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/CO₂, CH₄ and N₂O (RECCAP1 only C/CO₂).
• 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 N₂O 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

Tier 1: Global Products
- Regional fluxes
- Atmospheric CO$_2$ Inversion Models
- TransCom (Low resolution)
- + Global Obs. Network

Tier 2: Regional-Specific Products
- Regional application
- Atmospheric CO$_2$ Inversions Model (High resolution)
- + Regional ghg obs.

Regional Carbon Balance

Regional cuts from global land & ocean models (Low resolution) + Regional cuts from global data products + Regional specific Models (continental, ocean basin, biome, land use change, others) + Regional specific observations (fluxes, pCO$_2$, remote sensing, forest inv., others)
The 3-Greenhouse Gas Challenge for RECCAP2
Budget Integration of 3-GHG: CO$_2$, CH$_4$, N$_2$O
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)
Basin Carbon Budgets and Processes

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

VOD-L Band Biomass

Ocean CO₂ Storage Change

Grubber et al. 2019, Science

Ocean CO₂ Storage Change

Brandt et al. 2018, NatureE&E

FLUXNET-CH₄

Knox et al. 2019, BAMS

Column GHG – GOSAT-OCO-2

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Future Component

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

Ocean Carbon Sink to 2100

Chris Jones, Roland Séférian
\[ \text{NEE}_C = \text{NEE}_{\text{CO2}} + E_{\text{CO}} + E_{\text{CH4}} + E_{\text{VOCs}} \]
Methane Budget Framework

Saunois et al. ESSD-D, 2019; Stavert et al, in preparation
New Protocols for Global and Regional Budgets

- CO₂, CH₄, N₂O Global Budget Frameworks
- RECCAP2-ocean: Protocol for modelling products
- Atmospheric CO₂, CH₄, N₂O inversions
- TRENDDY – biospheric modeling
- LULUCF multiple model ensemble
- Wetland Model Inter-comparison
- Nitrogen-Model Inter-Comparison (NMIP2)
- Freshwater and transport to ocean for the CO₂, CH₄, N₂O
- Land to Ocean Aquatic Continuum
Expected Products

• Special Issue/s with all Budgets and Global Syntheses (AGU journal collection). Submission: August 2021-November 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

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<td>RECCAP-2 South America Workshop</td>
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<td>Southeast and East Asia workshop (Tsukuba, Japan)</td>
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<td>April 2020</td>
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<td>May 2020</td>
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