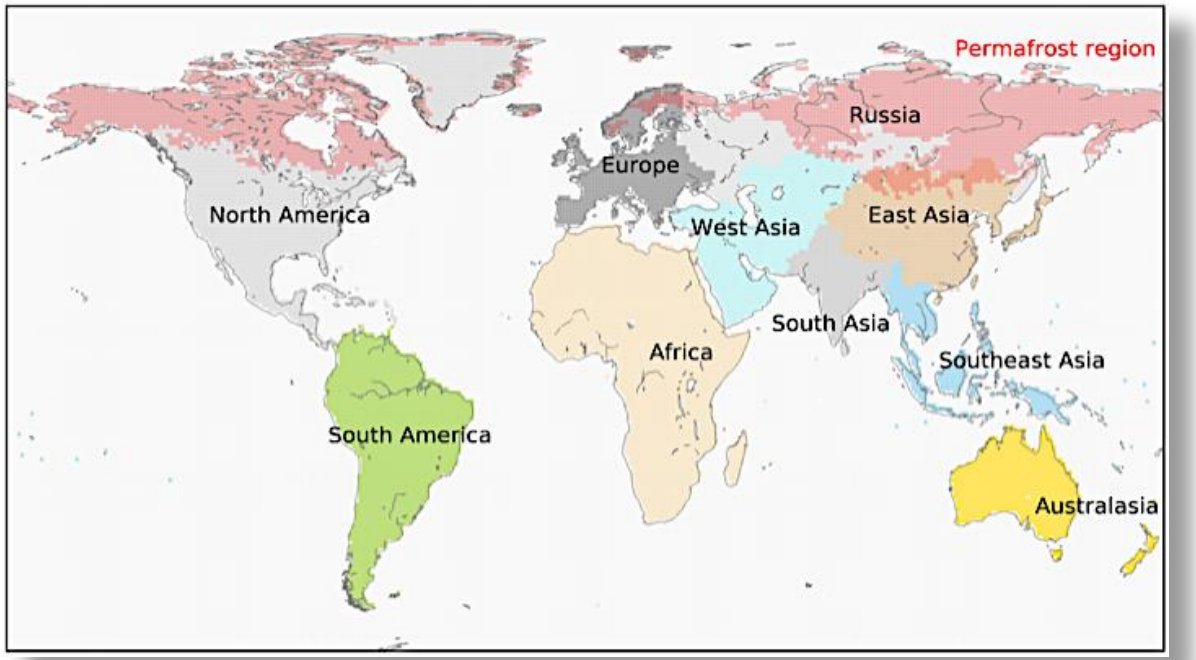
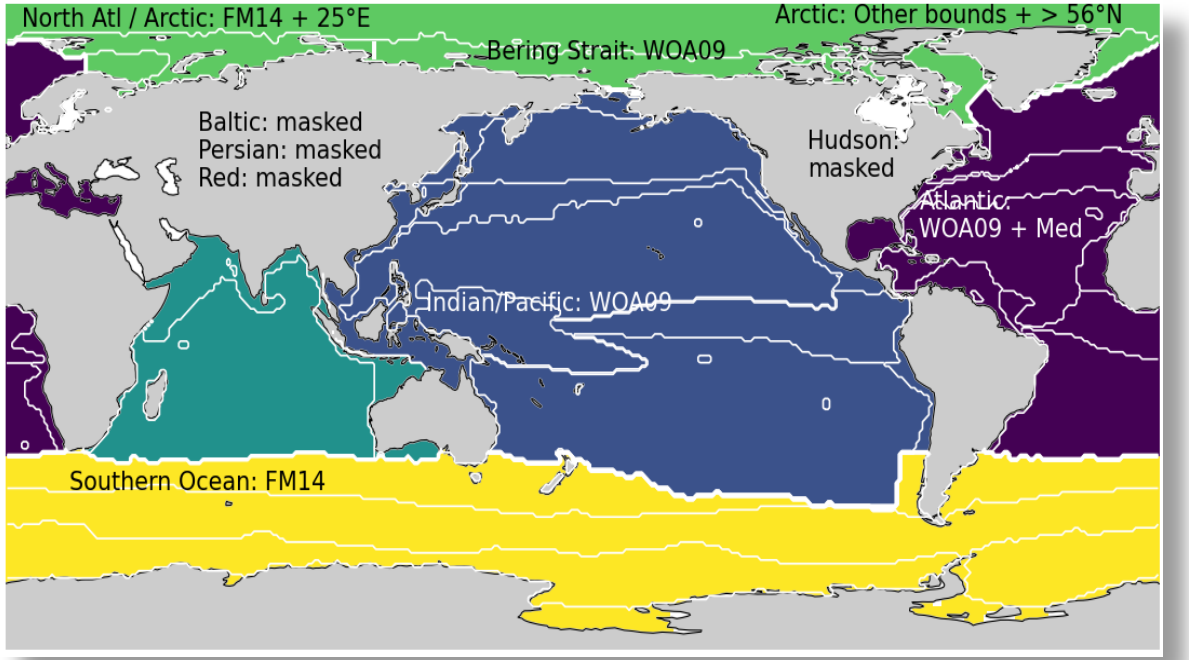
REgional Carbon Cycle Assessment and Processes2 (RECCAP2)

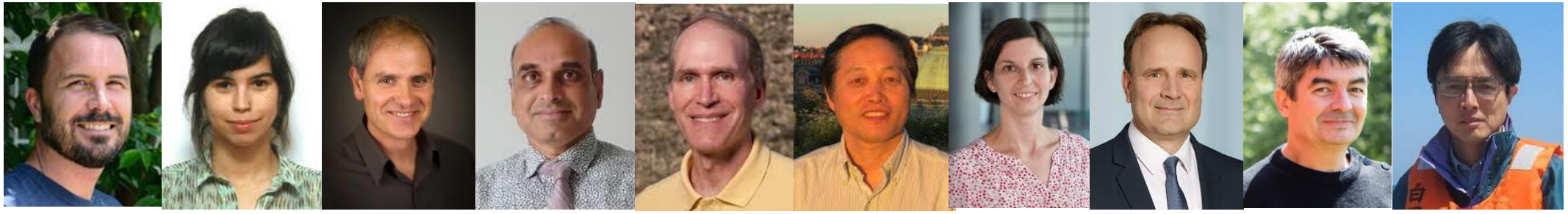
- Overview -





Gotemba, Japan 2019 – launch of RECCAP2

RECCAP-2 Steering Committee



Ben Ana Pep Prabir Rob Hanqin Judith Niki Philippe Masao

Scientific Objectives RECCAP2

1. To establish mean decadal **GHG budgets** of large regions covering the globe at the scale of **continents (or large countries) and large ocean basins.**

1. To evaluate the **regional contributions to the global budgets of GHGs and identify 'hot-spots'** of inter-annual variability and trends, and their underlying processes.

Policy-relevant objectives of RECCAP2

- To contribute to the global stocktake and tracking towards net zero emissions of anthropogenic and natural GHG sources and sinks.
- To quantify and further constrain anthropogenic greenhouse gas emissions.
- To develop robust observation-based estimates of changes in carbon storage and greenhouse gas emissions and sinks by the oceans and terrestrial ecosystems.
- To improve our knowledge of the processes driving changes in GHGs sources and sinks.
- To gain science-based evidence of the response of marine and terrestrial regional GHG budgets to climate change and direct anthropogenic drivers.

What is new in RECCAP2 compared to RECCAP1?

- GHG budgets to cover C/CO_2, CH_4 and N_2O (RECCAP1 only C/CO_2).
- Inclusion of coastal ecosystems (blue carbon).
- Explore plausible evolution of GHG budgets under difference climate scenarios based on CMIP6 and other modeling efforts.
- Inclusion of special topics: Land-to-Ocean-Aquatic-Continuum, Permafrost, Polar regions.
- Uptake of new global and regional GHG flux/stock products available, both observational and remote sensing (biomass, fire, freshwater bodies, wetlands, GPP, NEE,…)
- Improved and better constrained models (eg, land surface and ocean N_2O modeling).
- Highlight nature-based climate solutions.

