

3rd Carbon from Space Workshop
Reconciling the land, ocean and atmosphere components of the Carbon Cycle

26-28 January 2016
 University of Exeter, UK

Day 1

Session 1: Welcome, Objectives and Scene setting (Chairs: *Andy Watson, University of Exeter* and *Stephen Briggs, ESA*)

- 8:45 - 9:00: Welcome (*Andy Watson, University of Exeter, UK*)
- 9:00 - 9:10: Background and Meeting Objectives (*Stephen Plummer, ESA*)
- 09:10 - 09:30: The Global Carbon Project: Future perspectives (*Rob Jackson, Stanford University, USA*)
- 09:30 - 09:50: The CEOS strategy for Carbon Observations (*Stephen Briggs, ESA*)
- 09:50 - 10:10: What did the IPCC AR5 state and what is its prognosis (*Philippe Ciais, LSCE, FR*)
- 10:10 - 10:30: Emergent constraints on carbon cycle feedbacks in Earth System Models (*Peter Cox, University of Exeter, UK*)

Coffee Break: 10:30-11:00

Session 2: Current understanding of the carbon cycle – pools (Chairs: *Han Dolman, Free University Amsterdam, NDL* and *Philippe Ciais, LSCE, FR*)

- 11:00-11:20: Global and Regional Carbon Cycle: the experience from the Global carbon Budget calculations and RECCAP: What do we know today and what are the major knowledge gaps? (*TBD*)
- 11:20-11:40: From atmospheric concentrations (CO₂ and CH₄) to fluxes: Can we reconcile differences found in inventories and the inversion results using in-situ and atmospheric satellite data? (*Frederic Chevallier, LSCE, FR*)
- 11:40-12:00: What do we need to do to improve the quality of estimates of the global terrestrial carbon sink: from a residual to a data driven approach? (*Martin Jung, Max Planck Institute for Biogeochemistry, DE*)
- 12:00-12:20: How well do we know ocean carbon stocks, the process of C sequestration into the deeper oceans and the role of ocean acidification? (*Christoph Heinze, University of Bergen, NO*)

12:20-13:00 Plenary Discussion: Current understanding of the carbon cycle - pools

Lunch: 13:00-14:00

Session 3: Current understanding of the carbon cycle – fluxes (Chairs: *Markus Reichstein, Planck Institute for Biogeochemistry, DE* and *Marko Scholze, Lund University, SE*)

- 14:00 - 14:20: Open questions on atmospheric carbon fluxes? (*Julia Marshall, Max Planck Institute for Biogeochemistry, DE*)
- 14:20 - 14:40: Challenges in coastal wetland assessment and the carbon cycle (*Zhiliang Zhu, USGS, USA*)
- 14:40 - 15:00: Ocean-atmosphere fluxes from satellite & in-situ observations and models (*Jamie Shutler, University of Exeter, UK*)
- 15:00 - 15:20: Fluxes between land and atmosphere (*Marko Scholze, Lund University, SE*)

15:20 Breakout organisation (*Stephen Plummer, ESA* and *Claus Zehner, ESA*)

Coffee Break: 15:30-16:00

16:00-17:30 Breakout 1 - Carbon pools and their interfaces

How do we use models and observations together to improve carbon cycle projections? <i>Leaders: Bernard Pinty, DG-Growth, EC, Peter Cox, University of Exeter, UK and Markus Reichstein, MPI, DE.</i>	How can we reconcile observations over ocean, land and atmosphere and ensure consistency of carbon flux calculations? <i>Leaders: Andy Watson, University of Exeter, UK and Marko Scholze, Lund University, SE</i>	How do we determine the magnitude of the carbon sink of a region (e.g. Europe)? – what has to be put in place (ground-based, satellite measurements; improved inversion schemes etc.) to solve this open question? <i>Leaders: Michael Buchwitz, University of Bremen, DE and Philippe Ciais, LSCE, FR</i>
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17:30-18:30 – Poster session (and ice breaker)

Day 2:

Session 4: Climate, humans and carbon cycle change (Chairs: Rob Jackson, Stanford University, USA and Dave Crisp, JPL, USA)

