

Interactive comment on “Development and validation of a global dynamical wetlands extent scheme” by T. Stacke and S. Hagemann

Anonymous Referee #2

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Comments on “Development and validation of a global dynamical wetlands extent scheme” by T. Stacke and S. Hagemann

The authors describe a dynamic wetlands scheme that estimates fraction of a grid cell covered with wetlands as a function of change in river water storage (which itself depends on precipitation, evaporation and subsurface drainage). I am afraid that I overall agree with Reviewer 1 comments that the manuscript is not written very well and require substantial work before consideration for publication in HESS. In particular, the equations describing the model are not very well explained and justified and therefore it is difficult to grasp aspects of the approach. Reviewer 1 has already raised several points about distinction between wetland types and being careful about comparing the simulated wetland fraction with its observation-based estimates so that it is an apples

C631

to apples comparison. So therefore, I will not focus on this issue.

I was not able to relate Figure 1 to the quantities in equation 1. It would be really useful to have the terms of equation 1 clearly shown in Figure 1.

Page 410, line 12. Please explain exactly how “the degree day approach” works.

Page 410, line 20. It is unclear to me what does “reduction of 10% in the maximum drainage” actually means. Drainage usually depends on the hydraulic conductivity of the soil. Is that what is suggested here? Also, since the wetland fraction is dynamic does this mean that an area of a grid cell has different hydraulic conductivity when it is a wetland and when it is not.

Page 411. In equation 2 is I_{gb} the sum of lateral inflow the sum of inflows from all the up stream grid cells. Please explain the function of parameter z in this equation. It seems that this parameter reduces the lateral inflow into a grid cell when a larger fraction is covered by wetlands.

The parameter c in equation 5 and the parameter C in equation 9 are confusing. Please use a different alphabet in any one of these equations.

Page 411. Lines 15-17. The solution in figure 2 looks like a solution to two equations. It would be useful to tell explicitly what these two equations are. In addition, is there an analytical solution to these equations.

Page 412. Line 8. This might be obvious but what is the resolution of the GTOPO30 data set.

Equation 6 is described as “actual sub-grid slope s for a given grid cell fraction f ”. However, looking at figure 3 it seems a more appropriate description of $s(f)$ is that it is the fraction of a grid cell that slope less than s . In essence then $s(f)$ is like a cumulative distribution function.

Is S_{sl} a tune-able parameter? Page 414. Lines 1-2. “ The simulated river discharge

C632

of all simulations was compared to observations from the Global Runoff Data Centre (2011)." Please reword this sentence to say clearly what was done since discharge cannot be compared to runoff. As you know runoff needs to be routed to convert it into discharge.

Page 414. Line 16. "... and, finally, averaged over all river basins". How many river basins?

Page 416. Lines 6-8. " The model computes increased wetland fractions mostly for the same regions which are wetland focus regions in the observations." I am unable to follow this sentence, please consider rewording.

Page 416. Line 21. I do not think it is right to call the mean of observations as "ensemble-mean". Simply call them "mean of observation-based estimates".

Section 3.2. I am confused about the role of snow cover when comparing simulated and observation-based wetland fractions. I am still unclear what does "wetland below snow cover" actually means? Wouldn't those wetlands be frozen anyway? How does the inability of the model to account for freezing affect its results? The follow-up discussion (page 418, lines 12-13) says that the decreased wetland fractions during DJF are due to decreased wetland inflow during the cold season. Is this a precipitation effect? What about the effect of temperature?

Page 420. Lines 12-14. Why does the mean flow increase for the Nile, Sao Francisco and the Colorado rivers?

Page 421. Lines 21-22. " In our study we concentrate on hydrological feedbacks between wetlands, the atmosphere and the ocean." Since this is an off-line study I do not think you can say that your study concentrates on feedbacks between the wetlands, the atmosphere and ocean.

Page 422. What does "vegetation skin reservoir" mean?

Page 422. Lines 15-16. " Eventually, this results in a wetter and cooler state of the
C633

surface and therefore in a stabilization local climate conditions". This vague statement appears completely redundant.

Page 423. Lines 1-2. " Here, about 530 km³a⁻¹ less water reach the oceans." Compared to what?

Figure 2. What are the units on the y-axis?

Figure 4. What are the units on the x-axis? It would be really easy to interpret this figure is the slope curve (similar to figure 3) was shown for this grid cell. In the caption of the figure the phrase "the wetland covered slope" is unclear.

Figure 6. Does this figure show a maximum wetland fractions? If I am not wrong most observation-based estimates are of the maximum wetland fraction.

Figure 7. Earlier in the manuscript the mean of observation-based estimates has been called "ensemble mean" and in this figure it is being called SIND. Please use consistent wording.

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