How is RECCAP2 organized?

- RECCAP2 is a bottom-up effort by the global research community and driven by the Global Carbon Project with many partner research groups.

- Builds from existing global and regional projects, and voluntary contributions.

- Timeframe. Community consultation and preparations: 2016-2020; Assessment: 2020-2022 as a contribution to the Global Stocktake of the Paris Agreement.

RECCAP2 Aligned to Policy Needs

Paris Agreement – Article 4

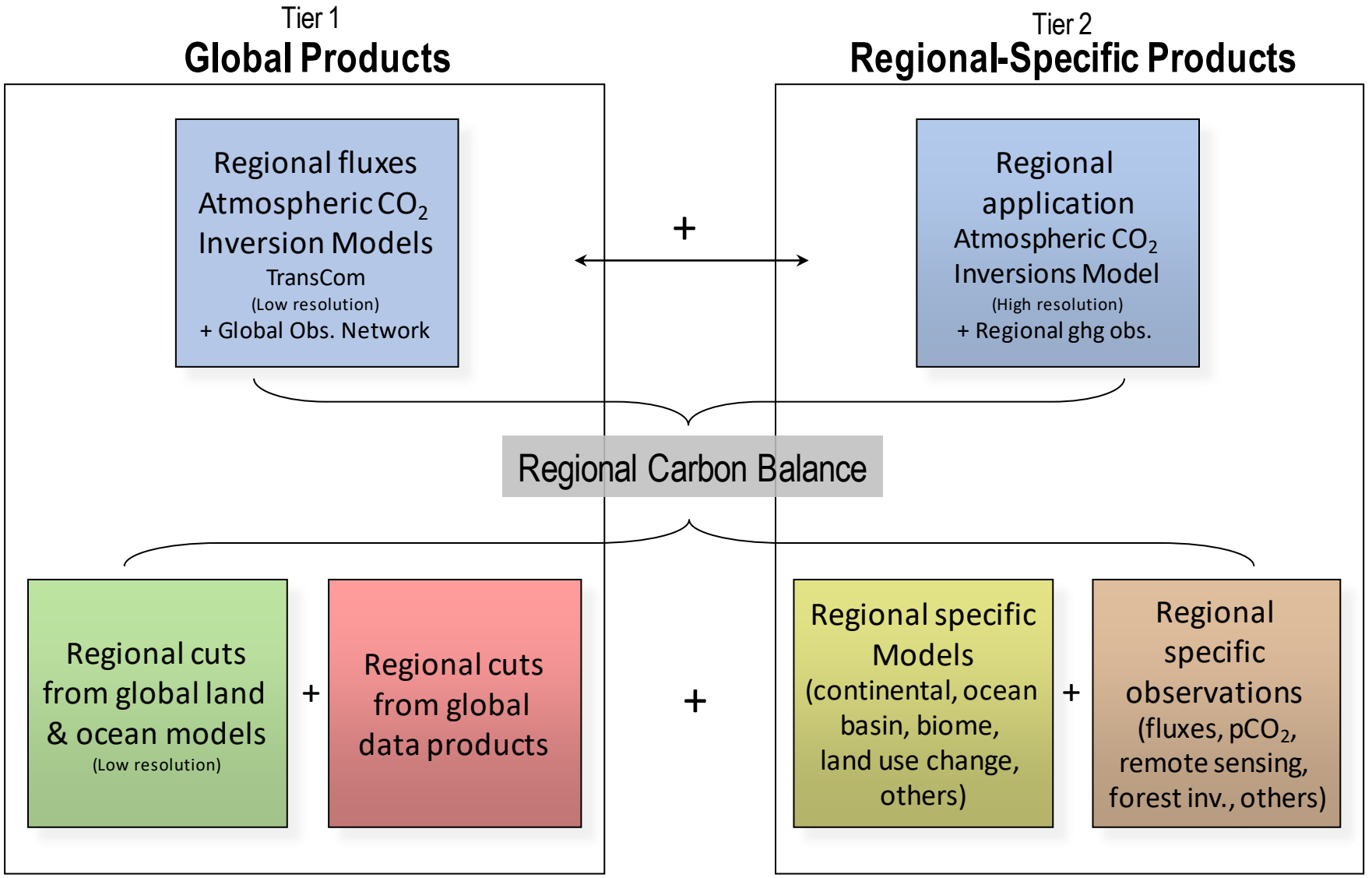
… to undertake rapid reductions thereafter (peak emissions) in accordance with best available science, so as to achieve a **balance between** *anthropogenic* **emissions by sources** and **removals by sinks** of greenhouse gases in the second half of this century…

1. Anchored in global biogeochemical cycles
2. The only tangible goal/outcome for countries to pursue
3. Anthropogenic vs Natural fluxes require attention

