

## Day 2 Notes

### **CMIP6 [Notes from Archambault]**

#### **GISS plans**

- Multiple DECK runs – multiple configurations (variations of atmos, ocean, physics, etc.)
  - GISS-E2.1
  - GISS-E3
  - GISS-E4
- MIP foci (of personal interest – not comprehensive):
  - DAMIP
  - RFMIP
  - AerChemMIP
  - CFMIP
  - PMIP (paleo MIP)
- Will not do a MIP for every DECK
- RFMIP: Radiative forcing calculations were not done correctly
  - the two methods applied by various centers were inadequate
- Ram echoes the importance of capturing the aerosol forcing; something that should take priority
  - RFMIP and AerChemMIP
    - If one thing is done collectively out of all the MIPs, it should be this one
- Motivates a lot of time spent on RFMIP –
- PMIP – to have confidence in regional changes that are projected, need to examine whether these changes were correctly captured for past climate change
- Single forcing ensembles can be useful (Marvel et al. 2015)
  - Do all the various forcings and responses add linearly?
  - What are the limitations?
  - Anything related to ozone changes (particularly tropical and ozone hole concentrations) is found to involve nonlinearities with respect to precipitation, etc.
- Also looking at efficacy of forcings in transient runs: Historical runs are found to underpredict sensitivity
- Forcing improvements:
- Irrigation – water added to land surface, either from rivers or groundwater
- Greater differentiation in land use
- Volcanic forcings
  - the forcings from large eruptions (greater than Pinatubo) were being overestimated previously
  - in theory other centers could do similar investigations and comparisons could be done to better capture uncertainty of eruptions like Pinatubo
- Solar forcing uncertainty
- Aerosol forcing

- Urban fractions

### **CESM interest in MIPs**

- Initial MIP participation based on specific interest by community
- CESM2 has invested in high-res and chemistry/BGC
- Members of CESM are on the organizing committees of several MIPs
- Maximize usability of results (CORDEX, etc.)
- Plan to use 4 different version of CESM for the MIPs with ocean at 1 deg
- CMIP6 DECK + Tier 1: Low res versions (~250M CH), and high res version (~260 CH)

CMIP6 allocation: Cheyenne will come online next year with a 1 year overlap with Yellowstone – 1 degree version will start early to take advantage of this  
Likes Gavin's idea of looking at volcanic SO<sub>2</sub> emissions

### **GFDL – John Dunne**

- Top priority MIPs - too many too participate in all
- high interest in: DAMIP, RFMIP, CFMIP, OMIP, FAFMIP, C4MIP, LUMIP, AeroChemMIP, DynMIP...) – about 10
- Lots of interest in complementarity
- Expect to participate mainly in FY17/18 given current constrained resources  
Should US centers coordinate timing of CMIP participation?
  - Something to consider for RFMIP/AeroChemMIP
- Gavin: AR6 is not necessarily a main driver anymore – there are still CMIP3/5 runs that are not obsolete; that said, interesting science will come out of CMIP6 that is tied to DECK runs
- Ram: everyone wants to have their papers to be cited in IPCC chapters
- Gavin: disagrees that it matters
- Susanne Bauer: Individual MIP deadlines will drive the process, unlike in the past – will have a main paper with core findings for each MIP
- Some coordination is needed so that a group can get something published – otherwise analysis may happen years before the paper can be written
- Scenario MIPs are not of interest to GFDL (but they will do them)
- GFDL estimates that CMIP6 data will 1.5Pb of public data
- COP-21 requested an IPCC report on the consequence of 1.5 or 2.0C – but timeline is very short
- Is there interest from agency managers in sensitivity studies to address adaptation for these warming scenarios?
- Is what has been done already sufficient? Already have projections that pass through 1.5-2C warming
  - could look at simulations at that point
- ACME – too distracting to do CMIP
- EMC – not justified
- ACME claims that misinformation is being propagated about DoE restricting to CICE development

