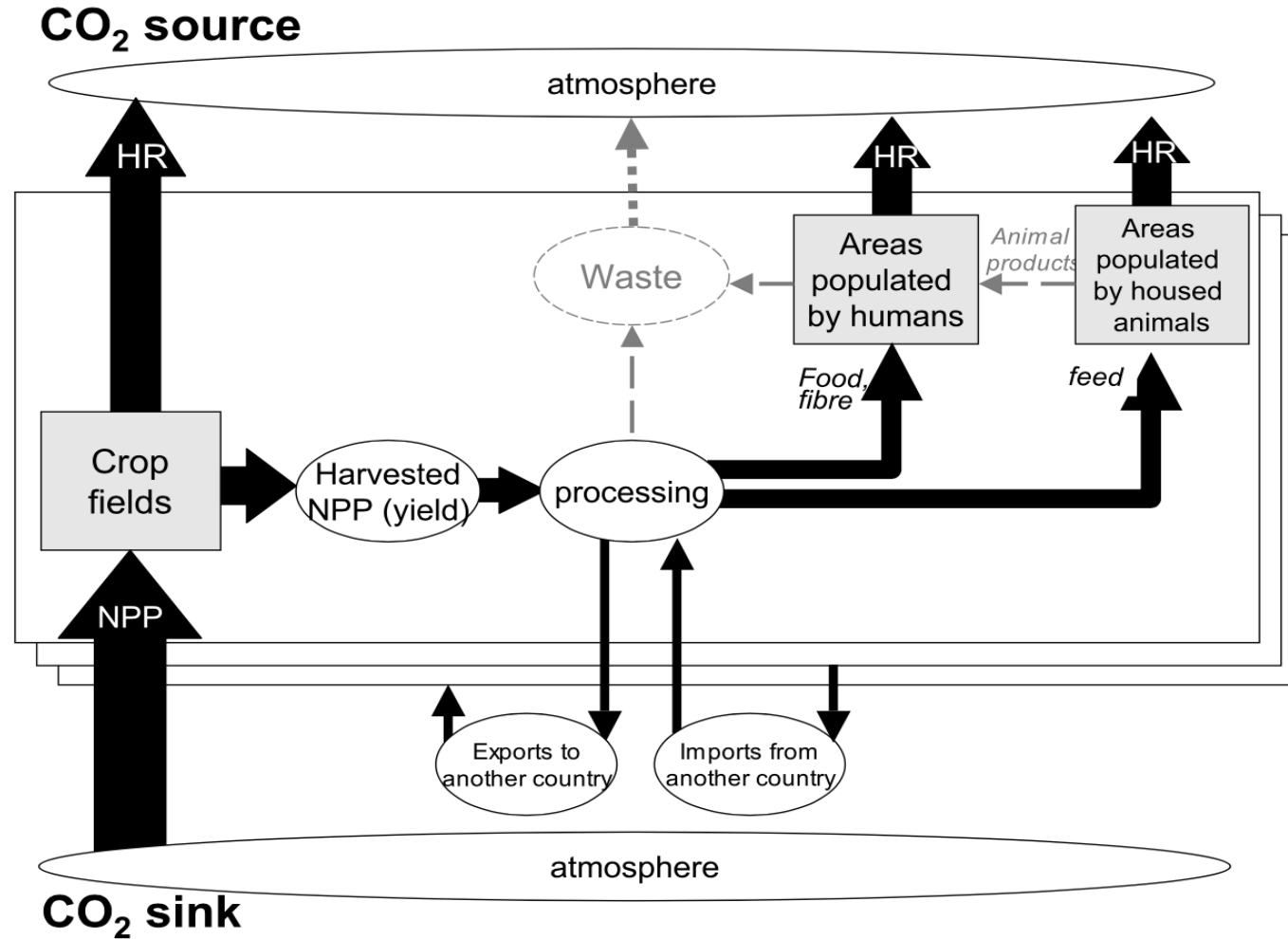
# Amount of C mobilized



Ignoring lateral C fluxes is a cognitive dissonance of carbon cycle research 3



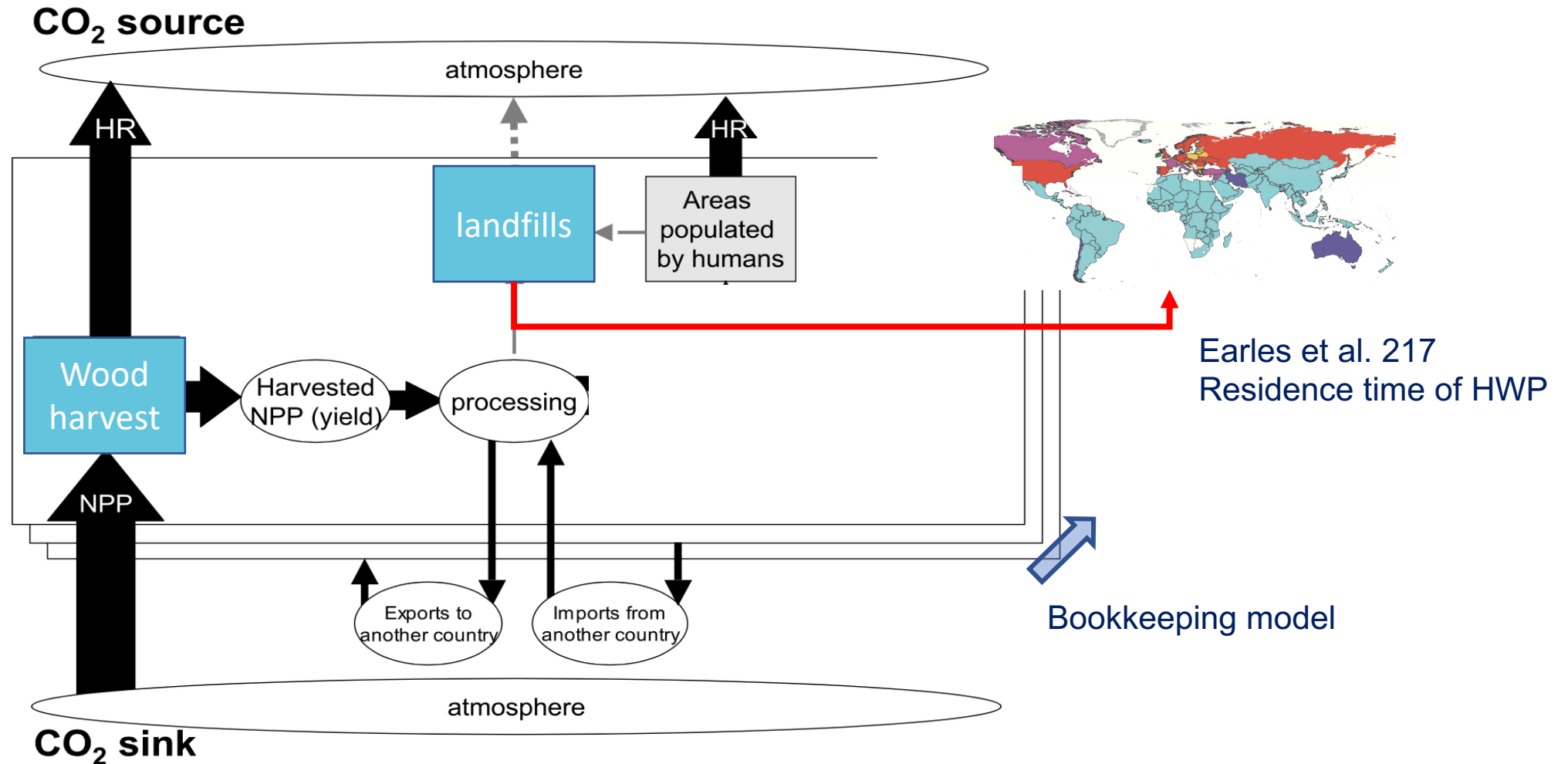
# Crop products







# Wood products





# Biofuels

IEA fuel data ( energy statistics )

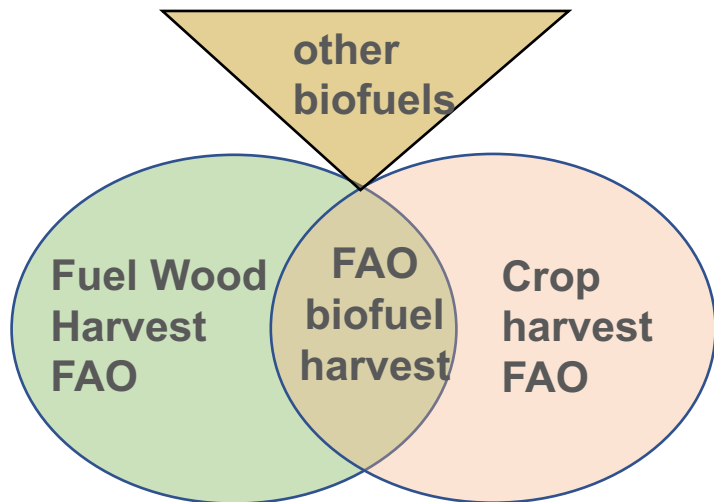
PKU-CO2 spatial patterns of biofuel use

Woody : Harris et al. 2021 patterns of forest timber removals (woody fuels)

Croppy : FAO + 1 km MODIS crop cover + MODIS NPP (crop fuels)

FAO < IEA

=> "Missing" woody fuels due to secondary biofuels and "non commercial" biofuel harvest



## Perspective



**Global biomass trade for energy –  
Part 2: Production and trade streams  
of wood pellets, liquid  
biofuels, charcoal, industrial  
roundwood and emerging  
energy biomass**