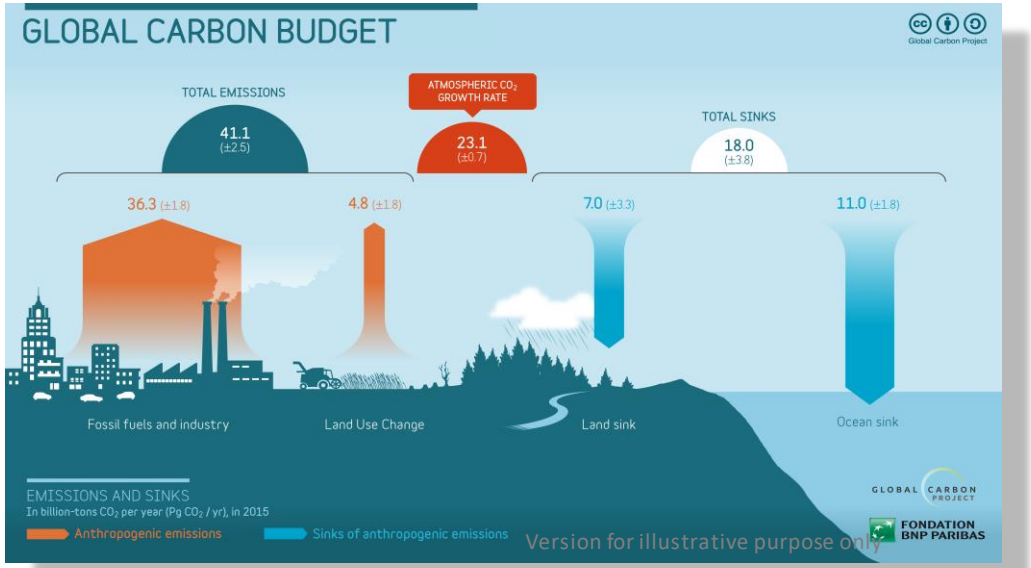
RECCAP2 is Aligned to Policy Needs

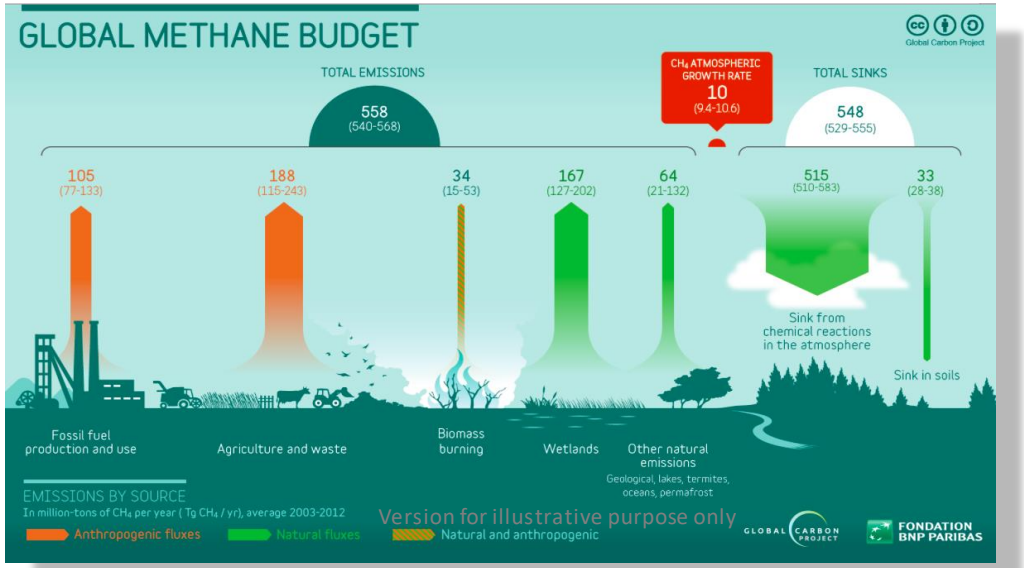
1. To track regions towards net zero emissions, anthropogenic and natural fluxes (Paris Agreement)
2. To support the Global Stocktake and NDCs (Paris Agreement)
3. To quantify anthropogenic GHG emissions (w/atmospheric constraints)
4. To quantify natural and anthropogenic C sinks (to support nature-based climate solutions).
5. To constrain the remaining carbon budget through a better understanding of the response of marine and terrestrial regional GHG budgets to climate change and direct anthropogenic drivers - climate-biogeochemical feedbacks.

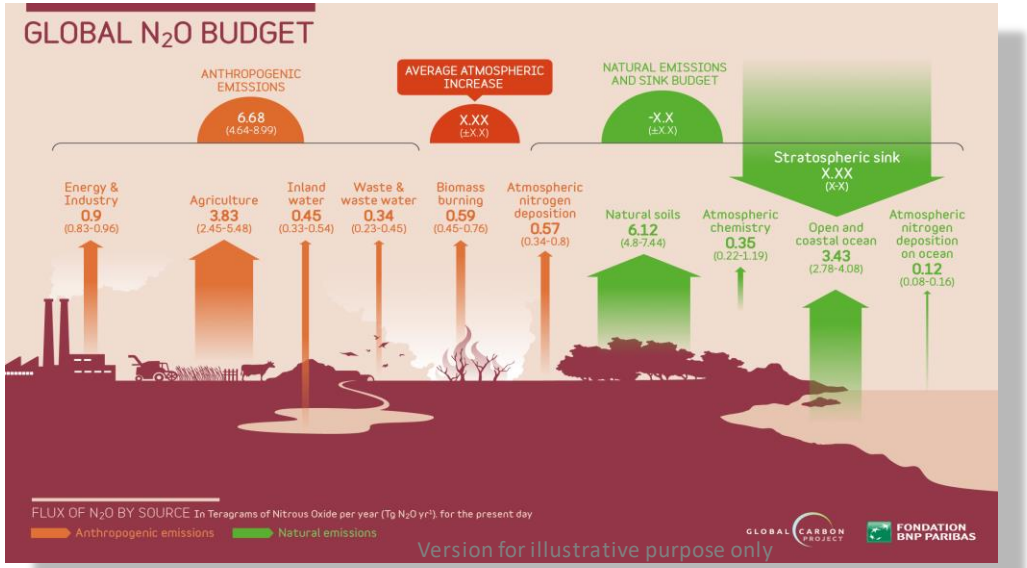
A Dual Constrain Approach for Regional Syntheses