- 09:00 - 09:20: Is there observational based evidence of carbon cycle changes and if so can we attribute the causes of these changes (Andy Watson, University of Exeter, UK)
- 09:20 - 09:40: Climate extremes and the carbon cycle (Markus Reichstein, Max Planck Institute for Biogeochemistry, DE)
- 09:40 - 10:00: Space-borne observations and carbon tipping points (or sensitive regions) (Dave Crisp, JPL, USA and Emanuel Gloor, University of Leeds, UK)
- 10:00 - 10:20: Anthropogenic impacts on the carbon cycle (Rob Jackson, Stanford University, USA)
- 10:20 - 10:40: Carbon budgets of megacities using combined in situ and satellite information (TBC)

10:40-11:00 Plenary Discussion: Climate, humans and carbon cycle change

Coffee Break: 11:00-11:30

Session 5: Reporting session from Breakout Day 1

- 11:30-11:45: **Reporting Session A - use of models and observations**
- 11:45-12:00: **Reporting Session B - consistency of carbon flux calculations**
- 12:00-12:15: **Reporting Session C - determining the carbon sink of a region**

12:15-13:00 Plenary discussion: Reconciling land, ocean, atmosphere inconsistencies (TBC)

13:00-14:00 Lunch

Session 6: Key problem areas and new frontiers (Ralph Dubayah, University of Maryland, USA and Mark Dowell, JRC, EC)

- 14:00-14:20: Wetland emissions - the largest and most uncertain source in the global CH₄ budget (Catherine Prigent, LERMA, FR and Philippe Bousquet, LSCE, FR)
- 14:20-14:40: Carbon in the tropics - a resolved question? (Sassan Saatchi, JPL, USA)
- 14:40-15:00: Arctic melting and greening: impacts and importance (Dave McGuire, University of Alaska, Fairbanks, USA)
- 15:00-15:20: Black carbon and aerosols in the carbon cycle (TBC)
- 15:20-15:40: Towards an integrated biosphere net primary production estimate (Mark Dowell, JRC, EC)

15:40 Breakout Organisation (Craig Donlon, ESA and Klaus Scipal, ESA)

15:50-16:10 Coffee Break

16:00-17:30 Breakout sessions: Concrete actions and target 2021

<p><i>The unresolved questions in the carbon cycle: what are the priorities and where do satellite data contribute?</i></p> <p>Leaders: Sassan Saatchi, JPL, USA, Dave Crisp, JPL, USA and Mark Dowell, JRC, EC.</p>	<p><i>Novel Observations and Products for 2021 and beyond: new and better exploitation of satellite and in situ data</i></p> <p>Leaders: Hartmut Boesch, University of Leicester, UK, Shaun Quegan, University of Sheffield, UK and Shubha Sathyendranath, Plymouth Marine Laboratory, UK</p>	<p><i>New Frontiers for models and observations: What can we imagine and what projects can be designed - targeted RECCAPs, CxMIP exercises, integrated carbon observing systems?</i></p> <p>Leaders: Pierre Friedlingstein, University of Exeter, UK, Julia Marshall, MPI, DE</p>
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17:30-18:30 Posters

Day 3:

Session 7: Advancing towards an integrated approach

- 09:00 - 09:20: NASA's Carbon Monitoring System program (*Kevin Bowman, JPL, USA*)
09:20 - 09:40: Towards an integrated Global Greenhouse Gas Information System (IG3IS) (*Oksana Tarasova, WMO*)
09:40 - 10:00: The role of space based observations to separate natural and anthropogenic fluxes in the context of a carbon monitoring system (*Michael Buchwitz, University of Bremen, DE and Philippe Ciais, LSCE, FR*)
10:00 - 10:20: Current limitations of an empirical spatiotemporal description of the global carbon cycle (*Jakob Zscheischler, ETH Zürich, CH and Miguel Macheda, Max Planck Institute, DE*)
10:20 - 10:40: The GEO Carbon Flagship (*Antonio Bombelli, CMCC, IT*)

10:40 - 11:00 **Coffee break**

Session 8: Reporting Session from Breakout Day 2

- 11:00-11:15: **Reporting Session D - The current unknowns of the carbon cycle:**
11:15-11:30: **Reporting Session E - Novel Observations and Products:**
11:30-11:45: **Reporting Session F - New Frontiers**
- 11:45-12:45** **Discussion on way forward and recommendations for the Space Agencies**
- 12:45-13:00** **Summary and closure**

Summary Paper drafting session