## Modeling and Analysis



**Global biomass trade for energy –  
Part 1: Statistical and methodological  
considerations**

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 Jussi Heinimö, Mikkel Development Miksei Ltd, Mikkeli, Finland  
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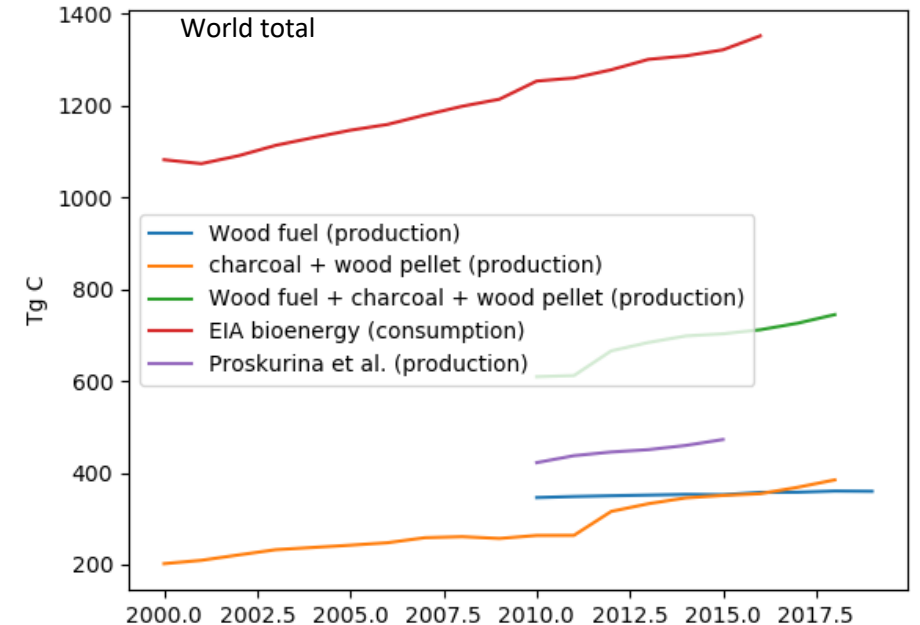
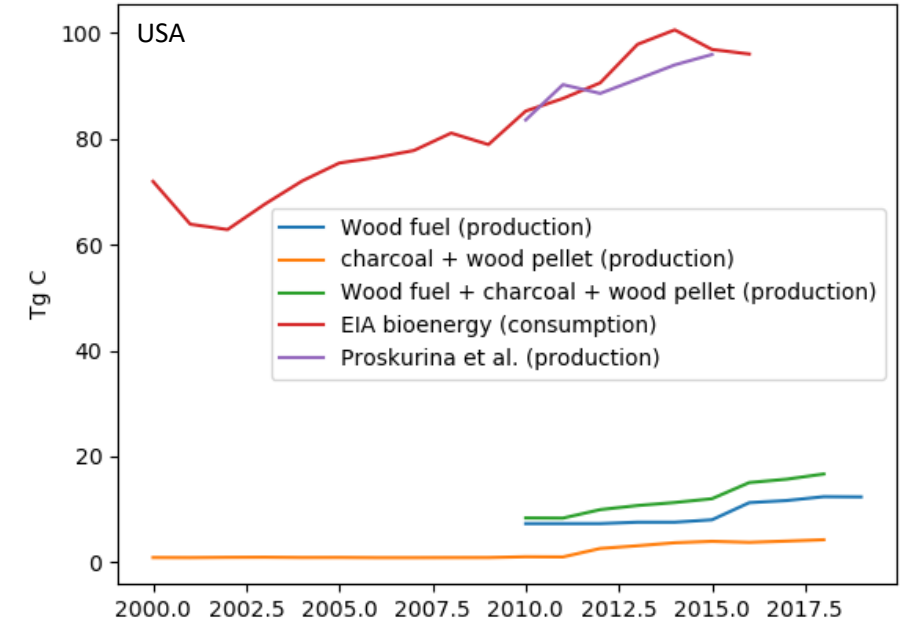
# Biofuels

IEA provides the production, imports and exports of some categories of biofuels, but they are not separated for wood-origin or crop-origin.