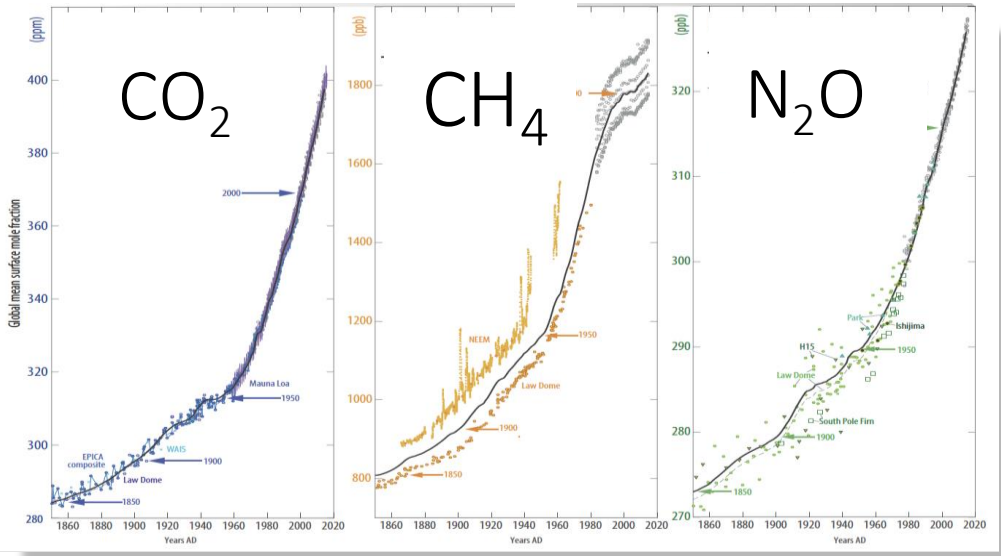


The 3-Greenhouse Gas Challenge for RECCAP2



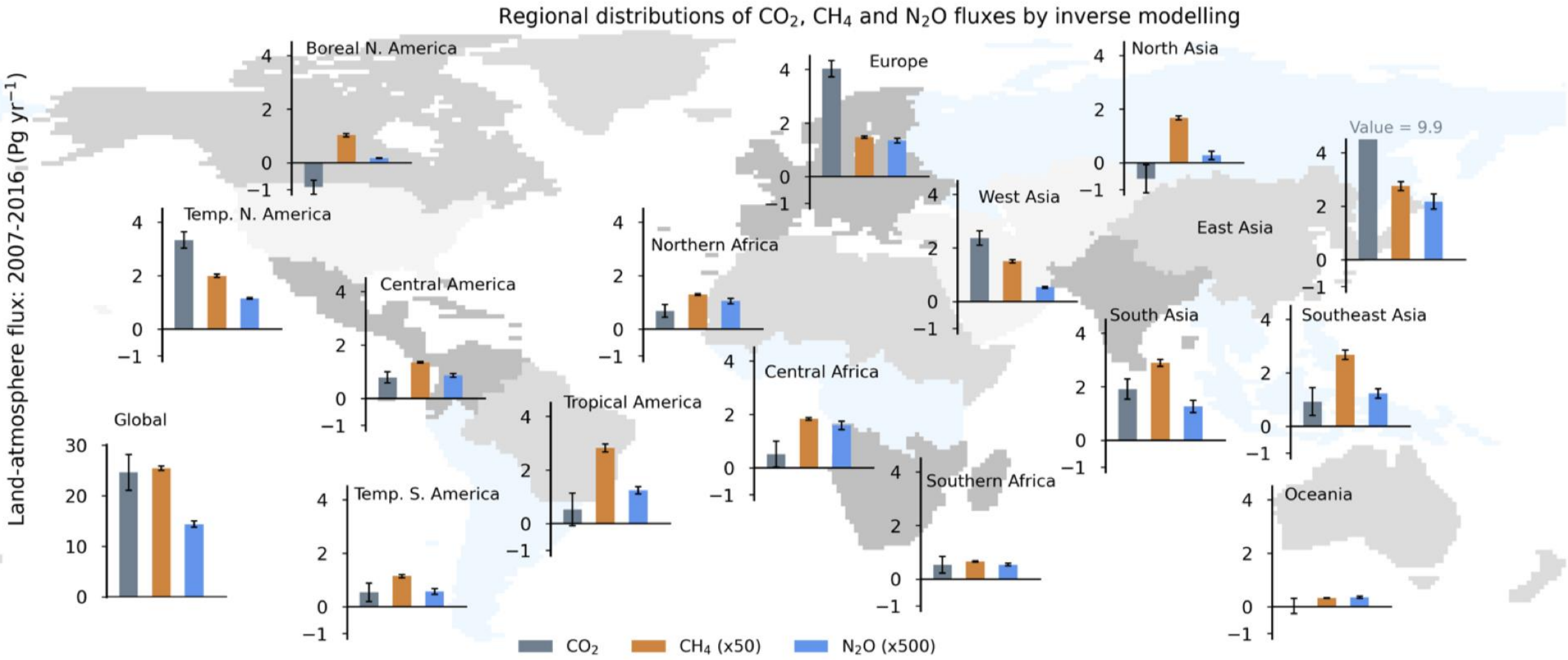






Budget Integration of 3-GHG: CO_2, CH_4, N_2O

GLOBAL CARBON PROJECT



IPCC, Ch5, 2021

Terrestrial Regional Budgets-RECCAP2

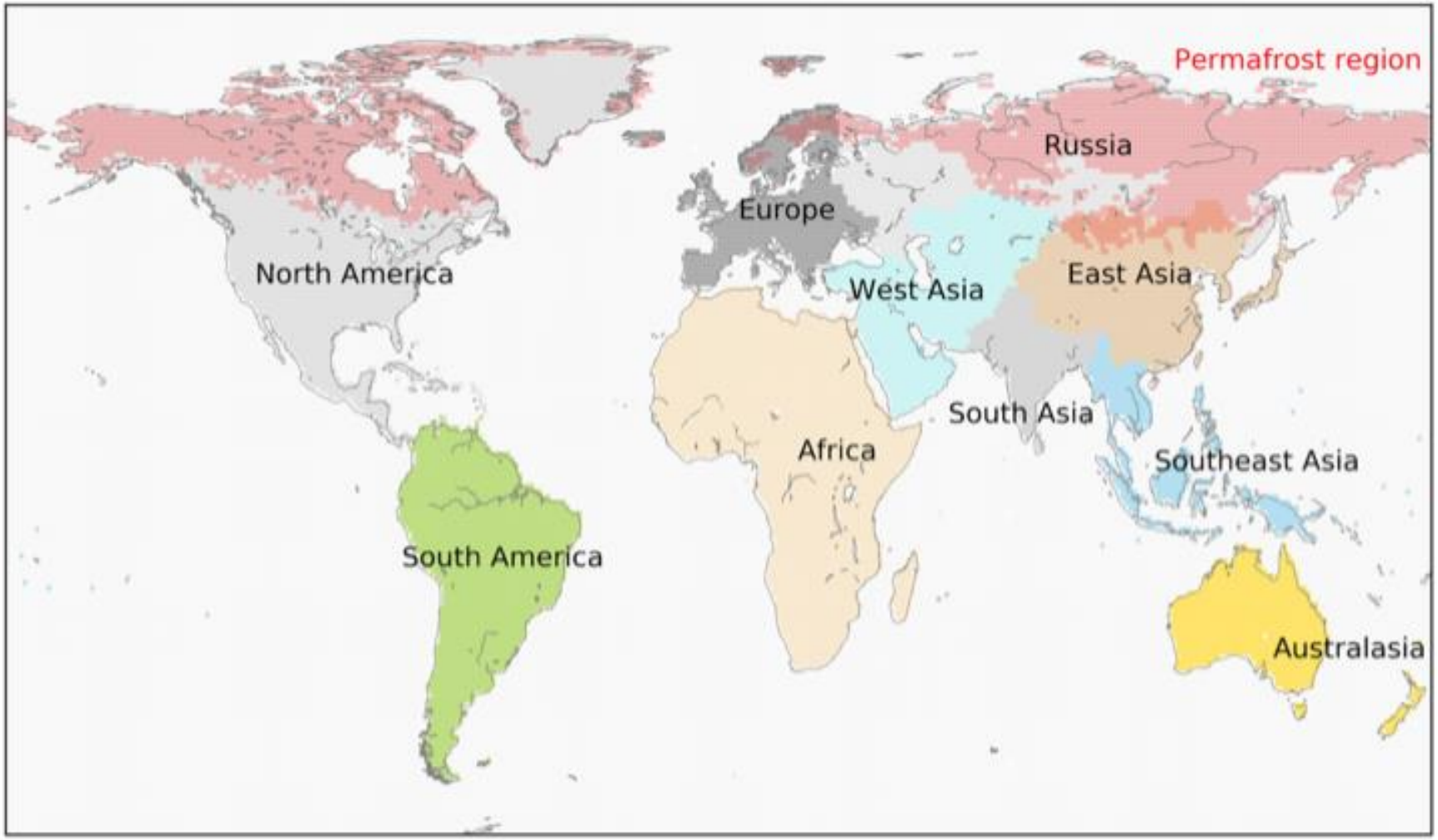
Land Regions/Teams:

L1	Africa
L2	Australasia
L3	Europe
L4	Russia
L5	North America
L6	South America
L7	East Asia
L8	Southeast Asia
L9	South Asia
L10	Central Asia

Special Interest Regions:

L11	Permafrost Region
L12	Polar Regions (Greenland & Antarctica)

Budgets 2010-2019), Trends, Variability, Processes, Future projections

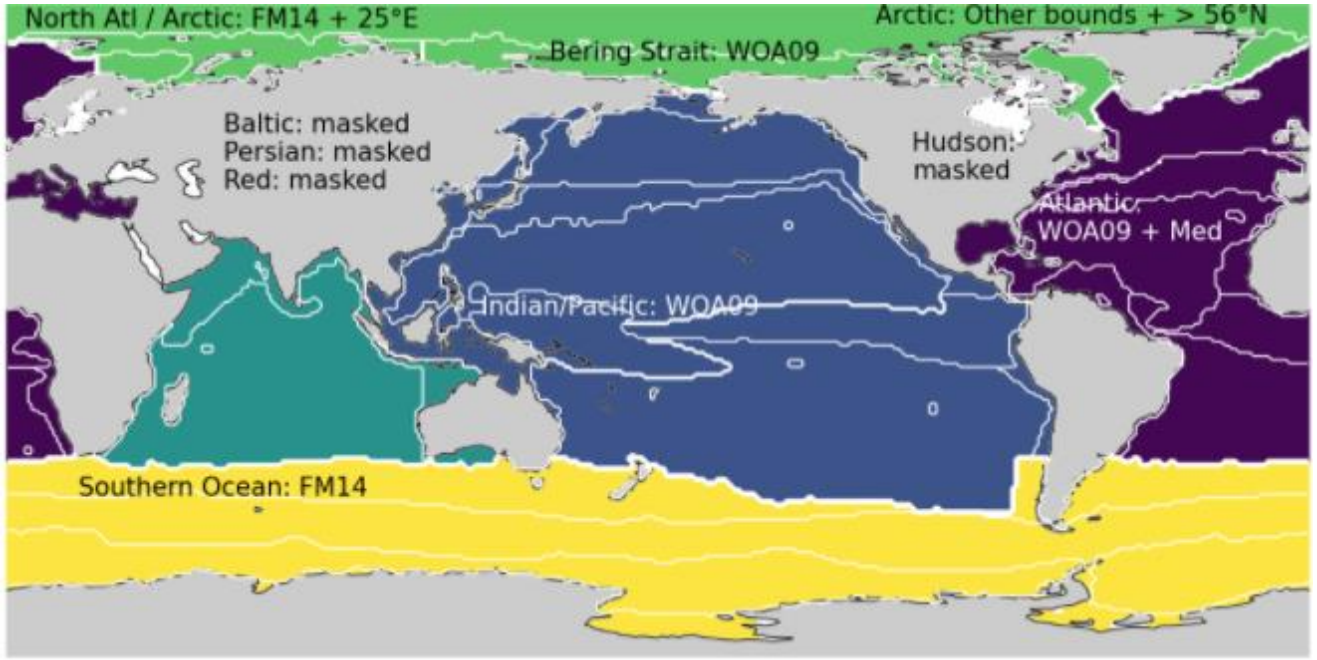


Basin Carbon Budgets and Processes

GLOBAL CARBON PROJECT

Global Ocean:

