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Hydrology and Earth System Sciences Discussions

Interactive comment on "Influence of feedbacks from simulated crop growth on integrated regional hydrologic simulations under climate scenarios" *by* P. E. V. van Walsum

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A revised version of the manuscript is available at ftp://ftp.wur.nl/simgro/doc/Articles/SIMGRO-WOFOST_20120302.pdf All references to figures or tables are to the new version mentioned above.

Reviewer #1 General comment Especially the text describing the method has been completely revised, and so has the method itself. It now takes the FAO56 method as starting point in the given explanation. So we start from a familiar methodology. Any references to material that is hard to access have been made available at:

ftp://ftp.wur.nl/simgro/doc/Literature/ In the references section some more links are provided for direct access We also added two appendices giving detailed descriptions of the interception model and the LP-method for deriving Kcb(LAI) relationships. The LP-code is also available (link given in footnote of Appendix B).

Title Title suggestion to include "ecohydrological" feedbacks is a good idea, thank you. Abstract We agree about this, the abstract is not the place for this. We have completely rewritten the abstract.

Introduction The rationale of the study is implied in the title, i.e. to highlight the necessity of including eco-hydrological feedbacks in regional hydrologic simulations for climate scenarios. The paper aims to makes this clear by making a comparison between 'static' and 'dynamic' modelling of vegetation. Other papers have described couplings to vegetation models, including feedbacks, but not shown adequately what the influence is on the simulation results actually is. The introduction has been partly rephrased, with the requested focus in mind. The last sentence of our introduction focuses on the comparison between static and dynamic models, and that touches on the rationale of the study: from the comparison you can conclude why it is necessary to use the dynamic model. P10153 L7-15. Crop modelling as such is not the subject of our paper. However, to answer your question, for the crop modelling the consequences are for instance that a deeper root zone simulated by the crop model is not communicated to the water uptake model, meaning that less water is available for the crop. P10153 L16-21. The consequences of neglecting the crop dynamics is in the given case that an error of max. 10% of the transpiration is made, which is clearly stated in the conclusions. Other studies like that with the Theseus model coupling to WOFOST are considered to not cover all aspects of the feedbacks. Another aspect that we stress is that other models do not properly model the soil-groundwater interaction, making them of limited value for decision making with respect to regional water management. P10153, L25-26. The role of the feedback loop via groundwater is highlighted by the relationship given in Fig. 12 (Fig .11, old version), showing the influence

of the groundwater level on the difference between the static/dynamic models. P10154, L4-6. A 'simple recharge module' just makes a water balance of incoming and outgoing water balance terms of the root zone, simulated as a bucket that flows over when full. We now call it indeed a ' bucket model', see line 21, page 2. See also the WOFOST description of its own option for a hydrological model http:\\www.supit.net

Methods and materials General comment We have completely rewritten this section.

P10155, L2 The title of 2.1 should indeed be more informative; we prefer "2.1 Modelling framework and attached models".

P10155, L3-19. SIMGRO is a framework. Expanding on the explanation of the modelling framework would steer away from the focus ('rationale') of the paper. We think the paragraph should not be expanded. Integrating the lines 10-19 into the Fig.1 would make it loses its purpose, of giving an overview. A separate figure with flow chart of information flow will be provided. The link is available to the documentation, see link in reference Van Walsum & Veldhuizen, 2012.

P10156 L14-15. We now refer to Rutter, who originally stated this point. See our new text, p.6, line 16.

P10158, L22. The used definition is questioned by Reviewer #4, See our reaction on. . .

P10157, L17-19 The soil evaporation method of Boesten and Stroosnijder now available as pdf at ftp://ftp.wur.nl/simgro/doc/Literature/Boesten&Stroosnijder_1986.pdf

P10158, L4-9 We have included the reasons given by De Bruin (1987)for using Makkink, on page 5, line 6-8. The reference is available as pdf, in the directory as above for Boesten&Stroosnijder. The reasons are partly scientific, and partly that it is the established practice in NL to use Makkink. The climate scenarios from the meteorological institute are provided in terms of modifications of the Makkink values. We have included a section in the Discussion, par. 4.1 on page 14, line 10 and further.

P10158, L25-26. We have left out statements about crop stress in the new manuscript.

P10159, L2-11. Parameters of WOFOST are provided via references. It would have no point giving tables etc if not the whole WOFOST model is described. . http://www.supit.net and http://www.wofost.wur.nl Van Wijk et al has been left out, because it is not considered essential for this paper. With respect to the sowing date we had to make some decision that is the same for both static and dynamic models. Changing the sowing date (e.g. 14 days earlier) is indeed a form of climate adaptation, but it can be done for both static and dynamic models. So it does not play a role in the comparison between the two approaches: it would artificially increase the difference between the two methods if we included it in the dynamic model, and not in the static one. That we now include the germination time could also be seen in this category.

P10162, L14-15. The temperature sensitivity of root water uptake is not included because no information is available for 'out door crops' . The mentioned literature reference (Yoshida and Eguchi, 1989) is for cucumbers

P10163 L23-26 The role of interception is part of the calculation method for evapotranspiration terms, so why move these lines to the general section 2.1?

P10164, L7-9. It is indeed very relevant to indicate that the climate scenarios have been generated by means of a deterministic transformation of the historic series. For this reason we can use a certain historical year and its ' pendant' in the future climate series, without having to worry about stochasticity. See remarks in new text p. 11, line 4 and on. We also give the link to Van de Hurk et al in the references.

P10164, L12-14. We have simply used the scenario with the strongest temperature change. This will show the biggest differences. Results We agree with the reviewer's remark about the weak storyline. We have rephrased the results, leaving out non-essential material.

P10165 L2-16. The mentioned verification is also visible in the Table of main results (Table 4 new text). So the extra table in the introduction is indeed, not needed. We do find this introduction itself essential: it gives focus on the red thread of our results

section. Discussion The discussion has been completely revised; we dropped the discussion of Wegehenkel completely, because it is not needed for interpreting our results. The exciting big discovery that you ask for. Simply that for predicting climate change effects a systematic error is made if dynamic vegetation models are not included, as also stated in the abstract.

Conclusions We have rewritten the conclusions, in an attempt to achieve the asked for elucidation. P10157 L9 “nett”: In the “ manuscript preparation” section of HESS it states that the paper should be in “ English” , without further specification. One would then assume UK English. A reference is made to Webster’s on the HESS page http://www.hydrology-and-earth-system-sciences.net/submission/manuscript_preparation.html so here is the Webster’s reference for “nett” : http://www.webster-dictionary.org/definition/nett Microsoft WORD 2010 erroneously wants to correct it to “net” .

P10162, L21 Indeed assimilation.

P10164 The order in Table 1: Ordering by order of magnitude would not seem intuitive, but indeed the order can be better: start with Grassland and Arable land, then Forest & Orchards, Freshwater. Built-up area,

Fig. 8: Indeed, the lines have been made more distinctive, see Fig. 9 new text. Fig. 9: Labelling of sub-figures.Is now Fig. 11, with improved captions.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 10151, 2011.