

Perspectives from Chapter 9

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(on behalf of the author team)

Topics to discuss:

- *Model Tuning*
- *Model and Experiment documentation*
- *Output dissemination*
- *Timing of intercomparisons*

First, a very sincere **thank you** to the WGCM for organizing CMIP5. Along with CMIP3, it provides the core material for the modelling aspects of the AR5. Without the CMIP coordinated activities, the IPCC Assessments would be weakened considerably.

None of the issues raised here are meant to be viewed as critical. They represent issues that we have faced in preparing Chapter 9, and we hope that discussing them will lead to even better assessments in the future.

- Model Tuning
 - Chapter 9 has a ‘box’ on model development that includes a brief description of model tuning.
 - We define it as the final parameter adjustment procedure, after all model components are assembled into a final coupled model configuration. However, this is not a universally-accepted definition.
 - This tuning typically involves a relatively small number of parameters, and adjustment is toward a small set of large-scale constraints (like global-mean top-of-atmosphere energy balance).
 - Usually ‘time-mean’ quantities, though historical transient change may be targetted explicitly or implicitly.

- In evaluating model performance, this poses a problem: *one cannot use model-obs error as a measure of model quality if the obs in question were used as a tuning target*. Quantities related in some way to tuning targets provide weaker tests of model fidelity than do those that are truly independent.
- However, the tuning process and observational targets used by each modelling group are seldom comprehensively documented.
- By looking at a wide range of performance metrics, making use of metrics connected to processes, and exploring a wide range of climate phenomena on a wide range of time scales, the problem is minimized (since no model could possibly be tuned to satisfy all of the corresponding observational constraints). However, it would be valuable to have better documentation of the tuning of each model.

- There is also a question of the extent to which tuning impacts model sensitivity and hence future climate response. The lack of correlation between model bias and model sensitivity suggests this is not a big concern, but it has not been well studied.
- Nevertheless, being more ‘transparent’ about model tuning, what it is, what it is *not*, what effect it has, how it is done, etc. would be helpful in dispelling certain myths and misconceptions.
 - We proposed some questions to modelling groups on this subject and certain ‘sensitivities’ were raised.

- Model and Experiment Documentation
 - Chapter 9 has a table describing model attributes that is more comprehensive than that in previous IPCC Assessments. This is due in large part to the valuable efforts of the METAFOR project (<http://metaforclimate.eu/trac>)
 - METAFOR also provides detailed documentation of each model experiment.
 - This effort has been extremely valuable to Chapter 9, so we want to express our appreciation to the METAFOR team.
 - An observation is that completing the METAFOR questionnaire was very time consuming, and the resulting database is not very accessible to users (e.g. people writing papers on CMIP5 model results).

- Output Availability

- Difficulties with the ESG distributed archive system caused a lot of stress for those writing papers (to meet IPCC deadlines) and those preparing figures specifically for the AR5. It was a new and complex system and so difficulties were inevitable. PCMDI and others made a big effort to improve the system along the way, but we should look critically at what worked well and what didn't (and why).
- Examples of problems:
 - Model results known to be in the archive but not accessible
 - Difficulty in working with data interface (automatic scripts typically didn't function due to authentication and other problems)
 - Model results being updated/corrected and users not being aware (i.e. 'version control') – how can a user, or someone preparing a figure for a paper/chapter know if output they have downloaded is out of date?

- There is a lot at stake:
 - The IPCC Assessment process relies on direct access to a multi-model ensemble of climate simulations in addition to the broad base of peer-reviewed publications (whose authors also rely on such access).
 - National modelling centres often justify their budgets at least in part on the basis of how their results will contribute to the IPCC process.

- Timing

- It is understood that CMIP5 was not undertaken *specifically* as input to the IPCC AR5.
- But in practice, it is central to the AR5 and difficulties ensue when timelines clash.
- I think we must accept that CMIP does contribute directly, and importantly, to the IPCC assessment process, and while it should not be a ‘slave’ to the IPCC schedule, it is in our collective interest to try to make the timing work better in the future.

- Discussion points -- Tuning:
 - Should WGCM promote more thorough documentation of model tuning, and more exploration into the impact of various kinds of tuning on model behaviour?
 - Can this documentation be made a standard part of model intercomparison projects?

- Discussion points – model documentation:
 - How can the METAFOR process be streamlined, both from the point of view of modelling centres inputting information and those who want to make use of it?
 - How do we assure the quality of the information? (e.g. we undertook a parallel mailing to modelling centres to ask them to verify the entries in our table, extracted from the METAFOR database and made changes as a result).
 - Note: this is not a criticism of METAFOR, it is merely a consequence of uncertainties in some questions, different people filling in different parts of the questionnaire, entries becoming out-dated, etc. But it causes potential inconsistencies.
 - How do we ensure that METAFOR (or something like it) will continue in the future and who should take ownership, given its value to the modelling community and those who analyze model output?

- Discussion points – organization:
 - How can we collectively improve the way in which the CMIPx multi-model ensemble output is organized and disseminated?
 - Speaking with my ‘other hat on’ as the head of a modelling centre, I think that the modelling centres should be more directly engaged, and engaged earlier on in the data dissemination discussion. Each centre’s contribution represents a large investment of resources and intellectual property, and so ‘getting this product to market’ in an effective and efficient way is important.