EGUsphere, referee comment RC2
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Comment on egusphere-2022-1196

Anonymous Referee #2

Referee comment on "Description and Evaluation of the JULES-ES setup for ISIMIP2b" by Camilla Mathison et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-1196-RC2, 2023

General comment:
The paper "Description and Evaluation of the JULES-ES setup for ISIMIP2b" describe the setup and performance of the Jules-ES for the ISMIP2b protocol very well. The paper describe in concise steps the setup of the Jules-ES for the ISIMIP2 simulation protocol and presents the comparison to selected observation (runoff, GPP, ET, albedo) for present day comparison very well.

Improvements in the description would be helpful (e.g. how are LU changes tracked within Jules-ES, more info about crop and pasture handling, see specific comments below).

It does fall short on the premise to "describes and evaluates a new modelling methodology to quantify the impacts of climate change on water, biomes and the carbon cycle" and "We simulate a historical and two future scenarios; a mitigation scenario RCP2.6 and RCP6.0, which has very little mitigation. " The paper currently only compares present day conditions to observations, the behavior of Jules-ES for the two future scenarios (impacted by the two contrasting climate change scenarios) are not presented. It would help the reader to judge the performance of Jules-ES in capturing climate change induced changes, if the authors would add a section about the future behavior of the Jules-ES for the contrasting climate change scenarios (e.g. does Jules-ES show an expansion of forest northward in a warmer climate scenario (RCP6.0) compared to a mitigation scenario (RCP2.6)).

I will be happy to review changes to address the above mentioned concern and the following comments for specific sections.

Specific comments:
Abstract: "The bias correction reduces the impact of the climate biases present in individual models. We evaluate JULES-ES performance against present-day observations to demonstrate its usefulness for providing required information for impacts such as fire and river flow. "
Very good to see (Figure 1 and S2) that the still quite large difference between GCMS in bias corrected average annual precipitation in the Amazon region is retained very well in the Jules-ES in the modelled catchment scale runoff.
An open question comes to mind, if not bias corrected GCM output would be used to drive Jules-ES, would that result in a poor performance compared to observations or might it show similar results.

Line 38: How more 'computationally efficient' is it, please provide an estimate. e.g. 10% faster or N times faster.

Line 39-41: please clarify, not totally clear what is meant with this.
"while using multi-model climate ensembles sample scientific uncertainty in land surface forcing that would not be possible within a single climate model framework."

Line 64-66:
"tropical broadleaf evergreen trees (BET-Tr)" how is the effect of seasonal drought occurring in various tropical regions handled in the BET-Tr modelling?

Line 65-66: "C4 grasses, C4 grasses" one of them is a C3, right?

Line 70-72:
How is mineral and manure nitrogen fertilization handled in the crop modelling? Are there C3 and C4 pasture PFTs? Please provide the crop and pasture PFTs short names (e.g. C3-Cr?).

Line 77: "(urban, ice, lakes)", what about ocean fraction?

Line 79-80:
"Conversely, when crop and pasture areas are reduced, the natural PFTs are allowed to recolonize the vacated grid box fraction. " Does 'recolonize' entail that new vegetation individuals establish in the abandoned fractions within the grid box or is the potentially existing Natural fraction just increased?

Please describe whether Jules-ES performs net or gross LUC transitions.
The mentioned "After accounting for land-use, the fractional coverage and biomass of each PFT within a grid box is determined by the TRIFFID dynamic vegetation model. " is not clear, whether the landuse history might be tracked within Jules-ES. Are the various LUC induced fractional areas within the grid box tracked separately within the Jules-ES or the existing landuse fractions just adjusted in size (increases and decreases)?

Line 81-82: How is grazed or managed pasture grass handled? Any pasture harvest or grazing estimated (e.g. a fraction of grass biomass removed and a portion of the N within the removed biomass returned to the pasture)?

Line 88-90:
"Inputs to the land surface are via biological fixation, fertilization and nitrogen deposition, with losses from the land surface occurring via leaching and gas loss, with Nitrogen deposition being externally provided to the model." How is N fertilization forcing handled?

Line 90-91:
"JULES simulates a nitrogen-limited ecosystem by reducing the net primary productivity if there is insufficient available N to satisfy plant N demand. Any excess carbon is added to the plant respiration. " N limitation would lead to reduced assimilation, not directly reducing NPP. What excess carbon? Please clarify.

Line 100-101:
"prescribed population density from HYDE3.2 (Goldewijk et al., 2017) gives human ignitions, and prescribed lightning from LIS/OTD version 2.3.2015 (Cecil, 2006) gives natural ignitions." Those seem to be historic data, what about future scenarios? Is present day population and lightning just recycled into the future?

Line 105: "C3 and C4 crop PFTs ", what about pasture PFTs handling in INFERNO?

Line 117: "model timestep of 1 hour" In supplement the disaggregator was shown with 3-hour timestep. Please clarify that time step discrepancy.

Line 122: "6h for convective rainfall, 1h for large-scale rainfall" How is convective and large-scale rainfall distinguished?

Line 129 "See Figure S1 for plots showing that using the disaggregator has little effect on vegetation that we would expect to be 130 influenced by rainfall." Figure S1 only shows the BET-Tr tree fraction, which is not a sufficient parameter to judge the effect of the time disaggregation. What about biomass, NPP, ET, soil C? Please add the plots and map differences for those important parameters (at least add the plots for your chosen parameters GPP, ET, albedo).

Line 136: "(1860-2006) and the RCP2.6 and RCP6.0 future concentration pathways (2006-2099)" The switch between historical and future was 2005 in CMIP5, please clarify?

Line 170-171:
"JULES-ES in the form of the suite u-cc669 available via the Met Office Science Repository Service (MOSRS - https://code.metoffice.gov.uk/trac/roses-u see data availability section for information). " MORS requires registration, what about the GMD code and data policy (https://www.geoscientific-model-development.net/policies/code_and_data_policy.html#item4) and its suggested archive of the source code on Zenodo?

Line 185-188:
"By assuming there are no losses from the river, we calculated the long-term mean, basin averaged runoff by dividing the river flow at the river mouth by the basin area." How good is that 'no losses' assumption, considering that in many regions river water is used for irrigation, and industrial and household purposes (https://www.globalagriculture.org/report-topics/water.html).

Supplement
Figure S1: Please add a difference map (e.g. b-a). Why would tree fraction be a good estimator to show the climate disaggregation influence? What about other variables biomass, GPP (or NPP), ET, albedo?

Technical corrections:
Table S2 caption typos:
"global runoff verus Dai" correct: versus.
"scores indict whether" correct: indicate

Figure S4 please correct the clipping of the ET images on in all 4 panels. The 'Observed albedo' z-scale values overlap and are not readable in the 4 panels.