- Mean and variability in air-sea fluxes, transport and storage
- The seasonal cycle - a window into the future
- The biological pump (processes) and the ocean carbon cycle



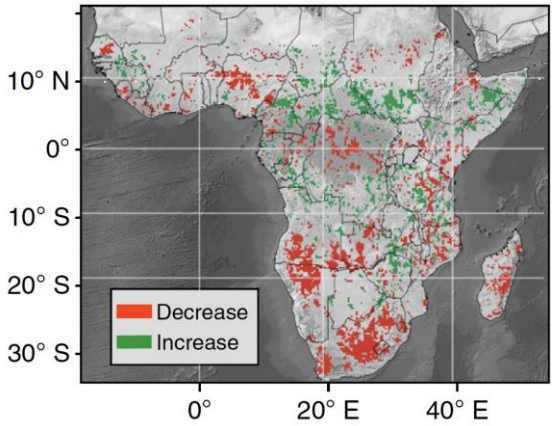
Ocean Basins Budgets:

- Global coastal Ocean
- Southern Ocean
- Pacific Ocean
- Arctic
- Atlantic
- Indian

Examples of New Observations/Approaches

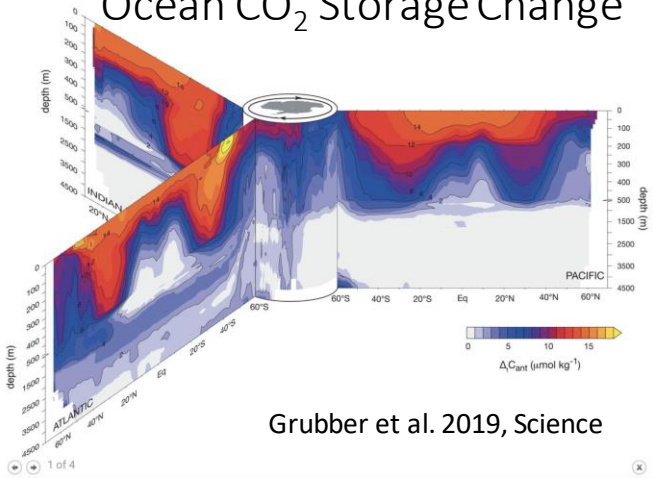
GLOBAL CARBON PROJECT

VOD-L Band Biomass

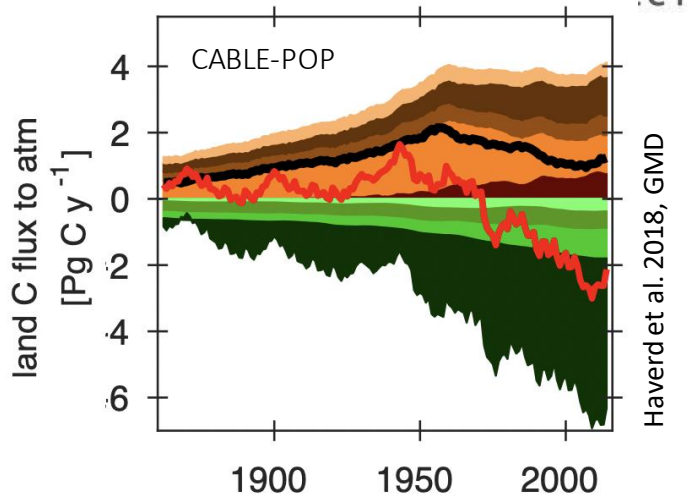


Brandt et al. 2018, NatureE&E

Ocean CO_2 Storage Change