primary solid biofuels ---- wood  
charcoal ---- wood

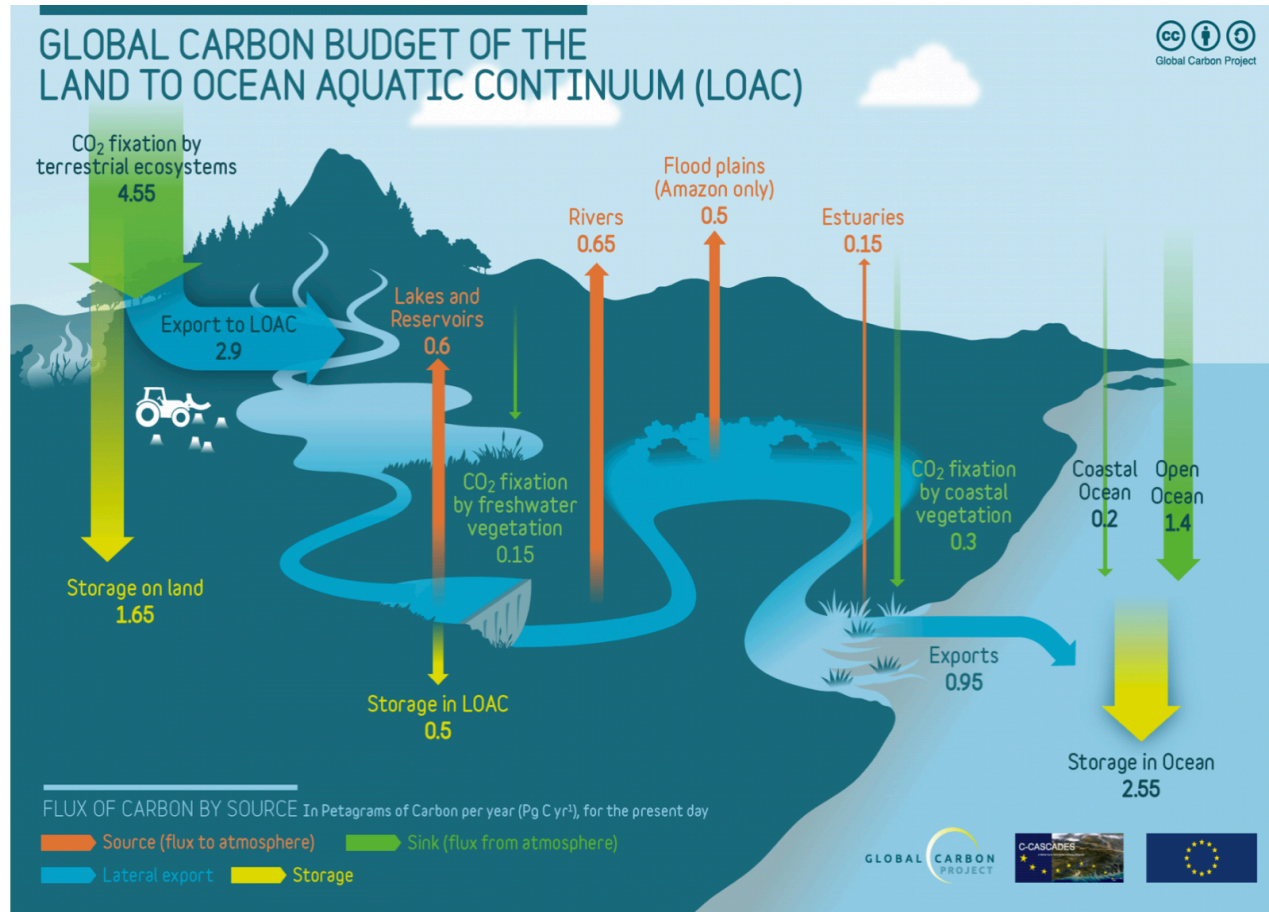
Bio-gasoline ---- crop  
biodiesel ---- crop  
other liquid biofuels ---- crop

bio jet kerosene ---- wood & crop & waste (not sure how to separate)  
biogases ---- not applied





# Rivers



We compiled data of :

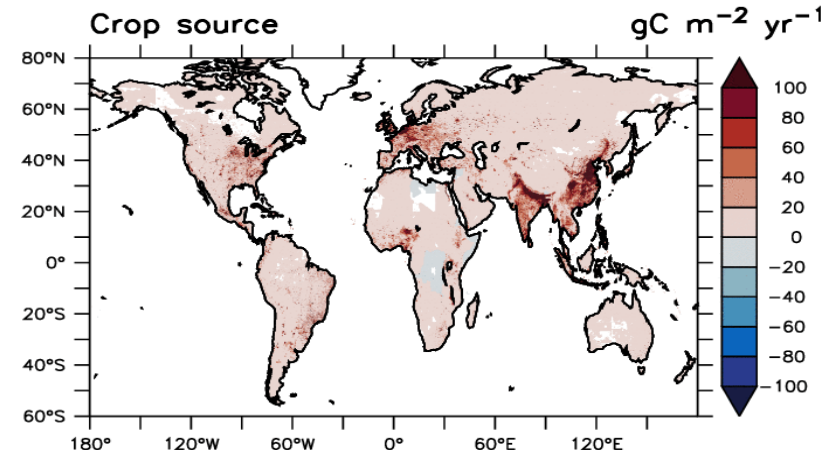
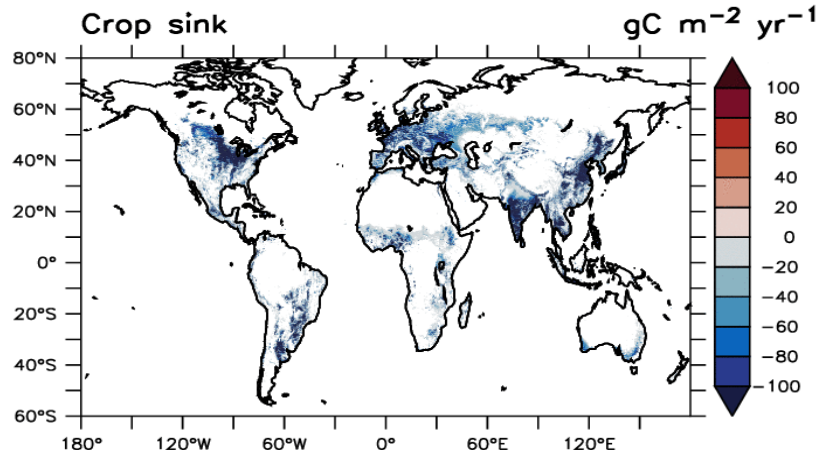
- ✓ River export to ocean
- ✓ Burial
- ✓ Lakes evasion
- ✓ River evasion
- ✓ CH<sub>4</sub>-C emissions

