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# Analyzing savannah vegetation phenology with remotely sensed data, lagged time-series models and phenopictures

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It is predicted that savannah regions will see changes in precipitation patterns due to current climate change projections. The change will most likely affect leaf phenology which controls net primary production. It is therefore important to; 1) study those changes and its drivers, 2) to be able to correctly model the changes to vegetation phenology due to climate change. To our knowledge there is no existing global savannah phenology model that can capture both the phenological events and the vegetation state between the events. We therefore, investigate how day length, mean annual precipitation and soil moisture affects and controls the vegetation phenology of savannahs (using MODIS NDVI as a proxy for phenological state) with a lagged time series model for global application. We furthermore use phenological pictures (phenopictures) to investigate savannah tree and grass phenology. Phenopictures are pictures taken with a digital time-lapse camera with the purpose of recording and studying phenological events. We used climate data from 15 flux towers sites located in 4 continents together with normalized difference vegetation index from MODIS for the model development. Two of the sites located in Africa were further analyzed using phenopictures. The developed model identified all three considered variables as usable for modelling of savannah leaf phenology but showed some inconsistent result for some of the sites indicating the difficulties in creating a simple common model that works equally well across sites. We attribute some of these difficulties to site specific differences (e.g. grazing or tree and grass ratio) that the simplified model did not consider. But we expect it to on average give the cross-validated result (r2= 0.6, RMSE = 0.1) when applied to other savannah areas. The preliminary analysis of the phenological pictures with respect to tree and grass to some extent support this by showing differences in the start of the leaves development in the beginning of the season. However, this differed between the two studied sites which further highlights the difficulties in creating a common model that works equally well for individual sites.