Summary from the 2nd US Climate Modeling Summit

Washington, DC [March 9-10, 2016]

Overarching Goal for CMS

- To enhance coordination and collaboration toward a common national climate modeling strategy and communication with the broader modeling community.
- The CMS is an annual opportunity for:
- Modeling center leaders to engage in discussion on major objectives and difficulties
- Agency representatives to present relevant current priorities, directions, issues
- Dialogue regarding whether and how we might improve strategies to further U.S. climate science and mission objectives

US Climate Modeling Summit (March 2016)

Perspectives from the meeting last year (CMS1) and connecting to this year's (CMS2) meeting

- Last year's meeting was a good introduction. Continuity from CMS1 not very evident in CMS2, but still a useful meeting that involves timely exchanges and updates from the US centers. Each Center is learning useful elements from the experiences of the other centers. Also, there are common concerns that are useful to share in a setting like the one CMS facilitates (e.g., discussions on high-performance computing (HPC) architectures, high-resolution models and simulations). The high-level participation at both CMS' is helpful in preparing a platform for decisions by the Centers, especially to engage on mutually beneficial subjects.
- Following on CMS1 discussions on various Centers' interests in the WCRP Model Intercomparison Projects, CMS2 witnessed detailed discussions on this subject. In particular, the centers participating in CMIP6 discussed the specific MIPs they are signing up to do, and the resources involved including computing and personnel.
- There was a concern that there is not enough of continuity from CMS1 into CMS2, and that the discussions have yet to inter-relate the interests of the research modeling centers with those of the operational centers.
- There was a request for establishing points of contacts among the centers regarding software architecture.
- The issue of the agency expectations for the US CMS was raised again. While the discussions at CMS2 addressed this point, it would be good to strengthen the concept in the months before CMS3 next year.

Discussions at CMS2 – a few highlights

- HPC concerns for the future. Compute architecture was an area of interest. Future HPC architectures highly likely to be different than at present. Serious issue regarding codes being adaptable in the future computing architectures. Strategy for adaptation? DOE may have a natural lead through its HPC leadership in the US. Is there something that we can do or should we just wait? Should we learn from other groups or engage with compiler companies? There is planning going on at DOE as part of the preparation for exascale computing - this may be extendable to other agencies. Computing/optimization should be a topic for next year's summit.
- CMIP6 participation by US climate modeling institutions. Names of persons who are participating in the MIPs from the modeling centers have been exchanged (to be finalized though). High level of mutual interest on a couple of MIPs e.g., RFMIP, AerChemMIP, perhaps working out a high-visibility intercomparison ahead of the WCRP timeline.
- Hi-resolution modeling. There is considerable enthusiasm in high-resolution simulations for understanding and predictions on all time scales. However, given the multi-faceted nature of this challenge, can we winnow the problem first to a few questions. For example, can we focus on one component?
- Climate model tuning paper. How do the centers 'tune' the models? What are the guiding principles, and how is the outcome measured?
- ScenarioMIP. Interest in a US-centric activity. How can this be formulated for CMS interests. Start from the ScenarioMIP and formulate a US-centric set of scenarios. One example could be sea-level rise.
- Land and Earth System modeling. Discussions on framing a water cycle question. Interest in land-carbon, and impacts of irrigation on surface fluxes and water balance. What types of land questions can be formulated? This interest prevails on all time scales so could be taken from the weather to multidecadal context.
- CPTs. Discussions did not lead to any concrete ideas, in large part because observations are an essential component of a CPT and this group's focus is almost exclusively on modeling.

- Subseasonal and seasonal predictions. Strategy for ensemble predictions – what are the different approaches being pursued by the groups? Seems like this element has to be communicated and understood. How do the different datasets' usage affects skill in predictions? There is NMME which is going on for a couple of years now. Subseasonal-to-seasonal is underway. So, there is a considerable basis already. A topic for next year's summit to discuss the evolving maturity in these subjects.
- DOE and CICE. There was some confusion expressed by the centers about the availability of column physics and its downstream influence on coupling in the global models. This issue was clarified and is now likely resolved.
- Communications aspects amongst the modeling centers very important for the US. CMS facilitates it well. Perhaps, next time focus on a common interesting feature such as experiences in high-resolution modeling of the climate and Earth System, with impacts on the sensitivity of the climate system and predictions.
- Feedbacks from the CMS to GCRP on the priorities, thus assisting in future priority planning. In person presentation/s at GCRP meetings would accentuate the communications to GCRP. What would be a mechanism? The group at the CMS meeting is one mechanism. There are monthly SCR meetings. Monthly lunch seminars could be a venue where this group could provide talks. IGIM could follow up.
- Chair for the CMS.

List of action items and POCs

Action item 1: (provide POCs for the major topical areas being pursued at the institutions) Submit POCs on the areas being pursued at the various modeling centers to Gavin, as already requested prior to the meeting. While there may not be a 1-to-1 match of areas across the institutions, the expectation is there will be sufficient overlaps for identifying the go-to persons.

A**ction item 2 (provide a summary paragraph)**: Each center prepares a paragraph on what has gone on since last year. Big picture stuff, somewhat similar to the inputs asked last year at the conclusion of CMS1.

Action item 3 (computer architecture/HPC follow-up meeting) How to adapt to new architecture and deal with the uncertainty. **Dave Bader will serve as the POC to pull a small group of people together for a follow-up meeting.**

Action item 4 (Model tuning paper): Gavin proposed a BAMS paper on model tuning. **Gavin is the POC and will follow-up with those interested**, with one representative solicited from each center. Action item 1 will facilitate this effort.

Action item 5 (RFMIPs coordination): US coordination on RFMIP would be useful. Get information regarding radiative forcing and methodology. **Ram is the POC and will coordinate with J-F**.

Action item 6 (US relevant scenarios): NCAR/GISS large ensembles to look at extremes? A pilot study that goes beyond the general scenarios e.g., deal with issues concerning sea level rise. **POCs: J-F and Gavin**

Action item 7 (Sub-seasonal and seasonal predictions group): how do we generate the ensembles? the perturbations approach? Initialization approach. **Steve Pawson/Hendrik are the POCs**.

Action item 8 (Water/Carbon cycle/boundary layer issues): Water balance over the US with a specific question in mind - irrigation and 2mT is one of the top issues. **Ruby/Randy with be the POCs to brainstorm ideas for this area.**

Action item 9 (Feedback to USGCRP/IGIM planning for modeling): Chairs: Ram agreed to be the chair and Hendrik the deputy chair; they will share the responsibility of chairing the USCMS until the next meeting. The prospect of a meeting in late Fall, perhaps via a telecom among the center Leads and key IGIM persons, will be considered, for the purpose of continuing the dialogs started in CMS2.

Next Steps

- "Brown bag" presentation (December 7)
- Planning for the 3rd Summit (to be held in February/March 2017)
- 1-2 day Workshop accompanying the Summit:
  - ➔Subseasonal-to-seasonal research
  - ➔ Computing architecture/ HPC
  - ➔ RFMIP (+AeroMIP, DAMIP,…..)
  - ➔ Climate OSSEs.