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Interaction of opposed climate forcings due to afforestation over Hungary

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Natural vegetation is a dynamic component of the climate system, which plays a key role in determination of weather and climate. Forests, due to their higher leaf area, larger roughness length, lower albedo and deeper roots compared to other vegetated surfaces affect the exchange of water- energy- and momentum with the atmosphere. Thus climatic feedbacks of forest cover change can alter the climate change signal. The low albedo of boreal forests is a positive climate forcing, whereas tropical forests diminish warming via evaporative cooling. The climatic benefit of temperate forests is highly uncertain, it greatly depends on the characteristic of the studied region.
For the period 2071-2100, biogeophysical feedbacks of complete afforestation have been investigated over Hungary, using the regional climate model REMO. Main components of the water and energy cycle have been analyzed on different time scales (monthly, daily, hourly), comparing the results of the afforestation experiment to the reference simulation with present forest cover. Research efforts are concentrating on the following questions:
· How are the basic climatic processes affected by afforestation on local/regional scale?
· Does the effect of enhanced evapotranspiration or the influence of decreased albedo dominate in determination of the surface- and the 2m-temperatures?
· How does the interaction of these two main climate forcings change during the summer months?
· Do the simulated temperature changes enhance or mitigate the climate change signal?

For summers in the 21st century, regional climate model simulations project a significant tendency of warming and drying in Hungary. Understanding the role of forest in the climatic processes and interactions may help in the adaptation and mitigation strategies.

Keywords: biogeophysical feedbacks, afforestation, evaporative cooling, albedo-effect