List of collated questions from May CoP Event

Question for: Tony Weber

Question from: Brian McIntosh (IWC)

Tony made me think about changing vegetation species across our landscapes as a consequence of increasing temps and changing rainfall patterns, and the subsequent and consequent effects this will have on changing landscape scale evapotranspiration rates. Do we have a good enough understanding of likely species change and impacts on landscape water balance?

Share from Afshin (Hi Brian, we can see a review that has attention on https://www.mdpi.com/2071-1050/11/24/7224/pdf)

Response from Afshin: on species changes: Most studies have focused on responses of plant monocultures to eCO2 and to changes in temperature and rainfall, while many managed grasslands comprise multiple plants of different functional types. Different functional types of plant species (e.g., C3 vs. C4 plants and legume vs. grasses) respond differently to elevated CO2, leading to changes in the composition of plant species in grassland.

Response from Tony Weber: One of the issues noted during the Critical Review of Climate Change in Queensland's Water Models project was that currently there are few models that can effectively model the likely changes in secondary processes, such as vegetation composition, cropping changes, land use changes etc as much of the research in these areas is still formative and not readily applicable to many models.

Question for: Louise Wilson

Question from: Phillip Jordan HRAC

Can you shed any light on bias correction processes, which GCM modellers apply as a post-process to GCM outputs? It seems to me that this isn't often a very transparent process to hydrologists that might want to use GCM outputs.

Response from Louise:

Thanks for your question Phillip, certainly we need to apply a bias adjustment to GCM output prior to using it directly in HMs. Typically the process requires good quality observations at appropriate spatial and temporal resolution, and with a reasonably long record length in order to statistically adjust the characteristics of the GCM output to something that is closer to our Earth. Alternatives to bias-correction can be to use the climate change signal directly from the GCM and using this to scale observations.

Question for: All

Question from: Lisa Walpole – Alluvium

I'm wondering what the base level understanding of these data products (and terms like ensembles, downscaling, bias correction (thanks Phil!) etc) the average modeller, decision-maker needs to have?

Response from Louise:
Hi Lisa - my view on the base level of skill a modeller would need would include a basic understanding of climate change and the various sources of uncertainty as that relates to their modelling - the framework here I think is a great tool for working through this. A decision maker may not need as comprehensive an understanding of climate change. In both cases partnerships with relevant SMEs is important!

Question for:

Question from: Jenny Riches - DES

Data is critical for relevant and valid results - but it's relatively expensive and needs to have dedicated ongoing investment for its collection. How can we ensure the required datasets are collected and shared given the amount of money available to support this is unlikely to increase?

Response from Jim: SEQwater
Issue can be that we spend too much time getting data correct when it does not really change the end result much and as a result indecision rather than making good sound decisions that make sense regardless

Response from Louise:

Hi Jenny, thanks for your question on the need for data sharing. Absolutely this is essential for building our collective ensemble which can be used impact assessments. There are some efforts underway to secure funding for a national database in Australia, and internationally there is the Copernicus Datastore ("C3S") which hosts and makes available for free to researchers all climate related datasets including observations.

Question for:
Question from: Kala Sritharan – Melbourne Water

Is there a process undertaken to ensure trust with the data and model with stakeholders when the model needs to be communicated for decisions/actions?

Response from Louise:
Stakeholders will have varying requirements relating to quality and type of data for decision making. An assessment of data suitability for the modelling question is an important part of establishing trust: show that the selected data adequately captures the variability and range of conditions that the modelling question is attempting to answer. This provides a basis for confidence in the modelling outputs.

Question for: Michelle Ho (CSIRO)
Question from:

@ Jim Fear: do you feel that you have a good handle on the sensitivity of decisions to different variables?

Response from Tony Weber: This is one of the key areas for decision making under deep uncertainty which the DMDU society has been discussing. In order to understand the sensitivity of decisions to different variables, we really need to be conducting exploratory modelling and then applying the range of outcomes to different scenarios using a decision making framework such as Robust Decision Making, Dynamic Adaptive Planning or Dynamic Adaptive Policy Pathways. Each of these provides methods for evaluating the uncertainty around different scenarios and incorporating these into decisions in a structured fashion. Further information on these are available in the book "Decision Making Under Deep Uncertainty – From Theory to Practice" Marchau (2019)

Question for:
Question from: Daniel Botelho (BMT)

Perhaps a little bit more philosophical here, with regards to nomenclature. Tony indicated models are to be used to make predictions. My understanding is that the IPCC is very careful when making a distinction between predictions and projections. