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Modeling the relation between leaf phenology and plant hydraulics in the Amazon rainforest: a trait-based approach on the effects of reduced precipitation and high CO_2

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Several dynamic global vegetation models (DGVMs) have been developed to better understand the vegetation's response to climate changes. However, DGVMs generate variable responses on the role of vegetation in the biogeochemical cycles, partially explained by the generalization made regarding the functional diversity, since it is represented by a small set of plant functional types. Trait-based models, which seek to include the variability of functional traits, emerge as a promising alternative for a better representation of the different plant life strategies, and consequently of functional diversity. Including leaf phenology in these models is of paramount importance because it plays a role in controlling the seasonality of carbon, water, and energy fluxes, but the models do not represent or represent inefficiently the phenology. In tropical ecosystems, such as in the Amazon, phenology is mainly driven by soil water availability and evapotranspirative demand, so simulating the impacts of a predicted drier climate require the representation of the connection between phenology and the hydraulic strategies of plants. Therefore, this work aims to contribute to the development of the CAETÊ trait-based model through the implementation of a leaf phenology module linked to plant hydraulic system. This development is being applied to the Amazon basin and its main objective is to improve the representation of the seasonality of vegetation with consequent improvement in the carbon and water cycle, and therefore to assess the impacts of climate changes on it. For this, two functional traits are being used as variants: ψ50 (xylem water potential at which 50% loss of hydraulic conductivity occurs) and τleaves (leaf carbon residence time). Through an environmental filter mechanism and traits trade-offs, each grid cell restricts the performance and survivorship of trait values combinations. The model is being applied under a 30% reduction of precipitation and increasing [CO_2] to 600 ppmv. As preliminary results we have the performance of the equations that represent phenology and hydraulics developed offline from the model code, which represented the Leaf Economics Spectrum related to the τleaves, besides the isohydric and anisohydric strategies related to the ψ50 (e.g. high P50 values [-1 MPa] interrupted the hydraulic conductance in ~ 0.5 soil water [W; gH20 / gsoil], while low P50 values [-7 MPa] maintained

conductance up to W = ~ 0.3). As expected results, two scales will be analyzed: at the community level, it is expected that it will present a change in the functional composition (i.e. composition of phenological and hydraulic strategies) in order to favor strategies that better deal with the new environmental conditions; at the ecosystem level, it is expected that this change in functional composition will alter the primary productivity and evapotranspiration. Finally, it is expected that the approach used will act as an alternative to investigate the relationship between hydraulics and phenology in Amazon in a less discretized way compared to a PFT approach, since this work is being a pioneer in considering this relation along with a logic of variant functional traits. Final results will be obtained before the EGU congress takes place.