- a statement could be developed and agreed upon by the group as a way to correct the perceived misinformation

**Opportunities and Challenges for Modeling with High Resolution and Advanced Physical Representations: [Notes from Dunne]**

GFDL (Ramaswamy) – GFDL focused on two axes of research – resolution and comprehensiveness

- On ocean, combining interior mixing mechanisms, scale aware parameterizations, sub-ice shelf cavities, various vertical layer coordinates
- On land, coupling C-N in vegetation, soils, and rivers, exploring BGC, prognostic aerosol interactions, including biomass burning, sub-grid hillslope heterogeneity, age-height vegetation succession, and land use management
- Problems ripe for S2S research:
  - Strat-trop coupling
  - MJO and associated impacts including atmospheric rivers
  - Subseasonal predictions of sea ice and tropical cyclone predictability/forecasting
  - Role of radiatively active gases and oceans on predictability
- ACME (Ruby Leung) ACME focused on answering how high resolution will improve earth system features to improve water cycle, river flow and freshwater supplies at the watershed scale.
- Hypothesis that change in water flow over the last 40 years have been dominated by land use and aerosol-driven climate change, while the next 40 years may be dominated by GHG changes.
- Comparing 25 km and 100 km Atm, enhanced river network, and 30 km and 15 km ocean
- Simulation period 1950-2050, pre-industrial, present day, and transient forcing with single forcing experiments and multiple ensemble members.
- Existing Atmospheric and Land components based on CESM2 for version 1, and considering new atmospheric parameterizations and land comprehensiveness and parameterization including microbes, land management, impoundment for version 2. On ocean, starting with high resolution (15-5km, globally, regionally higher) ocean with 100 layers, BGC at 1 degree, sea and land ice. For version 2, including advancements in ocean physics, coastal high resolution and land ice-ocean interactions in MPAS.
- Much interest in CPT's that are in line with ongoing DOE observational and modeling priorities,
  - Science questions include:
    - Sensitivity of moisture source over land to model resolution – implications for regional water
    - Energy-water-land nexus – feasibility of mitigation scenarios and implications for carbon
    - Terrestrial-aquatic interface – Implications of coastal interactions on coastal aquatic and sediment fluxes including inundation and extreme events for GHG and BGC

- NCAR (Large) – Resolving down to 0.25 threshold on atmosphere for hurricanes, and focus on either 1 degree or 0.1 degree ocean and nothing in between. Concerned about ‘hyperventilating atmosphere’ of enhanced precipitation and evaporation at high resolution. NCAR is exploring regional refinement to 10 km or so but not hydrostatic models.
- NCEP (Tolman) – National water center has been set up with high resolution hydrological modeling. Big issue for representing last 30 years is separating the operational and R/D streams. Would like to partner with others looking at teleconnection improvements possible when 3 km resolution becomes possible. NCEP considering a 128 layer weather configuration with 50 km horizontal resolution.
- GMAO (Pawson) – running 10 km and 1 km resolution atmosphere ocean runs, moving forward, looking at model physics improvements at 3.5 km. Have explored ocean data assimilation at 0.1 degree, but focused at 0.5-1 degree ocean data assimilation. On GMAO radar is future representation of coastal ocean. Planned reanalysis on skin layer to analyze atmospheric composition and atm-land interactions as better inferable from the satellite radiances. Looking at transition from 72 to 150 vertical layers in particular to represent ozone migration across troposphere-stratosphere transition. Enhanced representation of the planetary boundary layer another model of emphasis.
- GISS (Schmidt) – No high resolution plans for horizontal, but lots of effort on the vertical using 96 layers.
- Schmidt emphasizes the need for increased vertical resolution concomitant with increased horizontal resolution to represent QBO and other waver interactions.
- Ramaswamy emphasizes the importance of representing convection across resolutions.
- Schmidt notes that there are lots of instances where code implementation of vertical has been resolution-specific (per meter basis) instead of generalized (on per layer basis) and changing resolution across a continuum can help identify these issues.
- Tolman – there are a lot of processes on the ocean side that are prime for small groups to make progress.
- Pawson – most of the processes on the atmospheric side have mostly exhausted the ability to make quick progress using existing observations.
- Tolman – in a realm of limited computing, focusing on enhanced vertical resolution has potentially more opportunities for advancement
- Ramaswamy – recent reduction in computational resources has been incredibly limiting for efforts in high resolution for both prediction and earth system modeling efforts.
- Tolman – Directed operational compute enhancement at NCEP has recently overwhelmed the research emphasis, which is stifling for the long term advancement of prediction capacity.
- Ramaswamy – CMIP is a production mode that has also suffered from the reduction in computing resource.
- Tolman – there are tight restrictions on access and use of ‘operational’ equipment in commerce. There are separate operational and R/D machines.

