Geophysical Research Abstracts
Vol. 20, EGU2018-18757, 2018
EGU General Assembly 2018
© Author(s) 2018. CC Attribution 4.0 license.

Model-data fusion framework to assess the vulnerability of Australian carbon stocks and water resources

Cathy Trudinger (1), Vanessa Haverd (2), Pep Canadell (2), Peter Briggs (2), and Ben Smith (3)

(1) CSIRO Oceans and Atmophere, Aspendale, Australia (cathy.trudinger@csiro.au), (2) CSIRO Oceans and Atmosphere, Canberra, Australia, (3) Lund University, Department of Physical Geography and Ecosystem Science, Lund, Sweden

The Australian landscape is unique. It is characterized by large interannual variability in rainfall, and this drives significant variability in Australian carbon fluxes, particularly in semi-arid and savanna ecosystems. With its vast area, Australia may have a large potential for low-cost, land-based carbon mitigation, through protection of existing carbon stocks and revegetation. However the mitigation potential needs to be assessed with consideration of nutrients, water, and biophysical feedbacks in the context of a changing and variable climate. In order to provide a realistic assessment of the potential for land-based carbon mitigation in Australia from a biophysical perspective and its vulnerability to future climate change, we require a model with accurate representation of biomass accumulation and turnover, mediated by tree demography and disturbance, and their responses to rising CO_2, changing climate, nutrient availability and land-use change. An assessment of how changes in climate and land-use will affect Australia's future hydroclimates and water resources is also possible with such a model.

Here we constrain the CABLE terrestrial biogeochemical model for Australia at high spatial resolution (0.05°, approx. 5 km) with multiple observation types: carbon and water fluxes at OzFlux flux sites, carbon pool data, litter fall, biometric data, remotely-sensed vegetation cover, soil moisture (in situ and remotely sensed) and streamflow data. These observations are used either to constrain model parameters in a model-data fusion framework or to compare with model simulations. We generate multiple parameter sets to allow exploration of the effect on model results of parameter equifinality (whereby multiple combinations of parameters can give an equally acceptable fit to the calibration data). Our model allows for demographic effects on biomass accumulation and turnover, which is generally not the case in examples of carbon cycle model-data fusion because of the high computational cost of most models that account for vegetation structure.

With our calibrated model, we provide an assessment of the past and present Australian carbon and water budgets, including their mean states and interannual and decadal variability. We also calculate the (hypothetical) current biomass that would exist had there been no past land-use change.