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Geoscientific
Model Development
Discussions

Interactive comment on "The Joint UK Land Environment Simulator (JULES), Model description – Part 1: Energy and water fluxes" *by* M. J. Best et al.

B. van den Hurk (Referee)

hurkvd@knmi.nl

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General comments

This is a comprehensive partial description of the JULES model. The model is fairly complex and involves quite a wide range of expertise to develop. Its modular structure is well represented by the grouped description of the essential processes captured in the model.

The paper focuses on a technical description and does not address model applications or skill. Also the literature cited is basically limited to the earlier publications of the MOSES/JULES teams that have lead to the development of this model, and no attempt

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is made to make a comprehensive overview of the literature of LSM development. These choices are well defendable for such a technical model description for a journal like GMD.

However, a general omission of the manuscript is a set of considerations that should be followed when making choices between the many model options. For instance, what are the arguments used in the trade off between the use of a single layer or multi-layer snow scheme? Is it only a trade-off between computational effort and physical realism, or are issues like parameter availability, type of application, type of environmental characteristics also relevant? What are the criteria to choose between the different options for the coupling between surface energy balance and the underlying soil?

A more technical omission is the lack of a table including all the prognostic variables that need to be initialized, and a table of all non-surface type specific parameters that need to be set (examples are in the detailed comments below).

Specific comments

- 596-24: delete first ","
- 597: JULES is not the only Community Land Model, nor the first. A reference to the US CLM-enterprise would be appropriate here
- 599: from the introduction I miss a notion that not only a coupling to the atmosphere should be considered, but also a coupling to (offline) applications like river routing, wetland extent, irrigation or ground water routines
- Eq 4: not fully clear why both the surface and the soil emissivity are needed in both LW terms
- 601-25: the term "critical" point is quite vague. A reference to the often used phrase "field capacity" is justified here

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- 605-2: the veg/bare ground fractions are dependent on L, which is not straightforward to me. High/low leaf area can exist for both high and low vegetation cover fractions (e.g. compare a small fraction with high LAI as in tigerbush with large fractions with low LAI as in tundra vegetation)
- 603-9: is it obvious that the "critical point" for vegetation is the same as the one used to represent bare ground evaporation (Eq 6)?
- 604-13: "canopy water remaining" -> "available canopy water". The phrase "remaining" seems to refer to the situation *after* the time step of interest
- 605-18: is the land ice mask specified by the user? Include it in a table of non-veg.spec. parameters
- 605-25: insert "horizontal" before "gradients"
- 606-17: insert "this is" after "Again"
- 2.4: the description of the urban scheme MORUSES is difficult to follow without a cartoon of the model structure.
- Where do parameters needed to characterise these urban tiles usually come from?
- 607-21: ". . .beyond the choise (-> choice) of parameters that are used.": I don't understand this phrase
- 608-2: "have fixed values" -> "with fixed parameter values"
- 608-4: "calculated" -> "described"
- 608-21: what are the units of this "capacity"? kg/m^2?

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- Tables 2, 5 & 6: please add the symbols (and the eq nrs) used in the text to the named quantities
- 609-9: add “absolute” before “humidity”
- 609-12: about the height correction of top soil temperature: this applies only to the initial value of this temperature, I guess?
- Please add a table with all prognostic variables that need to be initialised
- 3 & 3.1: the intro to the snow model is quite unclear. Why do you call it a “zero-layer” snow scheme? Does the interaction with the vegetation apply to both the single and multi-layer snow scheme? The discussion of this interaction with the vegetation in 3.1 is difficult to appreciate without a cartoon of how these layers are actually situated relative to each other. It is also unclear what the purpose of eq 15 is, and whether this canopy snow is part of a multi-layer scheme.
- 610-10: what is the physical process behind this “unloading”? Blowing by the wind? Sublimation? Why is it limited to melting conditions?
- 3.3: the dynamic layer treatment is well described and illustrated. Yet it is unclear how the snow prognostic properties (e.g. temperature) are assigned after merging/splitting of layers.
- 612-20: add “is a layer thickness weighted thermal conductivity” after eq. 24.
- 614-22: what is meant by “cold contents”?
- Eq 43: why is z_0 of influence while determining f_s?
- 617-3: “largescale” -> “large scale”
- 617-21: why is Y not simply a function of the throughfall rate?

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- 621-14: it seems a bit strange to me to use a physical quantity (theta) as exponent in a this function.
- 623-20: insert “sub-grid” before “heterogeneity”
- 625-5: what is “flowout”?
- 627-27: “lark” -> “Clark”
- Table 2: the caption mentions “initialization” but this normally refers to prognostic quantities, not to parameters to be set. I would call this “characterisation”. What is the meaning of the word “only” in the entry for “Saturated soil water pressure”?
- Table 3: The descriptions used are not entirely clear at this point of reading the manuscript. Maybe add references to the sections discussing the options.

Interactive comment on Geosci. Model Dev. Discuss., 4, 595, 2011.

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