1st ESA Carbon Science Cluster Meeting

Terrestrial Carbon

23-24 June 2021[1]

Virtual

[1] Note - 15-18 June: 17th International Workshop on Greenhouse Gas Measurements from Space (IWGGMS-17)

Introduction

The carbon cycle is central to the Earth system, being inextricably coupled with climate, the water cycle, nutrient cycles and the production of biomass by photosynthesis on land and in the oceans. In the natural system the balance among carbon in the atmosphere, land and ocean is regulated through fluxes between these three main reservoirs. In addition to these natural components, there are the contributions to the atmosphere from human activities, namely, fossil fuel burning, cement production, and a range of land management practices. Over the past 250 years, the atmospheric carbon dioxide (CO_2) concentration has increased by roughly 45% from its pre-industrial value of roughly 280 parts per million by volume (ppm). In the same timeframe, atmospheric methane (CH_4), a greenhouse gas 28 times more powerful than CO_2 has more than doubled due to human activities, responsible for approx. 60% of total emissions, and, after a hiatus, is rising faster than at any time in the last two decades.

Understanding the patterns of exchanges of carbon between the atmosphere, ocean and land and the processes associated to them such as CO_2 fertilization, ocean acidification, changes in surface runoff of sediments, changes to wetlands and peatlands, warming of permafrost, and changes to natural disturbance regimes, are critical to improving knowledge of the carbon cycle, its direct and indirect impacts on society and identifying approaches to mitigate and adapt for its consequences. To achieve such understanding requires an integrated approach to the carbon cycle which exploits the both observations (satellite and in situ) and modelling and cross-domain research (ocean, land and atmosphere).

In the last few years ESA has launched a critical mass of projects addressing different and complementary aspects of the Carbon cycle over land, ocean and atmosphere. Those projects, today more than 20, represent the core of the ESA Carbon Science Cluster. Through this Cluster, ESA also aims at contributing to the establishment of a strong European carbon cycle research area in close collaboration with the European Commission Directorate General for Research and Innovation and other European and international partners.

To encourage exchange between these projects as well as linking them effectively to ongoing work internationally, the ESA Carbon Science Cluster will be supported by a number of research opportunities and networking actions. These are aimed at promoting collaborative research, and fostering international collaboration and bringing together different expertise, data and resources to ensure that the final result is bigger than the sum of the parts.

The 1st ESA Carbon Science Cluster Meeting initiates these activities under the ESA Carbon Science Cluster. **The focus of this first meeting will be on the terrestrial carbon component as a) there will be an ocean carbon coordination meeting later this year and b) the atmosphere component will be addressed in the ATMOS2021 meeting in November. Cross linkage will however be the focus of the 4th Carbon from Space meeting in September 2021.**

For more information about the ESA Carbon Science Cluster, the on-going projects and the coming opportunities, please, visit the dedicated page.

Workshop Objectives

In the last few years, ESA has initiated a significant number of activities in different areas of carbon science. These activities represent the core of the ESA Carbon Science Cluster and comprise scientific studies in the areas of land, atmosphere and ocean.

With the belief that it would be extremely beneficial to establish a technical forum for all teams and ESA to present the work done, discuss opportunities and define potential ways forward, ESA has planned the Carbon Science Cluster Meeting to:

- Present the status and results of ESA's science supported activities in Terrestrial Carbon Research, so that all teams are updated on the progress and informed about plans and outcomes of the different projects.
- To identify synergies and potential collaboration and cross-fertilization among the different teams.
- Strengthen coordination and collaboration of different activities if needed.
- Discuss and propose a way forward in terms of scientific gaps and requirements, science questions, and new ideas that may be used as guidelines for ESA to define a Carbon science plan for 2023-2025.
- Explore options to define a community

Preliminary Agenda

Day 1

9:30 – 10:45 Session 1. Introduction and Welcome – Stephen Plummer

- The ESA Scientific Exploitation and the Carbon Science Cluster (Diego Fernandez)
- Carbon in the Atmosphere (Christian Retscher)
- Carbon in the Ocean (Marie-Helene Rio)
- Current Challenges in Terrestrial Carbon Science (Ana Bastos, Stephen Sitch)
- AFOLU – A CEOS Roadmap and Initiative (Frank Martin Seifert)
- Workshop objectives and logistics, (Stephen Plummer)

10:45-11:00 Coffee break

11:00 - 12:30 Terrestrial Carbon Projects Session 1 - Stephen Plummer
Understanding Primary Production

11:00 Land Surface Carbon Constellation - Lund University (Marko Scholze)
11:15 Sentinels4Carbon - Noveltis SAS (Cedric Bacour)
11:30 TerrA-P – VITO (Roel van Hoolst)
11:45 Vad3emecum – MPI-BGC (Sophia Walther)
12:00 Sentinel 5P Innovation SIF - Noveltis SAS (Luis Guanter)
12:15 Photoproxy - Forschungszentrum Jülich (Uwe Rascher)
12:30 Multi-Flex - University of Milano Bicocca (Marco Celesti)

12:45-13:00 Discussion on GPP
13:00-14:00 Lunch break

14:00-15:30 Terrestrial Carbon Projects Session 2 – Stephen Plummer)

New observations for terrestrial carbon

14:00 SMOS+ Vegetation – Univ Toulouse 3 (Nemesio Rodrigues-Fernandez)
14:15 Albiom - Deimos Space UK Ltd (Maria-Paola Clarizia)
14:30 Biomascat - Gamma Remote Sensing AG (Maurizio Santoro)

Dynamics, disturbance, carbon management

14:45 Sentinel4Carbon - TUD (Theme 2) (Matthias Forkel)
15:00 S14Science Amazonas – GISAT, Agresta, NMBU, NLS (Neha Joshi)
15:15 SHRED – TU Vienna (Mariette Vreugdenhil)
15:30 F-DTE, Assesscarbon, Forest Carbon Monitoring (Matti Mottus)

15:45-16:15 Discussion on new observations and dynamics

16:15-16:45 Open discussion on project status, cluster, new mechanisms for working, new call for cluster

End of first day

Day 2

9:30-11:00 Future Missions, Campaigns, Tools and other ESA activities in support of Carbon science

9:30 Biomass, FLEX, status and plans – Klaus Scipal, Matthias Drusch
9:45 Sentinel Expansion Missions – Malcolm Davidson
10:00 Land Surface data campaigns – what is there, where, what is planned – Dirk Schuettemeyer
10:15 Earth System Data Laboratory – Anca Anghelea
10:30 CCI and carbon activities – Clement Albergel
10:45 Applications – The 'World' projects – Frank Martin Seifert

11:00-11:30 Coffee break

11:30-12:30 Parallel Technical Discussion sessions

1. Towards a European Terrestrial Carbon Constellation project
2. Science needs in preparation for Copernicus Sentinel Expansion Missions (2026)

14:00-15:30 Final session

14:00 Recommendations from Breakouts
14:45 Final Discussion
15:15 Wrap-up and Next Steps