Geophysical Research Abstracts
Vol. 20, EGU2018-5388, 2018
EGU General Assembly 2018

Land use and land cover distribution is a primary determinant of global carbon cycle projections and regional temperature projections

Alan Di Vittorio (1), Xiaoying Shi (2), Ben Bond-Lamberty (3), Kate Calvin (3), and Andrew Jones (1)

(1) Lawrence Berkeley National Laboratory, Climate Sciences Department, Berkeley, United States, (2) Climate Change Science Institute, Oak Ridge National Laboratory, Oak Ridge, USA, (3) Joint Global Change Research Institute, Pacific Northwest National Laboratory, College Park, USA

Earth System Models (ESMs) project future global change based on historical and current conditions, as well as projected greenhouse gas emissions and Land Use and Land Cover Change (LULCC). As climate change is closely related to changes in atmospheric CO_2 concentration and to local conditions, it is important for these models to accurately project carbon cycle dynamics and LULCC. A previous comparison of 11 ESMs demonstrates a reasonable mean projection for 2005 CO_2 concentration, but with a 12 ppmv standard deviation of values. Efforts to reduce this variability and improve future projections have focused on fine scale biogeochemical processes rather than contextual conditions such as land cover distribution. However, using the integrated Earth System Model (iESM) we have shown that uncertainty in land conversion assumptions leading to a 5.1 M km2 difference in global forest area generates a 6 ppmv uncertainty range, which is 50% of the inter-model variability in historically projected 2005 CO_2 concentration. This uncertainty in 2005 land cover distribution continues to affect the global carbon and regional climate into the future in an RCP4.5 simulation. The iESM LULCC CO_2 concentration uncertainty in 2005 increases by 50% to 9 ppmv in 2094, and the 2005 uncertainty in terrestrial carbon stock increases from 26 PgC to 33 PgC. This initial forest cover also generates differences in 2005-2094 average annual regional surface temperature projections ranging from -0.6 to 0.7 degrees °C. Furthermore, differences in regional surface temperature projections also range from -0.3 to 0.6 °C due to spatial redistribution of similar global forest area and ∼1 M km2 difference in shrubland, when comparing the maximum forest and default cases. These results highlight the importance of accurately characterizing land use and land cover and its uncertainty in global change analysis.