- Ramaswamy – there is a proposal to extend the current (monthly) NMME to sub-seasonal (weekly) forecasts, but there is currently no computational capacity to support it.
- Koch - interest in High Res MIP? No ability at GFDL, possible interest at NCAR but not a priority – thought that the Europeans were taking the lead.
- Mariotti – Interest in initialized predictions at high resolution? GFDL and GMAO have interest but cannot commit to deliverables with existing efforts and resources.
- Considine – Is there any opportunity or need for collaborating or coordinating among the centers to achieve high resolution goals?
- Leung – We have asked the question, but we don't have the resources
- Pawson – GMAO has taken the FV3 core and is testing it at high resolution, and NCEP is considering taking that core moving forward.
- Ramaswamy – there are opportunities for joint activities such as the NMME that takes a lot of resources that serve a common goal. There are combined interests in extending work on the subseasonal forecasting efforts. We have to identify the scientific questions that have shared priority that would benefit from collaboration/coordination... what are these questions
- Considine – Is there something that would reduce the resource requirements of each group by cooperating.
- Large – For the CMIP definition of 0.25 degree atmosphere, there are little identified modes for shared goals that would lead to obvious synergies.
- Ramaswamy – the drive should be to address specific scientific challenges. Most of the discussion has been around developing capabilities rather than directly on the science challenges that drive them.
- Pawson – One mode of collaboration is where the groups divide the workload to get a common result, and another is when both groups supply a similar product that is compared in an ensemble perspective (like NMME) to characterize uncertainty.
- Ramaswamy – there are a other areas such as carbon cycle in which the different groups are exchanging ideas, insights and status that we could enumerate
- Mariotti – The focus should be on what are the natural actions that are useful points of cooperation.

### **Opportunities and Challenges for Modeling with High Resolution and Advanced Physical Representations: [Notes from Archambault]**

#### **GFDL**

- Increases in modeling complexity and resolution go hand in hand
- Using both HYCOM and MOM6  
S2S interests

#### **ACME**

Top priority high-res science questions/experiments:

- Improved simulation of Earth system water cycle – how do the forcings (land and water use and climate change associated with aerosol forcing) of the last 40 years differ from what is expected in RCP scenarios?
- Addressing this with a focus on North American and Asia
- Final experiments are coupled, but also running uncoupled experiments offline
- Water cycle experiments looking at a variety of forcings
- Vertical gradient and meridional gradient of water vapor is significantly improved with higher resolution, and this affects cloud cover substantially
- Process model advancements – atmosphere v1 and v2, land v1 and v2 (different human dimensions, among other things), ocean and cryosphere v1 and v2
- Interest in CPT approach -- DOE already uses a similar approach, with areas of interest:
  - diurnal precip
  - marine biogenic aerosols and cloud effects
  - water mass transport (to clarify: CPT uses available datasets, not collecting new data as in a field campaign)
- Science questions:
  - Moisture source for precip over land (moisture flux convergence from ocean vs. evapotranspiration)?
    - test sensitivity to resolution (question about diagnostics to be used)
  - Energy water land nexus – mitigation scenarios, terrestrial carbon sink, implications to carbon reduction pathways/costs
  - Terrestrial-aquatic interface – effects of C, N, and P fluxes from terrestrial systems to coastal margins on ocean BGC and net GHG exchanges

