**Geoscientific
Model Development
Discussions**

Interactive comment on "Describing Earth System Simulations with the Metafor CIM" *by* B. N. Lawrence et al.

Anonymous Referee #1

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General Comments

This paper deals with topics that must be of concern to any large-scale modeling efforts, namely, how do we ensure scientific consistency and replicability of our results, given the enormous variability in configuration?

The challenge for the reviewer is to properly understand his/her role in gatekeeping the results. The reviewer must evaluate the novelty of the approach and the quality of the evidence supporting that decision. In this case, the novelty of application is obvious, since the introduction motivates quite well why the existing state of affairs is not acceptable. As for evidence of success, we have prima facie evidence from the Metafor website. However, as to the evidence supporting this *particular* approach to meta-modelling, I am afraid the paper does not present much to support the contention that

Metafor/CIM will ultimately enable widespread data sharing and eliminate the problem of understandability and replication in climate modelling.

This is for me the biggest weakness of the paper (and CIM in general). However, I think it an acceptable omission inasmuch as the project is so new that more time is required to evaluate the ultimate success of CIM. However, it would have been useful to have a section demonstrating at least initial evidence that CIM was indeed supporting this. How many modelling sites have adopted it? How easy is the website to navigate? Are all metadata fields being used? What are the gaps in the conceptual model? It would be nice to have more detail on these findings.

Specific Remarks

In Fig 1:

- I don't understand how SimulationComposite is both aggregating Simulations and a specialized Simulation. This is contrary to what I've seen in UML models (in essence it is composed of itself . . . so why not model that specifically?).

- You state "A SimulationRun may aggregate SimulationComposites" but this is not shown in the model.

- Why is "Platform" not associated in any way with Software? This seems vital to proper reproduction.

- What is the association between Conformance and DataObject? It is currently untyped.

- The various colours are not explained in the figure caption.

- Frankly I hate reading critiques of UML models but portions do seem inconsistent.

The conceptual model only refers to conforming to "quantitative" requirements. How are qualitative, non-functional attributes modeled? I am thinking of second-order properties such as execution time, modularity of the simulation, etc. I notice a class "CIM_Quality" - how does this relate to these qualitative requirements?

I would have appreciated a more detailed description of the pragmatics of using CIM. How would an individual simulation/experiment be described using your toolset? I was able to track down the METAFOR questionnaire at http://q.cmip5.ceda.ac.uk/– I think it would make nice supplementary material for the paper to include this reference.

On page 1678 you describe the need for ongoing governance and versioning. One of the major challenges in data storage is of course ensuring that the formats are up to date. Can you give more detail on any governance proposals for ensuring CIM does not become abandon-ware if funding runs out?

Technical Corrections

- Page 1671: line 2 I believe this should be ISO 19100?

- 1671:12 - Sentence is cumbersome. Why not "Two important usages for earth system models are to provide projections of future possible climates, and to understand the scientific processes involved."

- 1672:22 missing close quote

- 1672:28 a link to the Metafor website would be helpful.

- 1675:28 s/its/it's/

- 1681:5–6 sentence fragment