Geophysical Research Abstracts
Vol. 16, EGU2014-4329, 2014
EGU General Assembly 2014

The Role of Artificial Atmospheric CO_2 Removal in Stabilizing Earth's Climate

Katarzyna Tokarska and Kirsten Zickfeld
Simon Fraser University, Department of Geography, Burnaby, B.C, Canada (kbt2@sfu.ca)

Recent research showed that global mean temperature remains approximately constant for several centuries after complete cessation of CO_2 emissions, while global mean thermosteric sea level continues to rise. This implies that a net artificial removal of CO_2 from the atmosphere may be necessary to decrease the atmospheric CO_2 concentrations more rapidly and bring the climate system components to their previous states on human timescales.

The purpose of this study is to explore the reversibility of climate responses to a range of realistic CO_2 emission scenarios, which follow a gradual transition from fossil-fuel driven economy to a zero-emission energy system with implementation of negative CO_2 emissions, using the University of Victoria Earth System Climate Model of intermediate complexity (UVic ESCM 2.9). The CO_2 emission pathways were designed to meet constraints related to the implementation of negative emission technologies derived from the integrated assessment literature.

Our simulations show that while it is possible, in principle, to revert the global mean temperature after a phase of overshoot, the thermosteric sea level rise is not reversible on human timescales for the range of emission scenarios considered. During the negative emission phase, CO_2 is released form the natural (terrestrial and marine) carbon sinks, which diminishes the efficiency of negative emissions implemented. In addition, spatial changes of vegetation distribution patterns are not entirely reversible on human timescales.

We suggest that while negative emissions could potentially stabilize the global mean temperature at a desired level, such technology does not supersede reductions in fossil fuel emissions, as the artificial CO_2 capture at large scale has many limitations and is unable to stabilize other climate system components (e.g. sea level) at desired levels.