Hendrik:

- NWC has an aggressive hydrologic modeling plan in order to trace water
- Interested in chemistry in that it helps weather and also helps validate satellite datasets

GMAO – lack of coastal ocean model, ocean skin temperature (GMAO and EMC work with joint center on this) incorporating satellite data

Issue of vertical resolution

- (GISS) can't benefit from higher horizontal resolution without a commensurate increase in number of vertical layers
- ~100 layers are required for QBO
- GMAO: looking at ~150 layer implementation next year
- Higher number of layers goes hand in hand with radiation code changes (GMAO)
- Vertical resolution also affects convection and moisture
  - CESM: changes in vertical resolution require changes in physics
- CESM: limited by cycles and access to computers – can only do so much
- EMC: increase in horizontal resolution is the biggest increase in compute → motivates looking at vertical resolution changes in terms of cost/benefit
- GFDL: limited by compute to do high res

- EMC: lost balance between research and operations – increase HPC for operations means that research can't keep up – now at near 1/1 ratio, but need more computing for R&D
  - Have compute cycles, but no computers to get on
- GFDL: NWS's weather prediction is only prediction that is considered formally operational by government
- EMC: operational model is under DHS control
- Ram: NOAA S2S model runs are not yet “operational” but not clear how HPC should be used – operational vs. research computer – how it is labeled matters
- Interest in initialized experiments (CAPT-type experiments)?
  - GMAO – interest in “exploring the possibility” in S2S prediction – 25 km atmos/ocean
- Interest in coordination among agencies?
  - Interested...too early?
  - Too few resources
  - 3 centers could find matching interests and explore based on existing resources
  - Pick something doable for various centers – RF is an example
  - NMME is an example of a collaborative activity
- Another example is the DyCore testing
- Recap/actions
- In some respects, lots of collaboration is ongoing
- Susanne: Should there be more communication of research among the groups? clouds models, etc.? Should this be facilitated, or does this already exist?
  - Ram: agreed that this is important – need a POC for each area
    - Each group should have a POC for various SME (people actually doing the work)
  - Susanne – global climate modelers seem to know each other, but what about high resolution people?
  - Ram – should come back to this as an action item – initial slate of key areas
- GMAO: High resolution AMIP runs could be feasible/useful
- GMAO: Should the sub-groups meet and develop action items? Not that useful to “meet” – they know each other
- Ram: subgroups can go off on their own, as long as they report back
- Ram would like a paragraph describing big-picture areas of focus from each center about priorities over the past year
  - Most groups are preparing for CMIP6
- Ram: any action item from HPC structure? Architectures in the future will be different (how is unclear)
  - Dave Bader: can work together on exascale issues (DOE has internal group)
- Proposal is for one joint paper about tuning (overall, different groups, how to make more transparent)
- Dave Bader will be POC on infrastructure planning

- Gavin will be POC on BAMS paper
- Ram will be POC on RFMIP coordination
  - May need to be modified a bit to appeal to all agencies (Ram can talk to J-F. offline)
    - Can the timing be ahead of the other MIPs?
    - Publication?
- Scenario MIP – JF and Gavin will be POCs for this (a U.S. centric scenario)
  - J-F: start from scenario MIP and go from there
    - 1.5C scenario with no overshoot?
- Subseasonal to seasonal prediction – collectively, can modeling aspects be brought into focus?
  - Steve Pawson: how to generate ensembles is a big issue
    - How do NASA datasets improve initialization?
  - Steve and Ram can be POCs on ongoing S2S activities
- Hydrologic modeling – impact on land sfc models
  - Ruby: what are impacts of irrigation in models?
  - Water balances at the surface
  - Biases in 2-meter temperature
  - Everyone has a landmodel – Hendrik, Ruby, Steve can be POCs
- Carbon cycle? MSTYMIP? – ongoing MIPs?
- CPTs – suggest a CPT?
  - Should come from the community, not from directors
- Interaction with IGIM?
  - USGCRP principals meeting is once a month – presentation in person just ahead of a meeting is very impactful
    - Good for this group to present to this group
  - Hendrik is nominated as chair of USCMS; Ram is deputy