At catchment scale

Soil to river export is deduced by mass balance

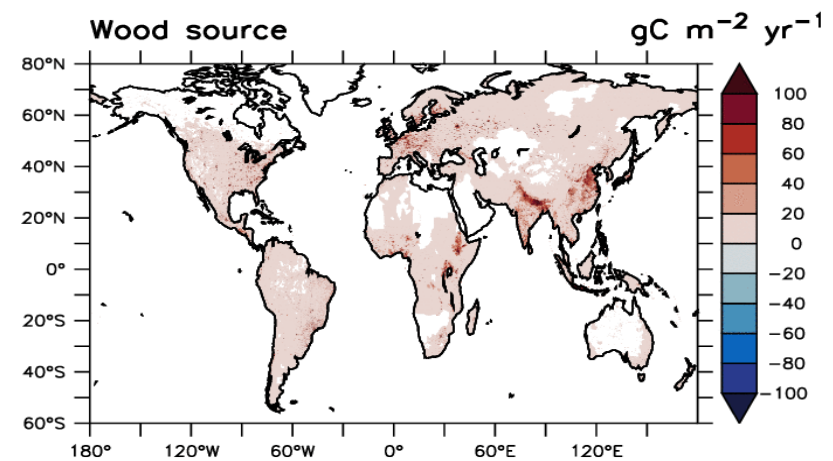
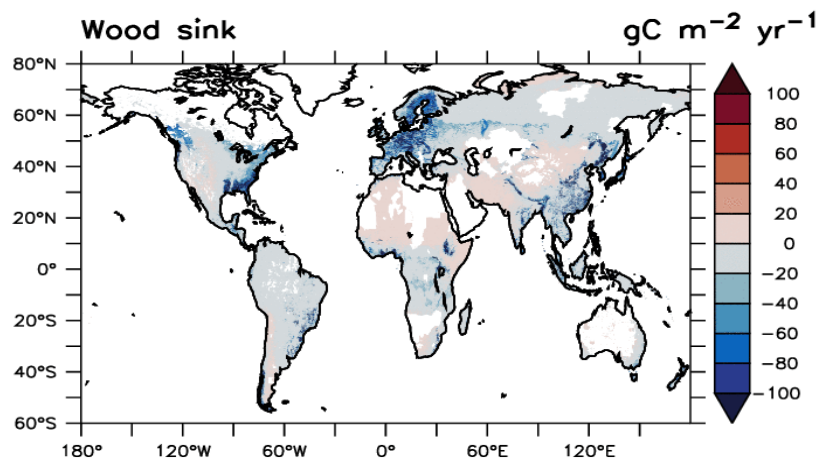


# Crops and Woods



Annual for 1961-2019,  $0.08^\circ \times 0.08^\circ$

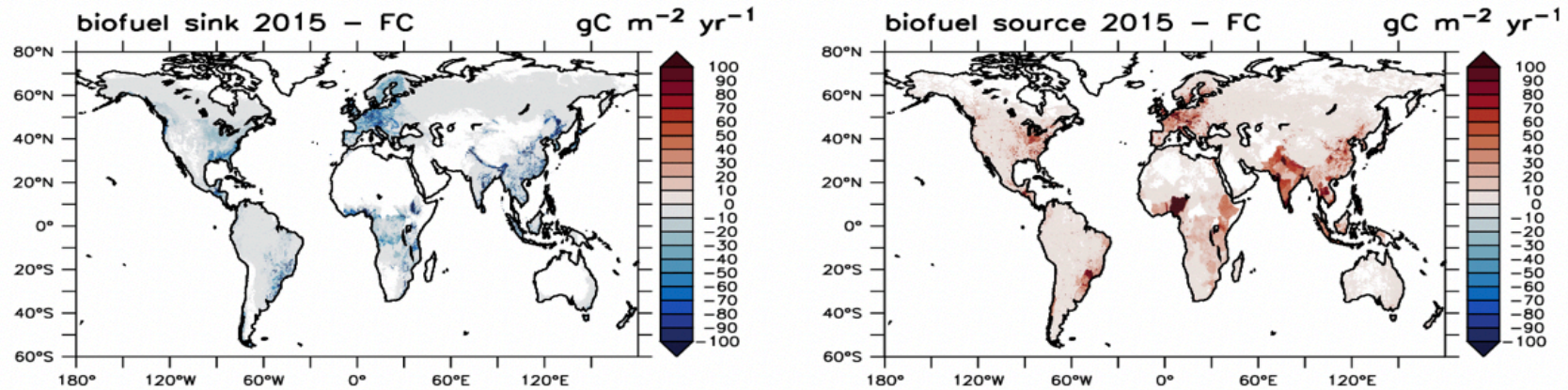
Extended from Deng, Ciais et al., ESSDD, 2021



