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Towards a second phase of the REgional Carbon Cycle Assessment and Processes (RECCAP)

Ana Bastos (1), Philippe Ciais (1), Josep Canadell (2), Frédéric Chevallier (1), Pierre Friedlingstein (3), Martin Jung (4), Markus Reichstein (4), Stephen Sitch (3), and Chao Yue (1)

(1) Laboratoire des Sciences du Climat de de l'Environement, Gif-sur-Yvette, France (ana.bastos@lsce.ipsl.fr), (2) CSIRO Marine and Atmospheric Research, Canberra, Australia, (3) Geography, College of Life and Environmental Sciences University of Exeter, Exeter, UK, (4) Max Planck Institute for Biogeochemistry, Jena, Germany

The international carbon cycle research community, under the umbrella of the Global Carbon Project, conducted one of the largest and most comprehensive assessment ever undertaken: the Regional Carbon Cycle Assessment and Processes (RECCAP-1; http:// www.globalcarbonproject.org/reccap). RECCAP-1, which was carried out from 2011 to 2014, delivered an unprecedented synthesis of the mean carbon balance and change over the period 1990–2009 for all subcontinents and ocean basins. The global coverage provided, for the first time, opportunities to link regional budgets with the global carbon budget, to investigate trends in global and regional fluxes [1].

In RECCAP-1, remote-sensing data with global coverage and high-frequency were under-utilized, since at the time data driven C budget models using remote-sensing and other forcing data were in early stages. This has changed with the availability and frequent update of satellite-based surface monitoring products (XCO_2, vegetation cover, biomass, soil-moisture, burned area) and of data-driven products of ocean and land CO_2 fluxes [2, 3]. Ocean and land-surface models are also now able to capture a large fraction of the variability in the ocean and terrestrial sinks [4]. Still, a non-negligible and highly variable fraction of the global carbon budget remains to be captured by models, pointing to key processes/regions that need to be better constrained. Thus, the time seems right for another effort by the carbon cycle community to evaluate regional carbon cycle budgets, their trends and anomalies and the key driving processes. The need and timeliness for a second phase of a region carbon cycle assessment was discussed at a meeting during the 10^{th} International Carbon Dioxide Conference in 2017 (ICDC10), and the broader community responded quite positively to the challenge.

In this context, we present here a project recently funded by the European Space Agency (ESA) to build towards a new global assessment, RECCAP-2, to address the growing demand for measurements, reporting and verification of the evolution of regional fluxes and the outcomes of climate mitigation policies. The project will integrate satellite data, observation-based machine learning techniques and modelled data to provide annual updates for global and regional carbon budgets at higher spatial resolution, aiming at improving the quantification and understanding of drivers, processes, and hot spot regions essential for predicting the future evolution of any carbon-climate feedback. Successful examples of such integration include the new understanding on the causes of the widespread record greenness and record atmospheric CO_2 growth-rate during 2015 [5], and evaluating the seasonal evolution of the global ecosystems' response to the El-Niño event during late 2015 and 2016.

Here, we will discuss the potential of for high-frequency integrated assessments to advance understanding of C-cycle processes and the provision of relevant information feeding into the global stocktaking process as required by the Paris Climate Agreement.

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