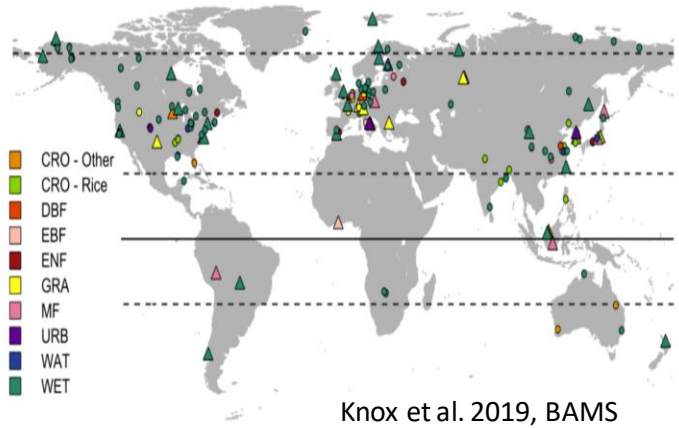


Grubber et al. 2019, Science



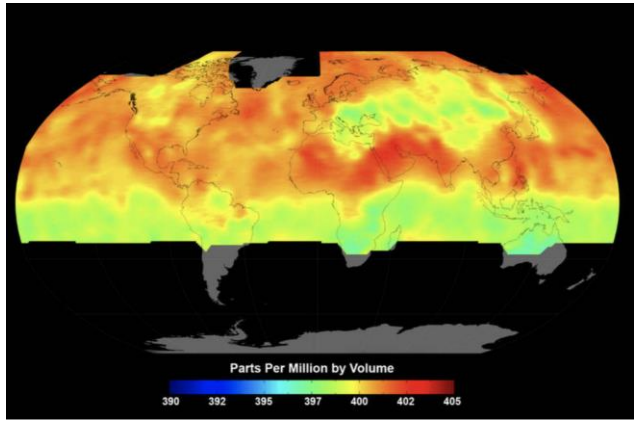
Haverd et al. 2018, GMD

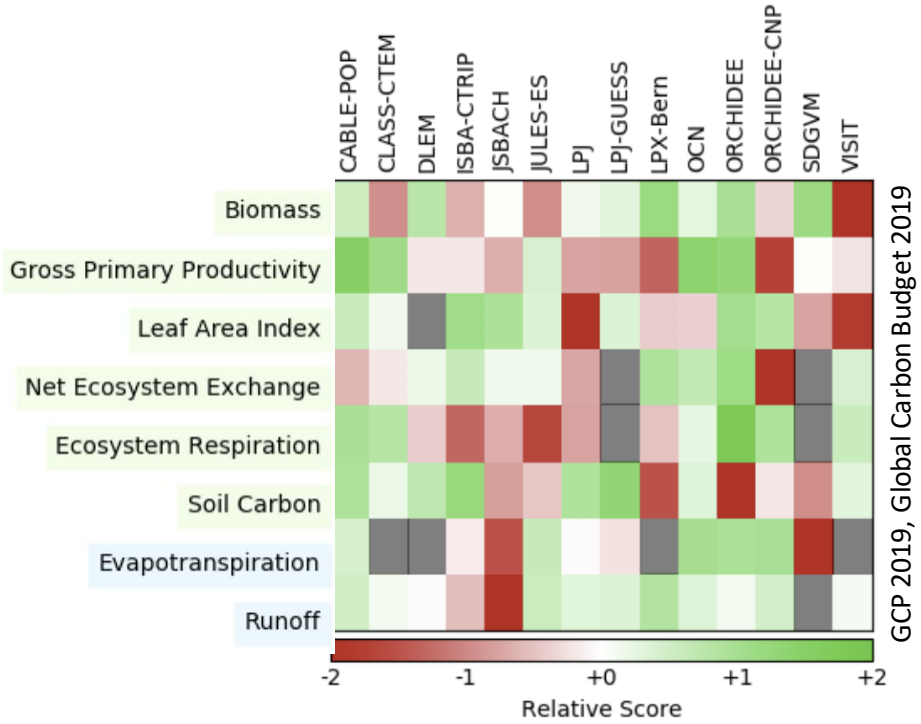
FLUXNET-CH_4



Knox et al. 2019, BAMS

Column GHG – GOSAT-OCO-2

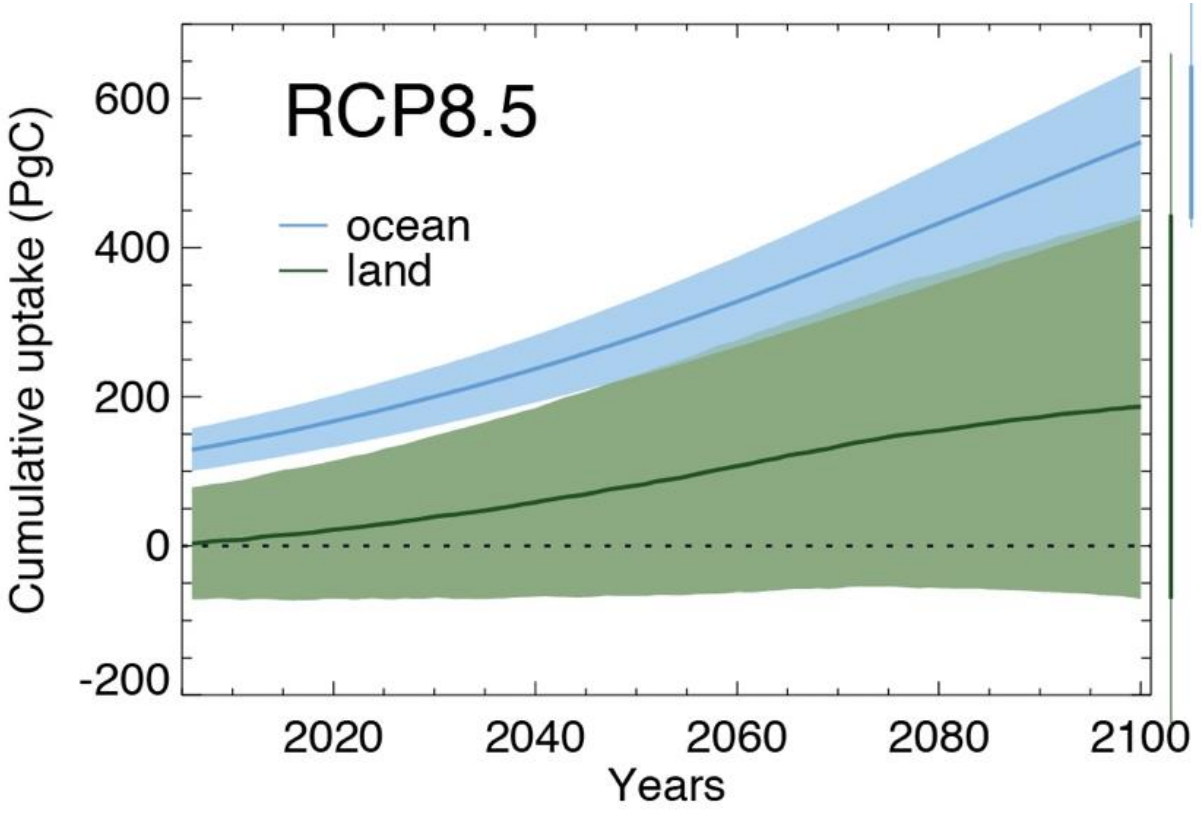


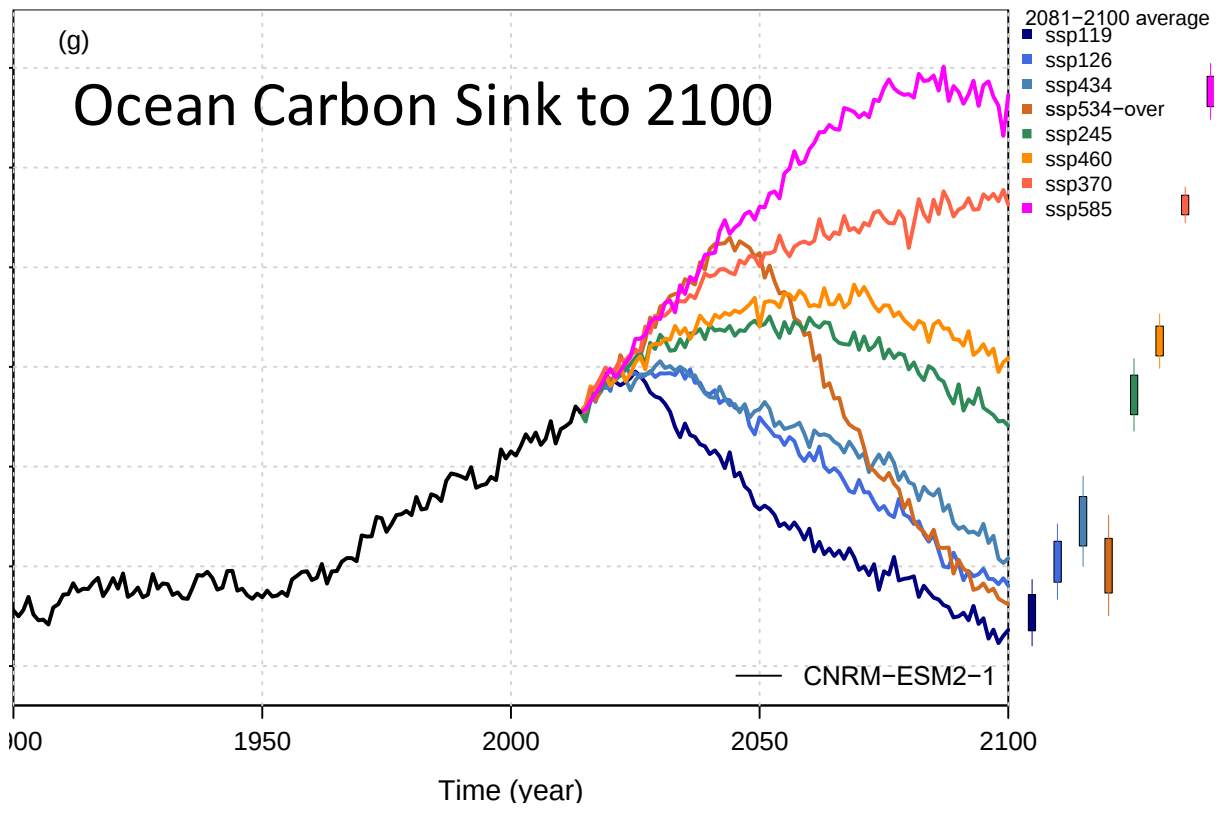


GCP 2019, Global Carbon Budget 2019

Future Component

Exploration of current and future budgets and processes sensitivity to drivers using regional data-based budgets, CMIP6, and other future modeling work.





