Geophysical Research Abstracts
Vol. 20, EGU2018-7644, 2018
EGU General Assembly 2018

Impacts of maximum deforestation/reforestation on regional climate over Europe

Susanna Strada, Erika Coppola, and Giorgi Filippo
The Abdus Salam ICTP, Earth System Physics Section, Trieste, Italy (sstrada@ictp.it)

By changing the land cover, humans modify the surface energy and water balance and alter atmospheric conditions with effects on climate at different scales, from local/regional (a few ten kilometers) to global scales (a few hundred kilometers). Among the CORDEX flagships, the LUCAS project aims to compare performance of regional climate models in representing the effects of land cover change on regional climate and extremes. To this purpose, we apply the coupled surface-atmosphere regional climate model RegCM4.6.1 over the EURO-CORDEX domain (horizontal resolution: 25 km). In addition to a baseline experiment that considers present-day land cover distribution, we perform two sensitivity experiments that consider extreme land cover changes. The "FOREST" experiment maximizes the forest cover over Europe according to potential vegetation (i.e. as if trees could cover the whole land area, except for regions where vegetation cannot realistically grow; e.g. deserts). The "GRASS" experiment converts all forests into grasslands (no croplands). All experiments cover the period 1985–2015 (one year spin-up) and are driven by the ERA-Interim reanalysis, which provides lateral and boundary conditions for both the atmosphere and the sea surface temperature.

Preliminary results show that over the boreal region conversion of forests into grass (i.e. the GRASS experiment) reduces surface temperatures, with the maximum cooling observed during spring. The loss of trees increases the surface albedo all the year around, especially during winter and spring when snow homogeneously covers the land. Locally, deforestation reduces evapotranspiration and lastly precipitation, because water is frozen and unavailable for plants. On the contrary, reforestation (i.e. the FOREST experiment) increases surface temperature. Trees have a lower albedo than grass and mask snow under their canopies, hence they provide a darker land compare to grasslands and store more energy coming from solar and long-wave radiations. The stored energy is then released back to the atmosphere as turbulent latent and sensible fluxes that can modify the atmospheric circulation with local and non-local effects. In our FOREST experiment, during summer the change in the net surface radiation does not retrace the change in the forest cover, suggesting a possible remote modification in the cloud cover triggered by the land cover change. As a next step, we aim to explore possible non-local effects as well as change in extreme events due to land cover change.