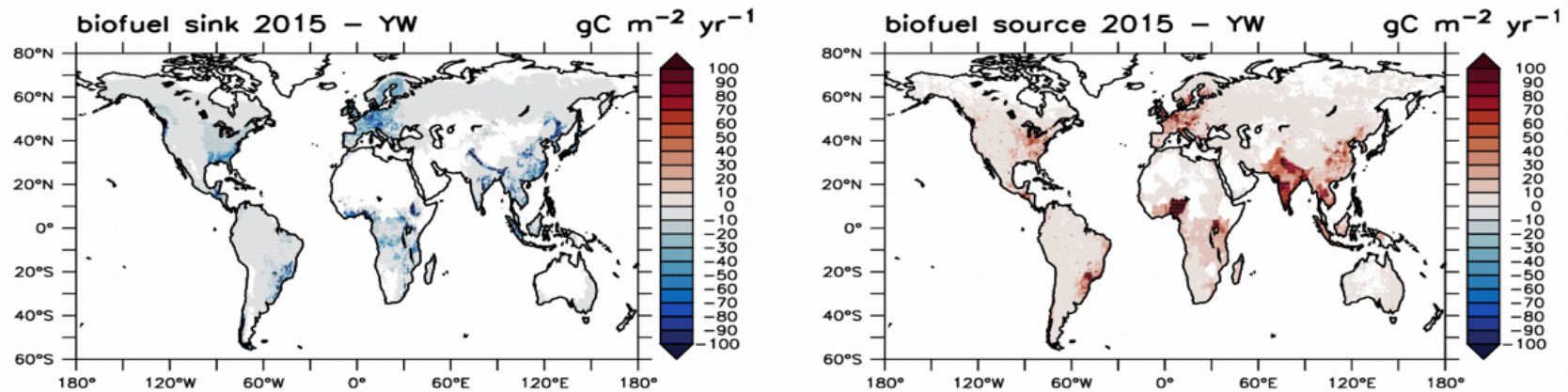




# Biofuels

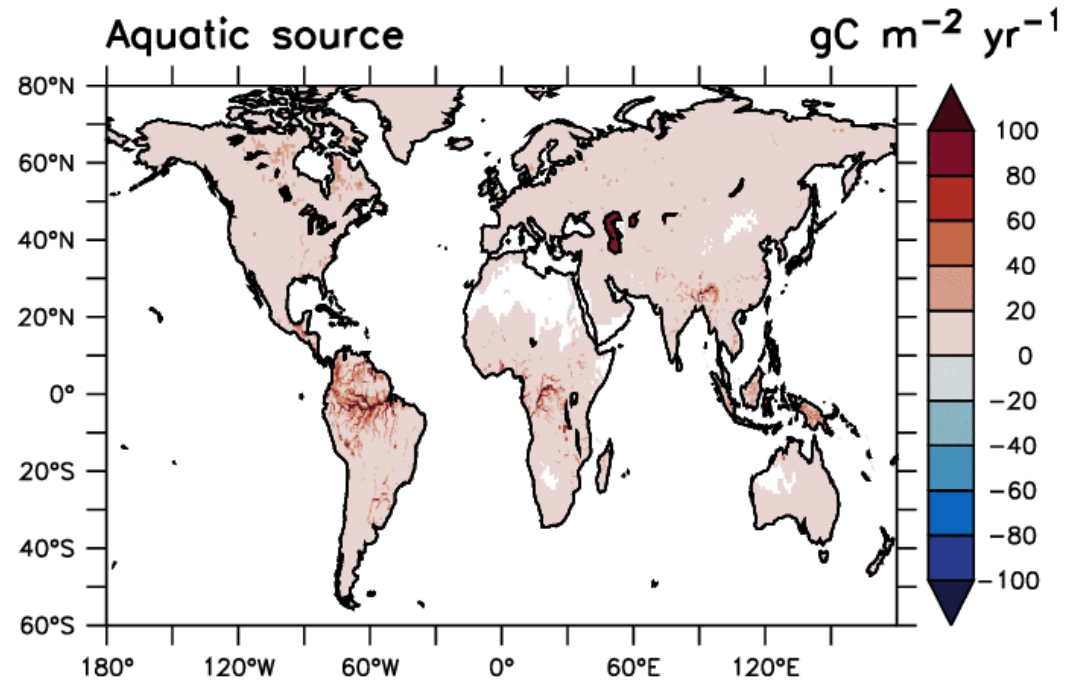
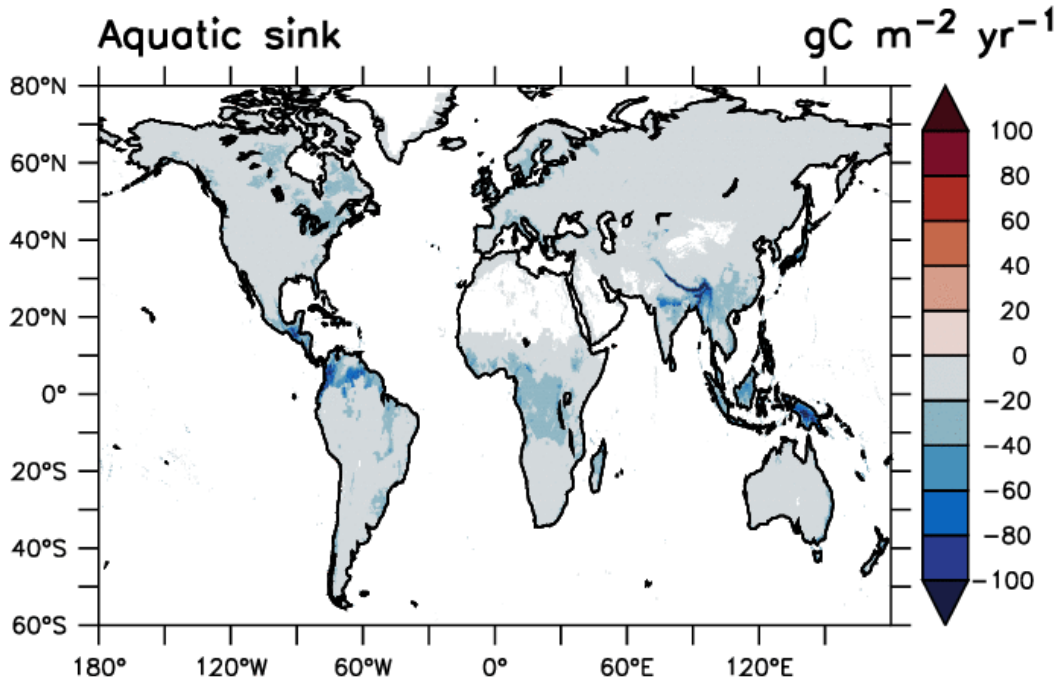


Annual maps at 8 km resolution since 1980





# Rivers



Mostly climatological, false  $0.08^\circ \times 0.08^\circ$



# Impact on inversions

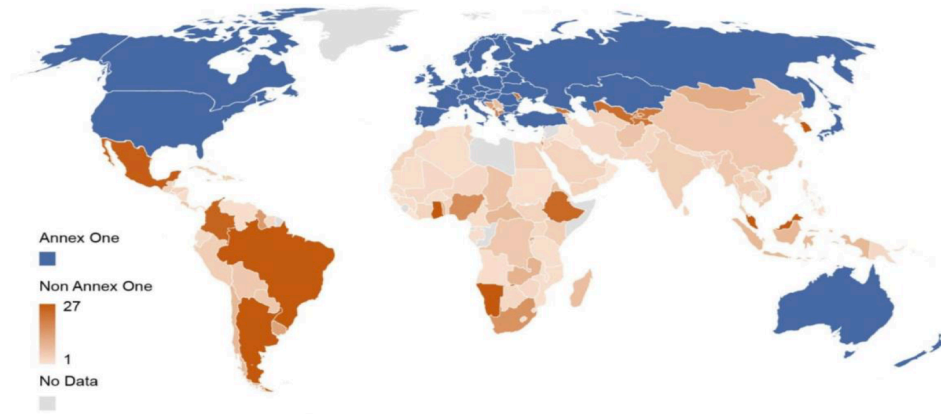
## Comparing national greenhouse gas budgets reported in UNFCCC inventories against atmospheric inversions

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Open Access Earth System Science Data Discussions

Correcting inversions fluxes -> inversions C stock changes to make them comparable with inventories

$$F_{adj}^{inv NEE} = F_{ML}^{inv NEE} - F_{tot}^{rivers} - F_{ant}^{crop trade} - F_{ant}^{wood trade} \Leftrightarrow F_{ant}^{ni},$$



All countries UNFCCC inventories ( new database )

