UK CMIP6 workshop Feb 27 Rhodes Lecture Theatre, Said Business School Oxford; Notes&minutes from sessions and links to presentations:

9.30 – 9.40: Meeting aims: Colin Jones `Click for presentation`

9.40 – 9.55: HadGEM3-GC3.1 DECK, Historical and scenarioMIP runs: Richard Wood `Click for presentation`

9.55 – 10.10: UKESM1 DECK, Historical and scenarioMIP runs: Alistair Sellar `Click for presentation`

10.10 – 10.30: Data conversion, submission and access: Matthew Mizielinski `Click for presentation`

and Ag Stephens `Click for presentation`

10.30 – 11.00 Plenary I: Practical aspects of mirroring/accessing/analysing CMIP6 data. Bryan Lawrence to lead:

Actions:
- Need IPCC/WIP drivers on the WG1 priorities for replication.
- Plan a priority replication/on-disk system for gathering inputs and managing workflows.

Big questions:
1. Pipeline UK data to JASMIN
2. Priority rest of world to JASMIN
3. What is on disk when?

Discussion:
- Much UK data has been produced (UKESM1)
- Please do not try to replicate data to your home, or home institution
- IPCC is trying to think about priority variables for WG1.
- Clarifications:
  - Verification of Met Office data:
    - Requires a scientist reviewing and approving the generation of each variable.
  - Verification of non-Met Office data:
    - Need to use suites provided by Met Office as basis.
  - CMIP6 data on JASMIN covers:
    - Login access on JASMIN
    - Publication to CEDA: under "/badc/cmip6/data"
    - Publication to ESGF: accessible via global ESGF tools.
- Met Office QA Checks:
  - Checks compliance with CMIP6 standards
  - Checks time axis is correct/compliant
- An errata service exists: to log/document errors found in data.
- Data Request includes some guide value ranges for variables.
- CEDA proposes that any large volumes should be analysed/managed on JASMIN.
  - But some institutions might have a small local cache.
- Can we learn from CMIP5 to identify the priority data?
  - Yes, we should start with that.
- HighResMIP:
  - Is trying to standardised Storm Tracking and publishing to the CEDA catalogue/archive.
- Variable priorities:
  - Monthly atmos.
- UK CMIP6 Analysis Team:

- o   Intends to take a lead on the replication priorities.
- We need a solution for gathering requirements in and mirroring them back to the community.
  - o   Needs a public view
- Impacts community will have different requirements
- Ideal situation: replicate almost all CMIP6 data to UK.
- Potential to synchronise some of the access with European partners.

11.30 – 13.00 4-5 min presentations of science analysis plans per MIP, including 1 slide on timelines for simulations and data submission (presented by respective MIP leads):

1. **C4MIP and LUMIP** : Andy Wiltshire   Click for presentation
2. **AerchemMIP** : Fiona O'Connor   Click for presentation
3. **CFMIP** : Mark Webb/ Cath Senior   Click for presentation
4. **FAFMIP** : Matthew Couldrey   Click for presentation
5. **HighResMIP** : Malcolm Roberts   Click for presentation
6. **ISMIP6** : Robin Smith   Click for presentation
7. **OMIP** : Andrew Yool/George Nurser   Click for presentation
8. **PMIP**: Dan Lunt   Click for presentation
9. **RFMIP** : Chris Smith   Click for presentation
10. **ScenarioMIP** : Colin Jones   Click for presentation
11. **SIMIP** : Jeff Ridley   Click for presentation
12. **DynVar**: Scott Osprey   Click for presentation
13. **ACSIS** project analysis plans : Jon Robson   Click for presentation

14.15 – 14.30: Summary of planned UK CMIP6 documentation papers and international context/timelines: Cath Senior Click for presentation

14.30 – 15.15 Plenary II: Making CMIP6 more than the sum of its MIPs: Science opportunities across MIPs/processes/models: Eleanor Burke and Matt Collins to lead:

IPCC analyses may well be based on what an 2/3/4 degree world looks like, so need to think about out analyses in a similar manner.
Let chapter authors know if have any results so they can add them into the draft.
Model evaluation opportunities:
1. Many different MIP experiments are available looking at the historical response from different angles – can we join these up somehow to understand historical simulation cooling further? For example, combine aerosol and land use analysis from LUMIP and AerChemMIP. HighResMIP has different aerosols.
2. Are the feedbacks represented properly in the climate models. Do we have any observational constraints to help understand how to do this? Can we improve process understanding to explain differences in feedbacks across models?

