# Simulating the effects of vegetation change on southern Africa's climate

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Vegetation is an important regulator of energy, moisture and momentum transfers at the earth's surface. Changes in the distribution of different vegetation types such as the conversion of tropical forests to grassland or cropland have an effect on both local surface climate and regional-scale circulation. Many general circulation model (GCM) experiments have been undertaken to simulate the effects of changing vegetation, particularly in the tropical regions. Regional climate models (RCMs) have also been used to explore land-surface-atmosphere feedback for various locations, but very little work has focused on southern Africa. This study aims to address how the regional climate of southern Africa responds to vegetation change. Of particular interest is the impact of human modification of the landscape. For this study, the MM5 RCM is configured for the domain covering the equator to 40°S in latitude and 5°E to 57°E longitude at a horizontal grid resolution of 50 km. The model is run with two vegetation distributions: 1) potential natural vegetation simulated by the Sheffield Dynamic Global Vegetation Model (SDGVM), and 2) present-day vegetation provided by the United States Geological Survey (USGS) global vegetation classification. The difference between these two vegetation maps is a plausible representation land-surface change due to human activities. The same land-surface parameters are used for both classifications so that the simulated changes in climate are attributable to changes in spatial distribution of vegetation types rather than changes in vegetation state.

Six-month simulations for the period September 1991 to February 1992 have been completed and analysis is currently in progress. Some initial observations can be made here. The results reveal decreases in surface temperature of over 2°C, in the north-eastern parts of the sub-continent and increases of up to 2°C in the centre of the domain, when changing from natural to modified vegetation. The decreases in temperature are associated with increases (decreases) in latent heat flux (sensible heat flux) and vice versa. Increased geopotential heights extending from the surface to the 500 hPa level over the centre of the domain appear to be associated with an overall decrease in rainfall for that area. A more interesting feature, however, is a cell of decreased moisture centred over Botswana and rising to the 700 hPa level before extending eastward. The 700 hPa level is an important channel carrying moisture into the sub-continent from the Indian Ocean, which makes this result of considerable interest. The exact mechanism causing this decrease in moisture is yet to be identified.