### **Session 3: USCMS organizational issues [Notes from Koster]**

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Ram: We want to come up with concrete action plans. Plan should be by consensus. Questions to centers: what is your overarching view of how the workshop went? Are we making progress? The communication aspect is very important and useful. We also want to generate a report within a couple of months – with an iteration in between. Session leads, with help from rapporteurs, start with sections.  
 Renu: presentations will be made available.

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#### **//What people thought of meeting//**

Jean Francois: Last year was good intro. It would be nice to have some additional interest in building on CMIP6; coming up with a collection of science questions would be helpful – that's what I would like to see from this meeting. Re HPC: everyone is struggling with hi-res, and this is a big impediment.  
 Gavin: The most opportunity for making the sum be more than sum of parts is building on CMIP6, where we are vanguard of pushing forward new ideas (?)  
 Bill: I didn't see continuity from last meeting. Other than that, the meeting is useful.

Susanne: We are already well connected. The hi-res part is not yet there for collaborations. Last year we suggested more communication between different groups across center (clouds, etc.) Is there a lack of communication for hi-res people? (Ram adds: The points of contact was requested, but only one group responded. The idea of POC is that they would know where to direct people who have questions.)

Hendrik: Would like to know POC for software architecture, etc. This meeting's delta relative to last meeting was nonzero. This meeting is in general useful and will aid collaboration. Re lack of computation and dycore comparison, would like to see more next year on performance measures.

Ruby: Learned a lot about other groups. Re hi-res: everyone's interested in hi-res, maybe activities focusing on one component may be useful.

John: One action from before was to get a more formal consensus of concerns re sea ice. Was aware of NCAR efforts on coastal representation, but not ACME efforts – potential synergy exists. Develop a synthesis of what is known, perhaps via a workshop, re(?)

Steven: Important that we get together like this; a set of action items would be useful.

Agrees that hi-res AMIP might be useful, but we need to target what to look at.

Doug: This meeting has been useful. We still struggle with what the agency reps hope to get out of this gathering. (Hi-res questions are an example.)

Randy: Useful meeting. Probably the topic leads from different institutions already know each other.

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#### //Future architectures//

Ram: Paragraph needed from each center about what has happened since last year – big picture things. re HPC: is there any action item about that? Future architectures will likely be different, and we don't know what they will be – we have to worry about how our codes will have to adapt. No current vision about what future architectures will look like. Is there any hope from learning from other groups (physicists...) about how to deal with this? Options: a) do nothing, b) interact with other groups, c) interact with architecture(?) developers.

Doug: Coordination with other DOE groups will happen in ACME. We could extend that to include people from other centers – there's an openness for that.

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#### //Miscellaneous//

Bill: this is 2<sup>nd</sup> meeting. In addition to what we've done in last year, say whether last year's meeting had any impact.

Steven: The very idea that we are deciding on action items is something.

Bill: (Not that positive about this)

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#### //Tuning paper//

Gavin: Some good ideas from last year: paper on tuning. This idea faded because people to write it were not ones in room. The POC list could facilitate this. This effort would be beneficial to centers and users.

Ram: Another idea was BAMS paper on overlaps that may be discernible amongst centers. We need to identify the people who can attack these papers.