Opportunities across different models from a UK perspective:
1. Several model versions available with traceable differences and at different model resolutions. HighResMIP is a great resource.
2. Nitrogen cycle across models and MIPs. Can we evaluate N dep and N emissions in models. UKESM is not fully coupled.

3. Why is there a difference in the ECS between HadGEM3 and UKESM? Need to continue 4x CO_2 runs further and add runs at different levels of CO_2. Difference in temperature between HadGEM3 and UKESM makes it harder to compare.
4. Could the UK lead an analysis of the reasons for the higher climate sensitivity across the different models? For example, is there a common process which has been updated since CMIP6 that several of the models have included? Additional positive cloud feedback in Met Office model has contributed to the higher climate sensitivity. We need to explain difference between CMIP5 and CMIP6? Possibly compensating errors in the CMIP5 models.
5. Is there any way of improving the sampling of uncertainty in the forcing in the CMIP6 model runs. Can maybe get emissions uncertainty and see how this affects results and use emission driven runs.
6. Regional focused analyses and process evaluation – for example, there is a workshop planned for Antarctic change. Do the models produce very different regional results to CMIP5.
7. Atmospheric chemistry – there are differences in these processes for the different UK models and resolutions. Need to explore the synergies between RFMIP and AerChemMIP. Particularly important to look at natural aerosols.

Further recommendations:
1. Ensure we have the model runs required to perform the important analyses.
2. Ensure the CMIP6 analysis team are aware of the analyses being performed.
3. The CMIP6 analysis team could put together some more information about the proposed analyses and meetings within MIPs in the UK and the wider community with contact people on the web so students and postdocs know who to contact. They could feedback this information to the wider community to help ensure people don't end up duplicating analyses. For example, AerChemMIP uses SLACK to communicate. There is a workshop in Princeton for RFMIP, PDRMIP, AerChemMip in June.
4. Organise another workshop in 2020 to enable stronger collaborations within the UK across MIPs.
5. Determine whether there are any funding mechanisms for further collaborative analyses. Can we put forward a carefully worded highlight topic, for example - what scientific issues have we found in CMIP6 runs? CONSTRAIN a UK lead EU proposal on ECS already exists.
6. There is project workspace available on jasmin to do CMIP6 analysis, even if not directly funded by NERC (etc). Please ask a project or consortium manager if you can access relevant project space.

15.45 – 16.35 Plenary III: Open session to discuss outcomes from the day: Jane Mulcahy and Adrian New to lead:

Need to demonstrate impact of CMIP6 versus CMIP5:
- Focus on benefits of high resolution to assess differences between CMIP6 and CMIP5. Could do this with just UK models. There is lots more satellite data available compared with CMIP5, e.g. CCI (http://cci.esa.int/) has satellite data from ~2000 for 20 ECVs. NCEO has 4 people funded for UKESM and links with ESA and ESMValTool. The Earth Observation community of cross disciplinary. CCI has a climate model user group (http://www.esa-cmug-cci.org/). which interfaces between MIPs. There is a CCI portal on JASMIN. There are several hundred other data sets on JASMIN, including ocean datasets. If you want to put e.g. observational data on JASMIN, contact the consortium lead. JASMIN has the larger data sets that are on BADC (but doesn't include smaller data sets). Is this the right approach???
- CMIP6 will include the Nitrogen cycle which could lead to big improvements over CMIP5.
- Effect of additional physics/ carbon cycle physics: need to understand this better eg adding more complex aerosol schemes tends to lead to enhanced cooling, higher sensitivity.

- Why don't we just use CMIP5 for AR6 as deadlines too tight? The MOHC should include simulations in CMIP6, and these will need to be prioritized, but data can still be used beyond the AR6 papers.

