Geoscientific
Model Development
Discussions

[GMDD]

Interactive
comment

Interactive comment on "PCR-GLOBWB 2: a 5 arc-minute global hydrological and water resources model" *by* Edwin H. Sutanudjaja et al.

Anonymous Referee #1

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Review of gmd-2017-288

PCR-GLOBWB 2: a 5 arc-minute global hydrological and water resources model Sutanudjaja et al.

Summary:

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This is a well-written manuscript that describes the components of PCR-GLOBWB 2 and its updates since version 1. It also includes an evaluation of a global application of the model at 5 and 30 arc-minute. While no individual component of the model is entirely new (i.e. most of the components have been the subject of their own publications), this manuscript serves a useful purpose in providing a complete overview of the

Discussion paper

updated model. As such, I recommend that the manuscript is acceptable for publication in GMD pending minor revisions

Comments:

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l.68: 'om' should read 'on'

l.73: What does 'global water management' mean? Most water management decisions are made locally or regionally (e.g. by basin). It is not clear to me which water management decisions are made globally.

l.86-88: How many of these publications had someone not closely affiliated with the Utrecht group as their primary authors?

l.88: 'yielded 97 publications with collectively over 2100 references'. I assume you mean citations rather than references (since it would be easy to add more references to a paper).

l.104-106: Is the resolution relevant from a code-perspective? I assume that the code itself is resolution-agnostic and that the resolution of the application is specified in configuration and other input files?

l.119: The experiments described in the manuscript serve to 'evaluate' the model rather than to 'validate' it.

l.178-179: '[...] in which the exchange of water between a series of interconnected stores is easily performed'. Awkward phrasing. You don't 'perform exchange' and it's unclear what 'easily' means in this context.

l.180: Provide more details on the modular construction of the model at the code level. This is of interest to readers of GMD.

Figs 1 and 2: Combine into one single figure.

l.196-210: Provide proper references.

l.239-240: How are rain-fed crops handled?

l.239-240: How easy / hard would it be for users to add additional / different land use types (e.g. urban or tundra)

l.251: Describe how 'Darcian flow' is implemented. Is this vertical drainage only under unit gradient? How is the unsaturated hydraulic conductivity specified or calculated?

l.276-278: Are the 'where under natural conditions (without groundwater withdrawal) significant groundwater discharge occurs' dynamically calculated or specified?

l.287: ': Harbaugh et al., 2000)' should read '(Harbaugh et al., 2000)'

l.301-302: At what resolution is the 8-point steepest gradient algorithm evaluated? I assume at a higher resolution than 5-min or 30-min, because neither will result in accurate channel networks if the steepest gradient algorithm is applied using cell-average elevations at those resolutions.

l.302-303: What happens when river flow is routed in an endorheic basin? Does it create an inland sea or is the water removed from the model?

l.304-313: Fix grammar and punctuation. As is, the enumeration and the associated semi-columns make no sense since there are multiple sentences after '2)'.

l.326: How is reservoir management handled? For example, are releases based on storage targets, rule curves, etc. How are different reservoir purposes addressed, e.g. flood control, hydropower, irrigation.

l.329: What is a 'standard' storage-outflow relationship?

l.335: What is 'water type'?

Section 2.3.4: Are inter-basin water transfers / diversions represented?

Section 2.3.5: It is not clear to me how the irrigation efficiency is used in the model.

I understand it can be used to estimate the water demand, but what happens to the water after it is removed from storage or the river network. Is the excess water (the 'inefficient' portion) added to the soil (where it can then contribute to evapotranspiration and return flow), is it directly added to return flows, or something else?

l.399: 'would be rather straightforward to change this'. Explain in one sentence how that would be done.

l.403: 'as function' should read 'as a function'

l.413: 'to use literature fractions of groundwater withdrawal and surface water withdrawal'. Awkward, suggested change: 'to use fractions of groundwater and surface water withdrawal reported in the literature'.

Section 2.5: Does the model use openmp (shared memory) or mpi parallelization?

l.485: Provide details on the memory constraints.

Section 3.1.1: Since neither model implementation was calibrated it makes it a challenging to evaluate the statements that say one version (5-arcmin) is inherently better than the other one (30-arcmin).

l.600: 'scale-consistent' - perhaps 'scale-independent'?

Table 1 and comparison of 5- and 30-arcmin resolutions: One way to reduce difference that may occur because of area mismatches would be to provide fluxes also as a depth per unit area, e.g. mm/year.

Section 3.4. and following: When providing error metrics (correlation, KGE, etc.) please provide the timestep at which the metric was calculated.

l.543: The term 'hydrological extremes' as used here is a bit misleading. For many of the smaller basins, the time-of-concentration is well less than the timestep used in the evaluation of the error metrics. For example, the monthly flow in a 2000km2 basin is not necessarily related to a flood event.

Section 3.4.2: When comparing with GRACE it makes more sense to scale the simulations to the resolution of GRACE (as is done in the analysis for Figure 8) than comparing the GRACE results directly to the 5- or 30-arcmin results. I suggest removing Figure 7 and the accompanying discussion and to focus on Figure 8 instead.

Figures 9 and 10: Distinguish the left and right columns in the caption and in figure labels.