Gavin/Ram: Let's push this tuning paper now (what kind of tuning goes on for different models).

Gavin: Most important for CMIP and operational models.

Bill: Showing the dirty laundry would be useful.

Hendrik: this stuff is usually out-of-sight.

Annarita: Need to identify POCs amongst the group here to address all the action items we come up with.

Gavin: **Action Item:** I'll send out email asking for point person to contribute to tuning paper.

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**// More on evolving architectures //**

Ram: return to topic: How is DOE's strategy shaping up regarding adaptation to new architectures.

Hendrik: there's work going on at NOAA about this, also.

Doug: DOE can do the practical coordination – small and actionable things, workshop with 1 or 2 people from each center.

Dorothy: DoD has computing infrastructure – would be worthwhile to have them at discussion table.

Hendrik: ESRL also relevant.

Annarita: **Action item** is to assign Doug to be POC person for this topic.

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**// MIPs, including RFMIP //**

Ram: (new topic) There is still merit in doing some aspects of MIPs, even if you don't plan to be heavily involved. Should we extend beyond RFMIP, under RFMIP banner? Not cost-intensive.

JF: What do we mean by radiative forcings? We should agree on methodologies.

Ram: **Action item.** I am willing to follow up on RFMIP with this group.

JF: AerchemMIP relevant(?)

Steven: Useful because this would be its own project.

Ram: We should also think about time coordination – maybe go ahead of official timeline for US purposes; maybe even get a pub out of it eventually.

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**//ScenarioMIP//**

Ram: ScenarioMIP, US-specific. What is our thinking?

John: this goes to GCRP!

Ram: two groups are interested in pursuing this.

JF: Will probably do ensemble. Not sure how many groups will do that. Should help for looking at extremes. Maybe we might all agree that this is of interest.

Ram: **Action item.** JF and Gavin will float ideas about US-centric ScenarioMIP to group. Start from ScenarioMIP and develop something new, US-centric.

John: Scenario that goes to 1.5...?

Gavin: Technical issues regarding ice sheets. We have limited ability re ice sheets.

JF: Probably a 1.5 scenario doesn't exist.

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**//Subseasonal-to-seasonal prediction (S2S)//**

Ram: Subseasonal-to-seasonal prediction. 4 groups into this.

Steven: If we are trying to do ensembles, each group has its own way to do ensembles. Approach can be important. What approaches do other groups use? Could this be a study in itself?

Ram: NCEP and GMAO could take lead.

Hendrik: CPC is looking into this. CPO MAPP opportunity already there.

Steven: in GMAO we are interested in how NASA datasets affect skill.

Randy: S2S already in good shape re coordination/collaboration (relative to other topics), given NMMEs.

Anjuli: S2S has international program; NSF is funding JPL (Waliser) to do some work.

Annarita: Broader international effort – NOAA effort fits into that.

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#### // Land issues //

Ram: Land and earth system modeling. Irrigation, rivers, carbon cycle. What could we do?

Hendrik: More detailed hydro could help alleviate hydro biases. Modeling of hydrology needs to improve, according to Water Center. A lot of systematic errors are associated with inaccurate water balance.

Ram: What is question?

Ruby: Possible questions: “What are impacts of irrigation on surface fluxes?” “How does running offline models vary with resolution(?)”

Ram: **Action item**: can Hendrik, Ruby, and Steven frame a water cycle question that we can address?

Steven: Carbon monitoring system gives us carbon fluxes diagnostically. How do predictive carbon models compare to diagnostic measurements.

Ruby: MistyMIP(?) does this??

Steven: need something more controlled.

JF: That sort of thing already exists. Clam (?)

Ram: Actually 2 questions here: 1) heat and water balance for land surface, and 2) carbon cycle

Randy: Land water and energy comparisons with obs and between models have been done for decades

Ruby: Irrigation effect hasn't been done

Ram: **Action item**: Randy and Ruby do offline discussion of what type of land questions may be addressable by group.

