CMIP5 early assessment

WGCM

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CMIP

- Climate "Science" side
  - Experiments runs
  - Variables saved, QC'ed, made public
  - METAFOR
- Data serving (computer science) side
  - Security
  - Servers interacting with each other
  - Visualization
  - Bandwith and other hardware issues

CMIP5 – Good things

- **Amazingly complex, extraordinary increase in scope compared to CMIP3 and relative to *any* other database in world.**
  - It must be counted a success that the experiments were run/data archived.
  - CMIP3=40TB, CMIP5=1.5 PB+, at least 40X bigger! And growing….
  - Number of experiments also up by some big X factor.
- **Distributed data management system was a first!**
  - Amazing accomplishment.
    - Complexity not well appreciated by users.
  - Software effort brought together people working on many different aspects of the software.
- **The systems set in place for CMIP are extensible.**
  - ESGF architecture is designed to be scalable and can be extended to meet future data needs
  - All other MIPs are and should be encouraged to embrace and extend the model, including ESGF nodes, DRS (vbl names/units) structure and CIM metadata (METAFOR).

CMIP5 – Things that need work

- **Infrastructure funding specifically targeting CMIP5 was insufficient, resulting in delayed achievement of some of the ambitious goals.**
  - ESGF was funded as a "research" project to develop a system that would serve communities broader than CMIP. (CMIP was one of 4 "use" cases.)
  - Efforts to make the system work operationally for CMIP were initially underfunded.
- **Governance model was informal with poorly understood procedures for decision making**
  - ESGF governance needed to be in place earlier
  - Uncertainty and disagreements on the timing of upgrading the system meant a delay in integration of the METAFOR model documentation effort with ESGF
- **Capabilities that were important to scientists attempting to meet IPCC-dictated deadlines were not deployed in time:**
  - Access to CIM metadata
  - Data citation mechanism using DOIs
  - Replication of data to improve accessibility
  - Quality assurance checks on model output
- **We are all downloading gobs of data instead of leaving it on the servers.**

CMIP5 – Things that need work

- **Modeling Groups were very late making data public**
  - In Feb 2012 there was very little carbon variable data available from ESMs where atm pCO2 was predicted. Better now?
  - Tension between making data public and writing papers on results
    - Especially a issue for "new" runs – like the ESMs this time
  - Most physical variables available in Feb 2012…which was very late
    - Remember we agreed to have the data public by Jan 2011 (!) in Paris (~Sept 2008)
  - Modelers always want to delay until the last possible moment to get the "latest" into the model
- **METAFOR**
  - Lots of effort to get people to fill out forms
  - Very little feedback to modeling groups to date
  - Publish and QC took lots of time
  - If we plan to use this again – there needs some feedback now and some encouragement for the groups. The usefulness is not clear to me as it exists. Large potential, but unrealized.

CMIP6(7,8,..) - Action Items

- **Encourage the formalization of ESGF with international inter-agency agreements, orchestrated by WCRP.**
  - WCRP and NRC endorsement should be capitalized on by agencies to increase base funding for a global data infrastructure.
  - Governance proposal being developed
  - Infrastructure cannot be financed with soft money! **See recent NAS report**
- **Conduct survey not only of users but also of data providers.**
  - This was missed in CMIP3.
- **Data providers -- aka modeling centers – are key to making this all happen.**
  - No overarching group that covers "science" side, software side
  - Role of WCRP Data Council unclear and could easily hinder things
- **All MIPS should follow the lead and standards set by CMIP5.**
  - With that understanding, CMIP could be divided into smaller, more focused and manageable sets of experiments, which would be less disruptive to the scientific life at the centers.

Summary
Computer Science Side

- CMIP5 distributed data base is a remarkable accomplishment
  - World's most complex distributed database
    - GOOGLE, CERN LHC databases probably larger
  - Working fairly well at present
- Governance and funding models need changed for future CMIPs
  - This needs to begin NOW.
- All other MIPs should use CMIP standards
  - Other "standard" development should be discouraged
  - Modeling groups need to be central to process

Summary (con't)
Computer science side

- WGCM use PCMDI as its main connection to ESGF
  - Relationship has worked well in all CMIPs
  - WGCM support of PCMDI helped organize software folks
  - PCMDI a leader in serving data

Future CMIPs
Climate Science Side

- Time slice experiments need to be better defined
- Standardize 20th C forcing fields
  - Aerosols – natural and human-made – conc and emissions
  - Solar
  - Volcanoes (?)
- Easier to perform MIPs
  - 1 giant MIP (ala CMIP)
  - Many smaller MIPs
- Tuning issues
  - Using estimates of historical forcing changes in tuning
  - Metrics - Circular testing?
    - Tune to present day and then evaluate present day simulation