Need better collaboration:
- How to bring together results from all the MIPs? Future workshops beyond Barcelona? International coordination. Most good science (from CMIP6) will be done beyond Dec 2019. Need to identify where CMIP6 gives specific science opportunities which could be leveraged by universities to identify specific scientific questions – which may then be funded. The time lines (e.g.3-4 years for a PhD) are likely too long for IPCC analysis, but need to think in advance about how to use the CMIP6 data beyond IPCC.
- How to coordinate activity with other UK-led projects (UKESM, ACSIS, PRIMAVERA, ORCHESTRA, CRESCENDO, Blue Action, etc). Decide on science areas and hold focused workshops?
- Collaborative papers: how to progress list of papers for JAMES? The 15 planned model characterization papers are just the start and don't include any analysis. It would be good to have "2" analysis papers before Dec. 2019. One of these could be the impact of high resolution (compared with CMIP5).
- It would be useful for the CMIP6 analysis team to know what the planned PRIMAVERA papers are so that gaps (in the CMIP6 analysis) could be addressed. See PRIMAVERA website for plans (https://www.primavera-h2020.eu/).
- How to include University sector in analysis? Need funding opportunity? There's an opportunity for clouds. Funding is an issue, £££ allocated for e.g. UK CMIP6 doesn't always make it to universities. NERC is not interested in funding analysis, which might be done by PhD student/PostDoc projects.
- Observational community – need to interact. Observational data is not necessarily useful unless it can be mapped to a model variable. There needs to be modeller-observer interaction to ensure/achieve this.
- Emerging constraints needs to be discussed. How will they be handled in AR6? They will be included in Ch. 7, but there is no specific evaluation chapter. Are there plans to test emerging constraints in CMIP6?

Data Issues:
- There's not enough space on JASMIN disk (7Pb) to manage all the data expected (20Pb) so need to decide how to manage e.g. what should be on disk and when. Access (to JASMIN) for universities/academia is project based. Project leaders can provide a route in. If there are space issues, speak to Bryan Lawrence. No one is funded to bring data to JASMIN, it is currently best efforts to get 'other data' e.g. GFDL's CMIP6 output on to JASMIN. NERC is not interested in funding this work.
- Start with the list of data which was used for CMIP5? Some data is available on the web UKCP interface but not on JASMIN. Raw data should be available on both. Priority data should be available on the JASMIN disk, but need an organised way of moving data on and off the JASMIN disk. Ag Stephans can be contacted about setting priorities for data on JASMIN. New tape robot with very fast I/O.
- How do users make the system aware of what data they need? There is a data management issue between what is on/will go on tape and disk. Question of how to define data in a meaningful way for users. There are 10 observational datasets that might be a good place to start.
- Access for University sector? There are three NERC centres involved in CMIP6 analysis and therefore 3-4 pots of money that could potentially be appropriated to fund someone to exploit JASMIN storage. Bryan Lawrence and Colin Jones to discuss... Plans within MOHC to have internal manage_mip? Maybe a backup to JASMIN or replicate it to JASMIN; not done in a one-person way; not co-ordinated.

- Data catalogues: ESGF global catalogue is searchable; CEDA catalogue is has a different level of granularity; Need some search function that does both as currently can't provide info such as "on disk" vs "on tape"; how long to retrieve from tape? PRIMAVERA has a good set up with a website (https://www.primavera-h2020.eu/) and awareness of workflow to cope with storage limitations e.g. plan workflows for managing data usage, i.e. don't try to download everything at once for use tomorrow!

Model Issues:
- N216 Orca025 Drake Passage transport weak in GC3.1 and falling (less than 50Sv). Issue of coastal current (order 20Sv) or AABW not produced properly?
- N96 Orca1 in UKESM1: Why is the Transient Climate Response higher (2.5-2.7K) than in the CMIP5 exercise (in 1% CO_2 runs).

16.35 – 16.45 Summary and Next Steps: Colin Jones and Cath Senior to lead.

- Analysis Team to meet and summarize discussions from this workshop.
- Make summary available to community.
- Develop a strawman for non-UK data to be mirrored at CEDA, circulate & take feedback.
- Set up a website/wiki for UK CMIP6 analysis work.
- Identify a few "key" science/analysis topics that UK scientists might lead papers on in advance of Dec 2019 where "key" topics might be of importance with respect to UK models but have commonality across other models.
- Potential areas for UK community to take a lead on a few papers that address "burning issues" with respect to CMIP simulations:
    - Higher ECS – anything common across models?
    - Mid century cooling – anything common across models?
    - Can we constrain the impact of N limitation of future CO_2 uptake?
    - N. Atlantic – impact of increased resolution on a range of simulated variability e.g. amok, ocean convection, arctic change, storms, blocking etc.
- Should the Analysis Team circulate some strawman suggestions on some topics (as above) and ask for volunteers to lead/contribute to such an effort?
- Opportunities to follow up on progress?

16.45 Close