Geoscientific
Model Development
Discussions

Interactive comment on "MAgPIE 4 – A modular open source framework for modeling global land-systems" *by* Jan Philipp Dietrich et al.

Anonymous Referee #2

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The paper presents the IT architecture of the MAgPIE framework focusing on two features: modularity and flexibility of spatial resolution. This is a rather technical paper which is well written and easily understandable in spite of its technicity. This type of paper is welcomed to improve the transparency of models and help interpreting their result.

Here are my comments:

1. The presentation of the modules (p. 5-7) raise a number of issues: (i) The definition of the modules is sometimes vague. The "costs" module is not easy to grasp: what kind of aggregates does it make? In fact, we wonder why this is a separate module for it. Why is the agregation not done in the corresponding module? The "production" module is defined as aggragegating cellular production to the regional level, but how

the cellular production is defined? I would say this result from the "yields" and "crop" module, but this is not clear from the text and from Figure 1.

(ii) Prices are almost absent from the picture while they are a key element of the system. They are the primary drivers of the intensification mechanisms which are for this reason unclear here: is there some livestock intensification? Does the technological change react to price or it is exogenous? Also how is the fertilizer use treated? In so doing we don't see the substitution possibilities between production factor while this is basically what the model represent.

(iii) Finally some feedback loops seem to be lacking, e.g.: the production of residues should affect the bioenergy module; the crop module should affect the livestock throug feed production; the livestock production may affect the yield through manure and the availabilty of land may have an impact on yields.

The last two points reveal the difficulty of representing a system in a modular way, as each module strongly interacts with the other, making the frontier between them sometimes meaningless. Livestock and crop production system are typical examples as they are generally strongly integrated. This point is an important barrier to the modular representation which should be discuss in deepth and better justified. In some cases the modular representation is appropriate for modeling reality, however in some cases it could put into question the consistency of the model. Most importantly, this approach may be seen as only compatible with conventional agriculture, and not with alternative agricultural systems promoting a systemic approach.

2. The key evaluation examples are not very informative in the context of this paper. The paper presents the "framework" and not really the model (i.e., the economic and biophysical mechanisms represented). For this reason, having, e.g., an evaluation of the crop yield simulated by the model is not very relevant to the paper. We would rather expect an evaluation of the modular architecture, as the authors did for the spatial resolution in the next section. How the modules perform running together vs standalone

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3. The evaluation of the spatial flexibility is interesting however I did not really understand why there is so much difference in the default and Brazil-specific settings. Why is there much specialization in the default setting? And to what extent does it affect the spatial deforestation/reforestation pattern in Brazil? Also, the paragraph beginning on p13 l4 is quite difficult to understand (why is there 200 clusters in the default version and 500 in the region-specific one ?)