Determining new C4 grass plant functional types to reflect the grass cover diversity in Africa

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Résumé

African inter-tropical herbaceous biomes will likely face drastic changes in a near future. Their grass cover, which can represent up to 90% of the biomass, shows a high diversity in floristic composition, height and structure, due to different grass acclimation to water deficits, minimal temperature and disturbances. This diversity, however, is not taken into account in Dynamic Global Vegetation Models (DGVM), which weakens the simulations of inter-tropical herbaceous biomes spatial boundaries. In the present study we defined two C4 grass PFTs relevant for characterizing with more accuracy grass cover composition, structure and response to precipitation. First, we set up a vegetation classification, from a regression tree based on C4 grass physiognomic group combinations and leaf area index (LAI) data, practical for both West and Southern Africa and useful for DGVM output interpretation. Secondly, direct relationships (Spearman correlations) between the abundance of each physiognomic group and LAI were characterized at 0.5○ for both Senegal and South Africa. Thirdly, we statistically checked whether the grass physiognomic group composition and the herbaceous LAI were recorded in phytolith indices that constitute unique proxies for African inter-tropical grass covers. Two grass groups named according to the lowermost ("low") limit of the culm height (cm) of their median species were selected. A short-grass group (low10) was dominant in steppes with herbaceous LAI lower than 1.5, whereas a medium-sized grass group (low30) was dominant in savannas with herbaceous LAI higher than 1.5. In Senegal the shift of dominance from low10 to low30 as well as a shift of structure (LAI) characteristic of the steppe/savanna transition was correctly traced by a 20-40 threshold in Iph phytolith index. In South Africa the limited set of phytolith data did not allow observation of the full savanna/steppe transition.These findings should help to implement the parameterization of two C4 grass PFTs (xerophytic and mesophytic) in vegetation models.

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Mots-Clés: PFT, herbaceous biomes, LAI