Chris Jones, Roland Séférian

Carbon Budget Framework

$$NEE_C = NEE_{CO2} + E_{CO} + E_{CH4} + E_{VOCS}$$

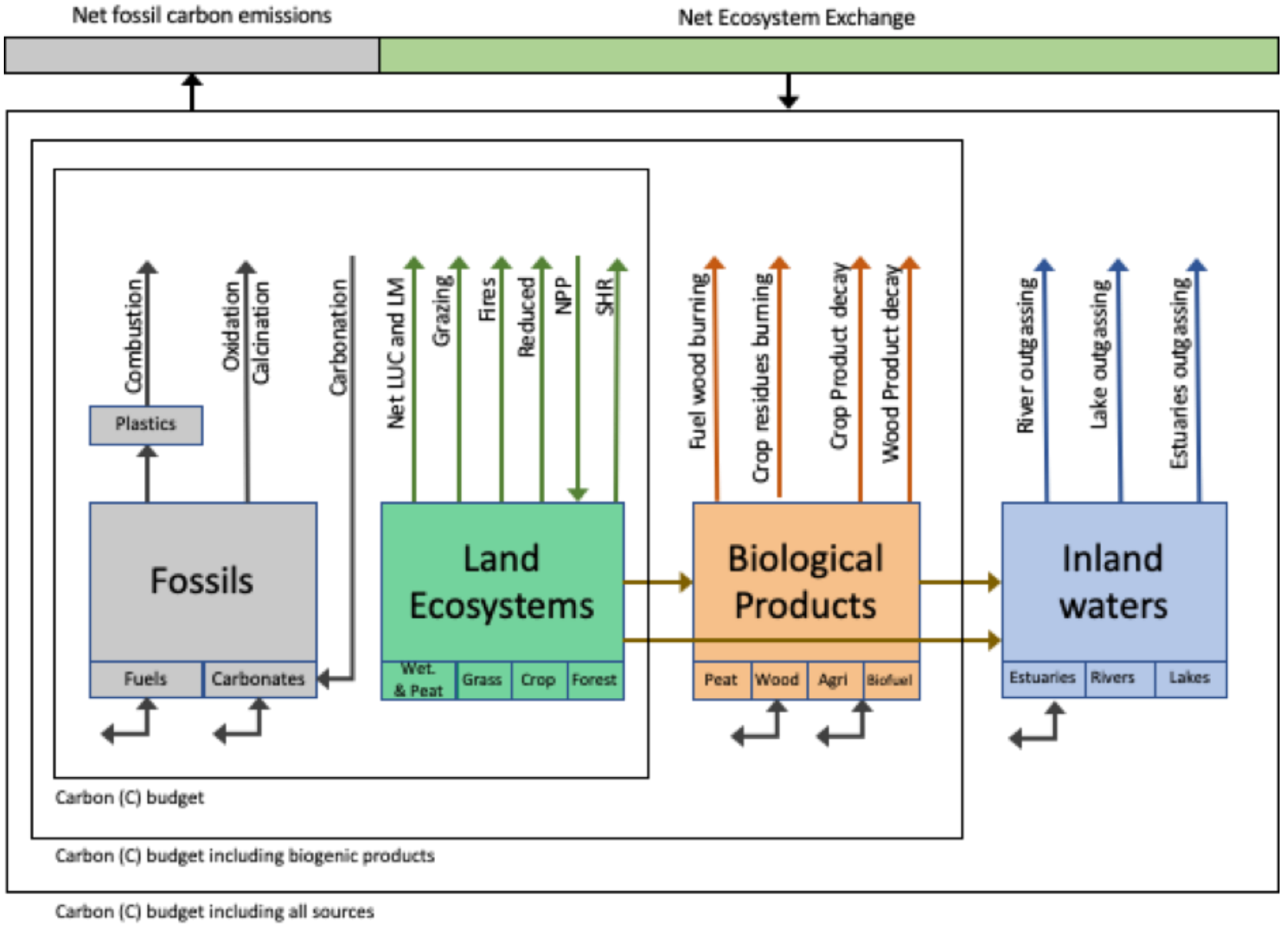
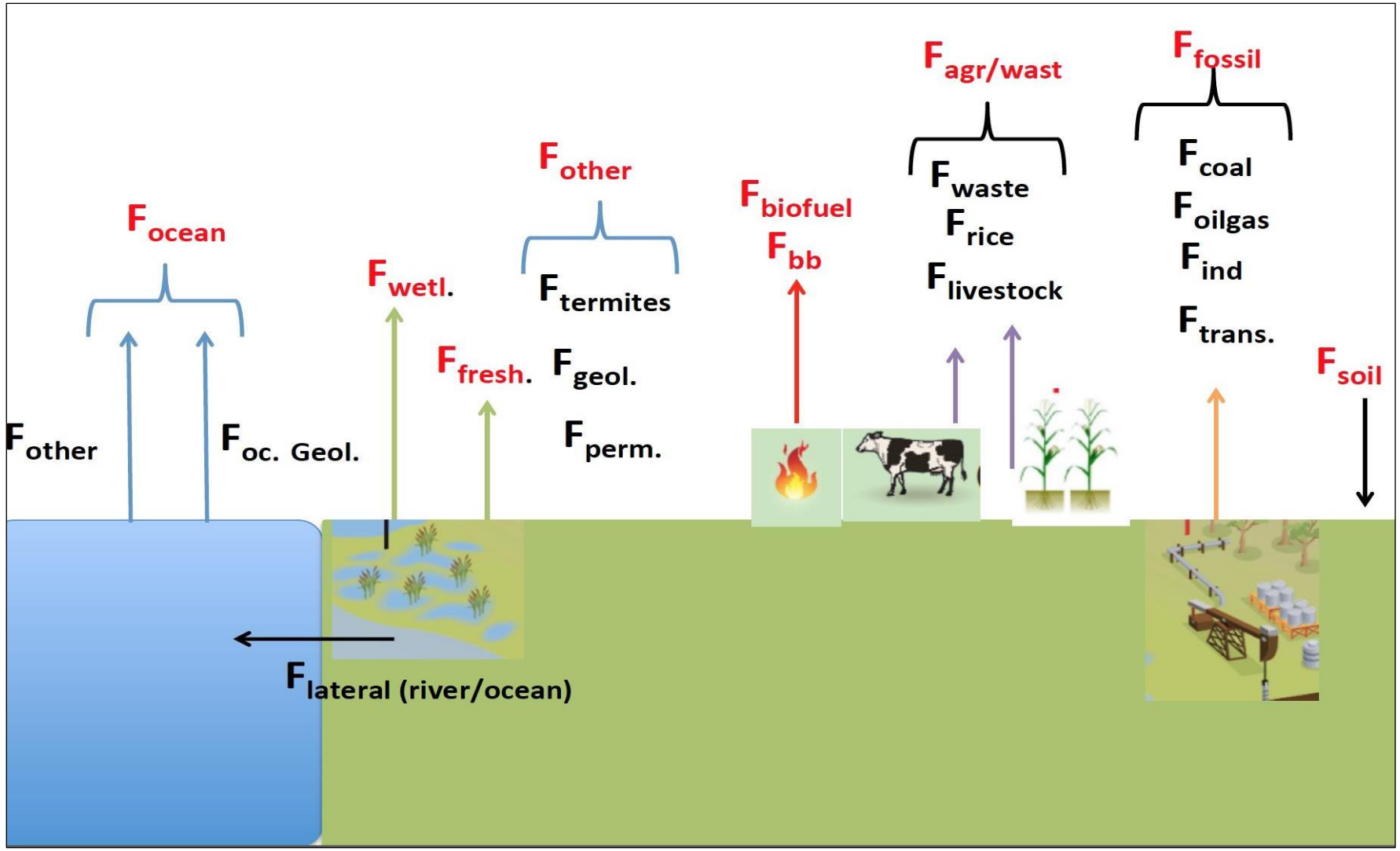


