Geophysical Research Abstracts
Vol. 19, EGU2017-15292, 2017
EGU General Assembly 2017

Climatic effects of biogenic volatile organic compounds (BVOCs) emissions and associated feedbacks due to vegetation change in the boreal zone

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As our understanding of the earth system improves, it is becoming increasingly clear that vegetation and ecosystems are not only influenced by the atmosphere, but that changes in these also feed back to the atmosphere and induce changes here. One such feedback involves the emission of biogenic volatile organic compounds (BVOCs) emitted from vegetation. As BVOCs are oxidized, they become less volatile and contribute to aerosol growth and formation in the atmosphere, and can thus change the radiative balance of the atmosphere through both the direct and indirect aerosol effects. The amount and type of BVOCs emitted by vegetation depends on a myriad of variables; temperature, leaf area index (LAI), species, water availability and various types of stress (e.g. insects attacks). They generally increase with higher temperatures and under stress.
These factors beg the question of how emissions will change in the future in response to both temperature increase and changes to vegetation patterns and densities. The boreal region is of particular interest because forest cover in general has been thought to have a warming effect due to trees reducing the albedo, especially when snow covers the ground.
We investigate feedbacks through BVOC emissions related to the expected northward expansion of boreal forests in response to global warming with a development version of the Norwegian Earth System Model (NorESM). BVOC emissions are computed by the Model of Emissions of Gases and Aerosols from Nature 2.1 (MEGAN2.1) which is incorporated into the Community Land Model v4.5 (CLM4.5). The atmospheric component is CAM5.3-Oslo.
We will present preliminary results of effects on clouds and aerosol concentrations resulting from a fixed poleward shift in boreal forests and compare the radiative effects of this to changes in surface energy fluxes. CO_2-concentrations and sea surface temperatures are kept fixed in order to isolate the effects of the change in vegetation patterns. Finally, these results are compared to simulations of a future climate (corresponding to 2xCO_2-concentrations) both with present-day and shifted vegetation patterns.