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#### // CPTs //

Ram: CPTs. Any new ones to suggest?

Bill: hard to see how this group can submit a CPT, since we don't have observations

Ram: but what problems can we suggest that a CPT can address?

Bill: Europeans tried that; observationalists not impressed.

Ram: Maybe something can be done on atmospheric side. Probably pass on CPTs for this meeting.

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#### // Feedback to USGCRP //

Ram: Feedback to GCRP re priority planning. What kind of mechanisms would be useful? How will they learn from us?

Dorothy: priorities are evolving slowly enough so that our contributions would be helpful  
Brian(?): Monthly lunch seminars would be one mechanism for communication to GCRP. In person presentation far more useful than report.

Annarita: Someone from this meeting could present to the GCRP group.

Ram: We'll try that.

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**// CICE and Arctic //**

Annarita: CICE?

Doug: It's settled. Column physics will be available!

Ram: Arctic?

Brian: Memorandum between Trudeau and Obama to reduce methane emissions.

Message: this is a popular topic that USGCRP will address.

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**// USCMS Chair //**

Ram: USCMS chair needed for the year, or rather spokesperson. Nominates Hendrik.

Hendrik (quickly): But I'm an outlier.

Final: Ram agrees to be leader, with Hendrik the deputy

**USCMS organizational issues: [Notes from Mariotti]**

Participant's reactions to USCMS:

- NWS: Hendrik, NWS would be interested in a having USCMA software infrastructure POC. This tag-up was very useful at this level. Also, would like to follow up at the technical level on some topic. Would like to see more discussion about compute/optimization/software at next meeting.
- ACME: Ruby, very useful meeting. HR, could be something we could pursue maybe at the component level (e.g. high vertical resolution, or land) AMIP type. Dave: what are the agency's expectations for the USCMS, it would be more helpful to have some clarity.
- NASA/GMAO: Steve good communication, would be good to walk away with some action items. E.g. CICE was a topic discussed that we could follow-up on. Randy: communication was good. Follow-up round tables would be useful on some topics and these communities are already going on.

**List of action items and POCs: [Notes from Mariotti]**

**Action item 1: (provide POCs for topical areas)** Submit POCs on topical areas to Gavin, as already requested.

**Action item 2 (provide a summary paragraph):** Each center prepare a paragraph on what has gone on since last year. Big picture stuff.

**Action item 3 (computer architecture/HPC follow-up meeting)** Compute architecture was an area of interest. How to adapt to new architecture and deal with the uncertainty. Is there something that we can do or should we just wait? Should we learn from other groups or engage with compiler companies? Dave Bader: there is planning going on at DOE as part of exascale planning - this could be extended to other agencies. **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.**

**Action item 5 (RFMIPs coordination):** US coordination on RFMIP would be useful. Get information regarding radiative forcing and methodology. A focus on historical simulations and coordination on timing. **Ram is the POC** for this action.

**Action item 6 (US relevant scenarios):** NCAR/GISS large ensembles to look extremes? A pilot study? Will float specific ideas on the group. Exploring something that would be potentially of more interest than the general scenarios. E.g. something that deals with sea level rise. **POCs: JF 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 on this.**

**Action item 8 (Water/Carbon cycle/boundary layer issues):** NASA does not have in-house expertise in land-carbon. Interested in the price of irrigation, water balance and surface temperature. Water balance over the US with a specific question in mind - irrigation and 2mT is one of the top issues for Hendrik. **Ruby/Randy will be the POCs to brainstorm ideas for this area.**

**Action item 9 (Feedback to USGCRP/IGIM planning for modeling):**

What would be a mechanism? This group is one mechanism.

Gary: there are monthly SCR meetings. Monthly lunch seminars could be a venue where this group provide a talk. IGIM will follow up.

Chairs: Ram and Hendrik will share the responsibility of chairing the USCMS until next meeting.