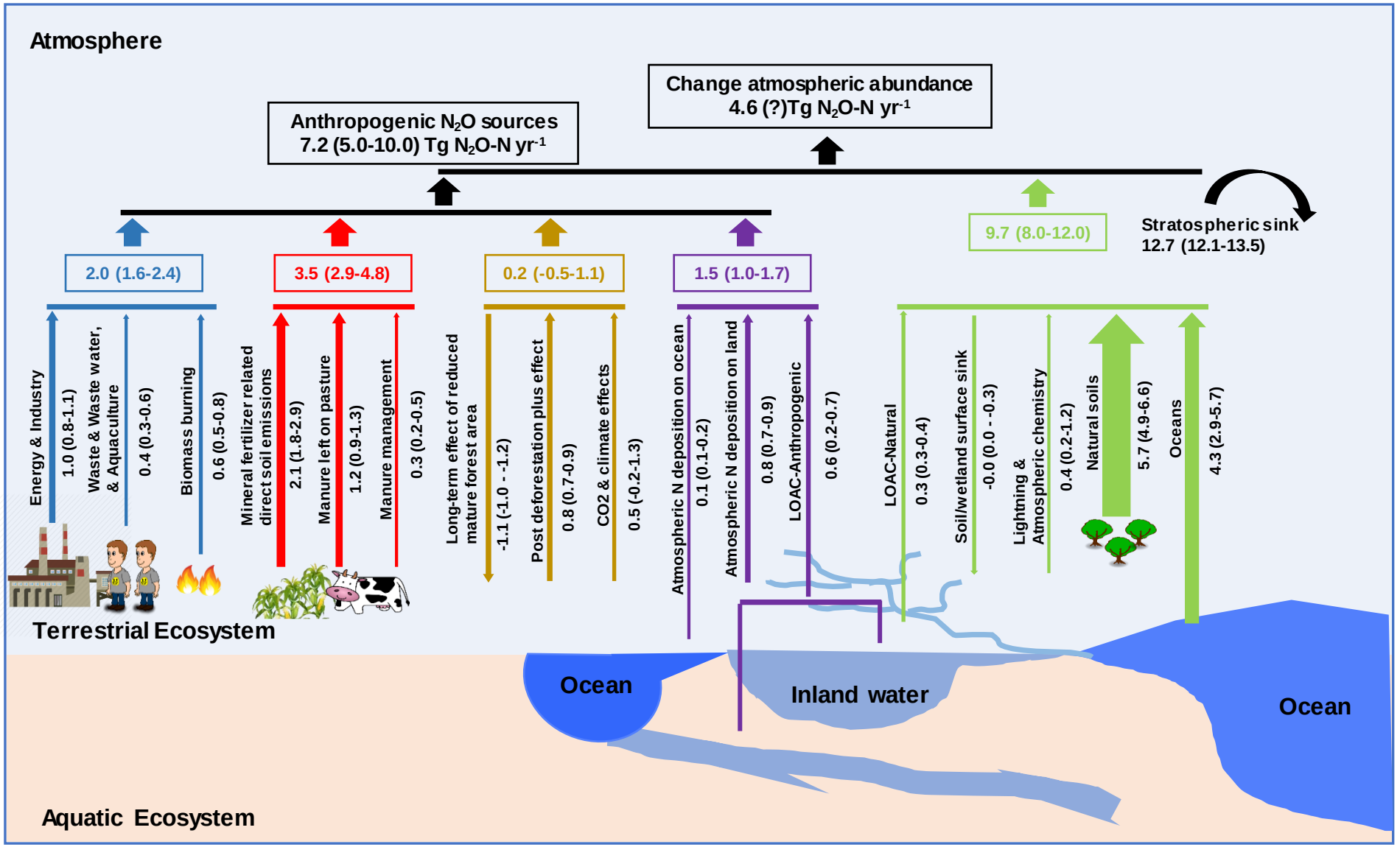
Figure prepared by P. Ciais / R. Andrew for RECCAP-2 protocol

Methane Budget Framework



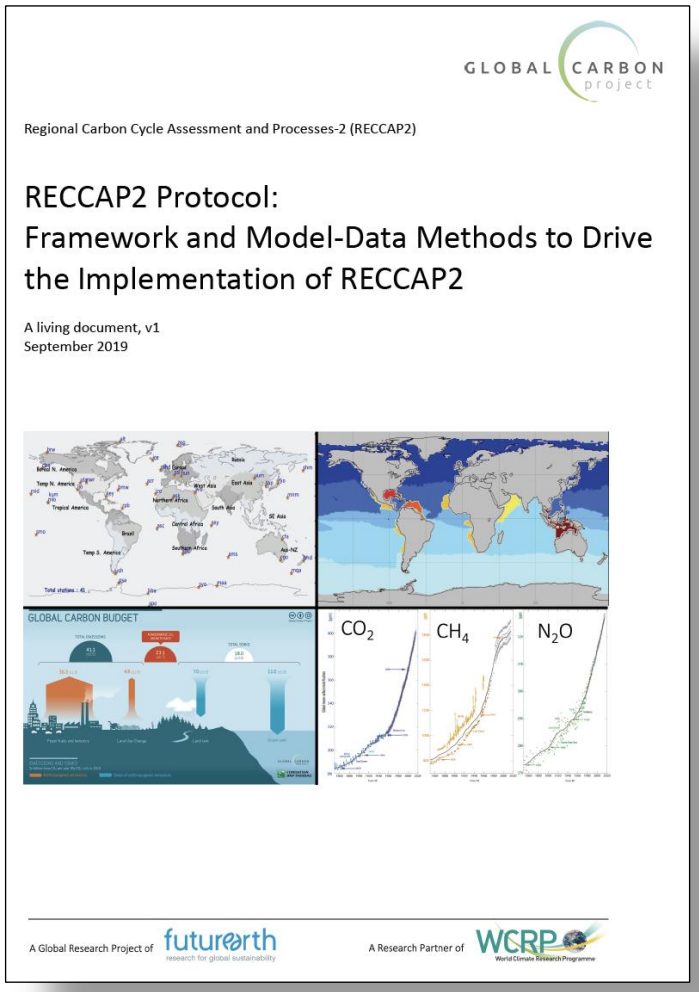
Saunois et al. ESSD-D, 2019; Stavert et al, in preparation

Global Nitrous Oxide Budget Framework



Hanqin et al, in preparation

New Protocols for Global and Regional Budgets



- CO_2, CH_4, N_2O Global Budget Frameworks
- RECCAP2-ocean: Protocol for modelling products
- Atmospheric CO_2, CH_4, N_2O inversions
- TRENDY – biospheric modeling
- LULUCF multiple model ensemble
- Wetland Model Inter-comparison
- Nitrogen-Model Inter-Comparison (NMIP2)
- Freshwater and transport to ocean for the CO_2, CH_4, N_2O
- Land to Ocean Aquatic Continuum

Expected Products

- Special Issue/s with all Budgets and Global Syntheses (AGU journal collection). Submission: August 2021-Novermbe 2022
- Submissions to UNFCC Global Stocktake.
- Submissions and side events to UNFCC COP and NY UN Climate Summit (GCP and thru WMO), others.
- Contributions to WMO annual reports.
- Contributions to IPCC.
- Outreach, including the Global Carbon Atlas.
- Large data legacy for further research and applications.

RECCAP-2 Timeline to Paris Stocktake

	Planning Phase							Activity Phase										Reporting		
Activity	July 2011	Jan. 2015	Aug. 2017	Sept. 2017	Mar. 2018	Dec. 2018	Feb. 2019	Spring 2019	Aug. 2019	Dec. 2019	Apr. 2020	June 2020	July 2020	Aug. 2020	Oct. 2020	Dec. 2020	Aug. 2021	Oct. 2021	Oct. 2022	2023
RECCAP-1 Kick Off																				
RECCAP-1 final submission																				
RECCAP-2 proposal @ ICDC																				
RECCAP-2 themed book																				
ESA RECCAP-2 Kick Off (+VERIFY)																				
AGU 2018 Session																				
ESA/NIES Gotemba RECCAP-2 Kick Off																				
Regional Team Formation																				
AGU 2019 Chapman Conference Breakout																				
AGU 2019 Session and Breakout																				
NACP RECCAP-2 Breakout											cance-lled									
RECCAP-2 South America Workshop																				
Southeast and East Asia workshop (Tsukuba, Japan)																				
EGU RECCAP-2 Session																				
South Asia workshop (Pune, India)																				
RECCAP-1 final synthesis paper (NSR)																				
RECCCAP-2 methodology paper / talk																				
NASA TWSC proposal submission																				
ESA – UNFCCC second phase																				
RECCAP-2 Oceans Website																				
All-hands virtual conference																				
AGU 2020 Session and Breakout																				
Joint GCP-AIMES RECCAP-2 (NASA TWSC)																				
Special journal issue opens																				
Special issue closes																				
Paris Stocktake																				

End