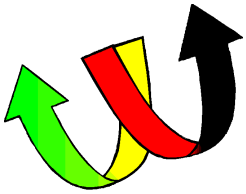

CACHAÇA

(Coupled Assessment of Climatic, Hydrological, Agricultural and socio-Cultural Aspects)

The model Cachaça gives an integrated, dynamic, quantitative and spatially resolved description of the causal relationships between climate - water availability - agriculture - quality of life - migration in the federal states Ceará and Piauí of Brazil. The context of the descriptions is the internal dynamics of the regional processes and the reaction to global change processes, e.g. climate change.

The model describes both of the federal states, using municipalities as explicit simulation units. Sub-units within municipalities (e.g. based on soils or vegetation) are not georeferenced in the model. The time horizon of the model is 50 years, allowing global change influences to reach appreciable levels. Temporal resolution is varying between process descriptions, from 1 day to 1 year.

The model is structured in a modular way, where one or a few modules represent one scientific disciplinary component of the model. The main task of integrated modelling is to arrange these sub-models to sufficiently cover the relevant themes of the problem studied, and to establish an on-line coupling between the modules, obeying consistency in the exchange of information and consistency in the overlapping parts of the models.

The basic components of the model are called CLIMO, HYMO, LAMO and SEMO, treating climate, water-related calculations, agriculture, and socio-economy respectively.

CLIMO

In the model, climate is basically taken from off-line generated climate scenarios (Gerstengarbe and Werner). These scenarios consist of time series for temperature (max., min), precipitation, humidity, and radiation. The data have a daily resolution and are given at a .5 degree square grid. In the present status of the scenarios, temperatures and precipitation result from a scenario-generator; humidity and radiation are added using regressions. Potential evapotranspiration is calculated in the model, using the Penman-Monteith equation.

HYMO

Water availability is simulated using a physically based, geographically explicit water balance model (Bronstert et al.). Included are evaporation, soil water balance, surface flow, ground water, rivers and water storage (small scale in the agriculturally used areas as well as large scale for various purposes). The models uses a division of municipalities in highland-, slope- and valley-parts. The water balance model is linked to a geographically explicit description of water use (NOWUM), distinguishing between domestic, industrial and agricultural water use. Agricultural water use includes animal water demand and irrigation demands for the various crops.

LAMO

Local agricultural potentials are simulated using production models (EPIC or CROPWAT), for the dominant local agricultural crops. These models use daily resolutions and are defined on homogeneous parts of municipalities. The actual usage of these potentials is now taken from statistics, but will be simulated by an optimisation scheme, optimising farm-incoming, under restrictions of available monetary, water and labour resources.. Production increasing techniques are included, e.g. irrigation and fertilisation. The optimisation will be performed with an annual step.

SEMO

A model of social dynamics simulates the dynamics of the interaction between the quality of life and various forms of social adaptation. Physical and socio-economic conditions define the quality of life. The level of quality of life steers the probability of migration decisions. The present rough version will be extended to distinguish between family types and their role in the agro-economy. Demography is described by a standard model using fertility and mortality rates for various age classes.

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Maarten Krol