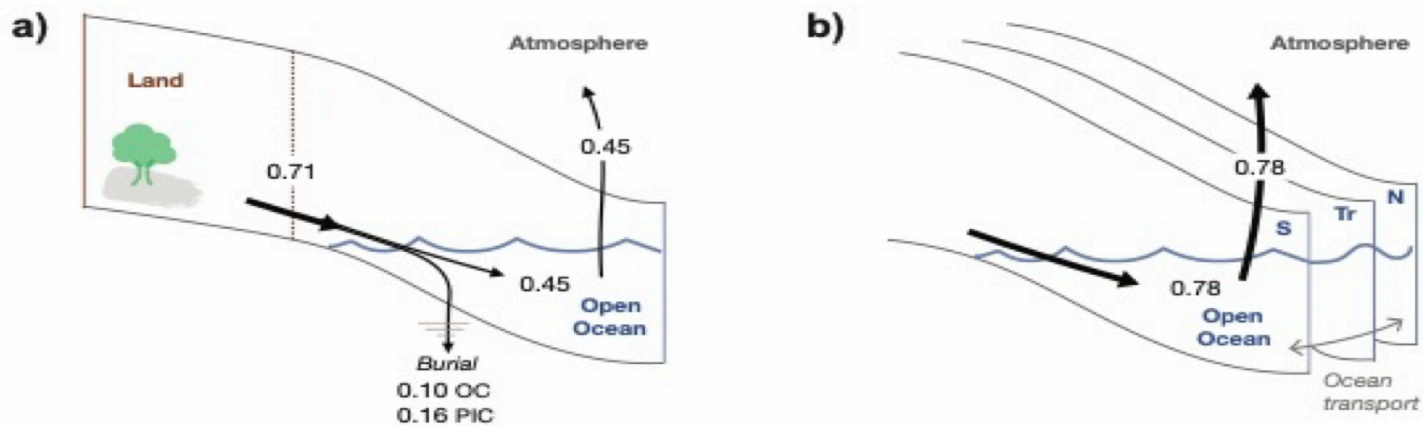




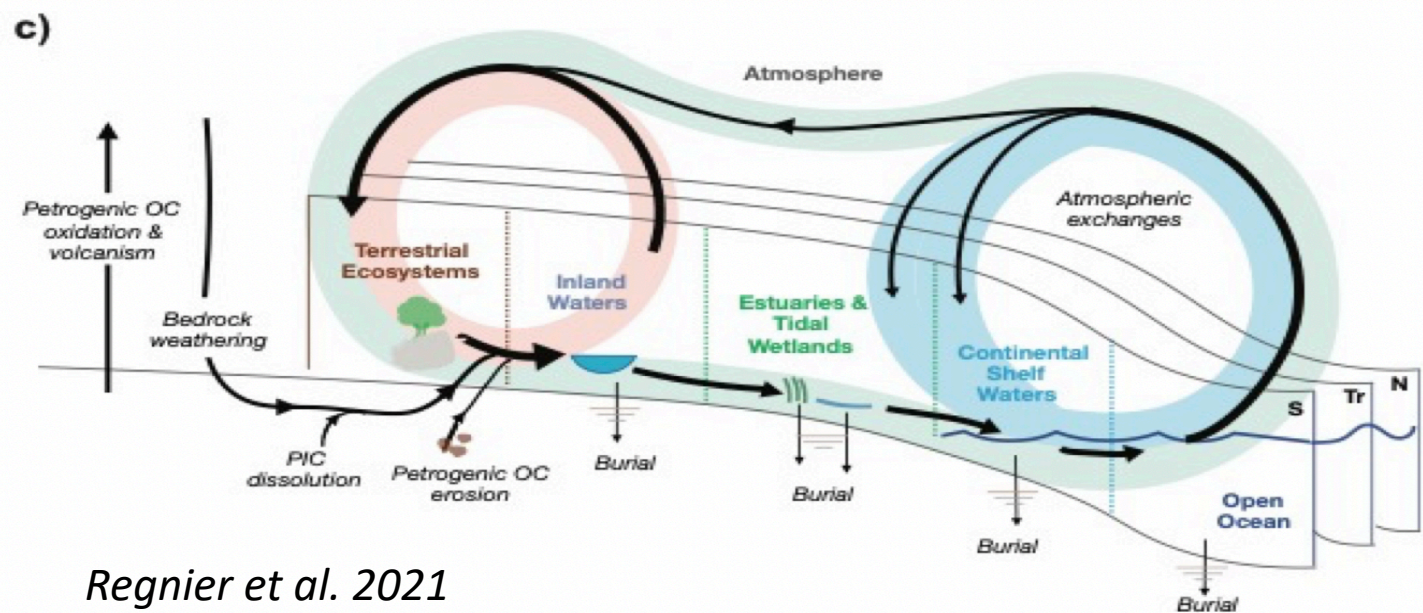


# Work in progress

GCP and IPCC assessments



New paradigm



Regnier et al. 2021