QUANTIFYING TERRESTRIAL CARBON SINKS

Preface

Terrestrial carbon sinks play a central role in the international climate negotiations and within national strategies to slow down net greenhouse gase emissions. In particular, there is a great interest in land-use options that enhance carbon sinks and/or reduce emissions from deforestation.

Climate mitigation efforts are also becoming more integrated into the larger portfolio of environmental and socio-economic activities geared towards sustainable development. In this respect, management of the terrestrial carbon cycle is even more important because it is fundamentally linked to multiple ecosystem properties and services essential to human wellbeing.

To support this effort there is an urgent need to improve process understanding of land carbon sources and sinks, and to develop capabilities that will allow operational monitoring of the dynamic evolution of the carbon cycle.

In this special issue we present a number of scientific developments aligned with these research and policy needs.

The first set of papers are concerned with the consequences of past and future land-use change for the functioning of the terrestrial carbon cycle (Gitz and Ciais; Levy et al.). The papers set the stage for some of the consequences of past and future actions taken to promote economical development or mitigate climate change.

The second set of contributions quantify the potential or current carbon sequestration capacity of several regions in the world including China, Central American tropics, Russia, and Europe (Pan et al.; Ni; Wang et al.; Krankina et al.; Tschakert; Potvin et al.; Schelhaas et al.; Piccolo et al.).

The third set of papers describe remote-sensing approaches to determine important characteristics and drivers of the land carbon cycle (forest fire, ecosystem structure, standing biomass). Remotely sensed observations are spatially extensive, homogenous, and have the adequate temporal coverage to monitor emerging properties of the terrestrial carbon cycle, but they need to be carefully calibrated and validated against *in situ* measurements in retrieving carbon variables. These data sources are potentially critical contributions towards multiple constraint data assimilation systems that could operationally measure carbon fluxes and stock changes (Tansey et al.; Le Toan et al.; Widlowski et al.).

The last set of contributions deal with a number of complex research challenges posed by the Kyoto Protocol, such as the need to factor out direct and indirect human effects on terrestrial carbon sinks (Kirschbaum and Cowie; Alexandrov and Yamagata; Lövbrand).

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Guest Editors:

JOSEP CANADELL
Global Carbon Project-CSIRO Atmospheric Research, Canberra, Australia

PHILIPPE CIAIS
Commissariat a L'Energie Atomique, DSM/Laboratoire des Sciences du Climat et de l'environnement, France

PETER COX
Hadley Centre for Climate Prediction and Research, Met Office, Exeter, United Kingdom

MARTIN HEIMANN
Max-Planck-Institute for Biogeochemistry, Jena, Germany