Geophysical Research Abstracts, Vol. 7, 01778, 2005
SRef-ID: 1607-7962/gra/EGU05-A-01778

Integrating agent-based models of subsistence farming with individual-based forest models and dynamic models of water distribution.

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Subsistence farming communities are dependent on the landscape to provide the resource base upon which their societies can be built. A key component of this is the role of climate, and the feedback between rainfall, crop growth, land clearance, and their coupling to the hydrological cycle. Temporal fluctuations in rainfall, on timescales from annual through to decadal and longer, changes the spatial distribution of water availability, mediated by the soil-type, slope and landcover. This in turn determines the locations within the landscape that can support agriculture, and controls sustainability of farming practices. We present an integrated modelling system to represent land use change that couples three simple process models:- An agent based model of subsistence farming; an individual-based model of tree growth; and a spatially extended version of TOPMODEL for the prediction of distributed soil moisture and stream discharge. In this way we can, for example, investigate how demographic changes and associated removal of forest cover influence agricultural production through changes in ground water availability and how land-use change affects river regimes and influences flood frequency and magnitude.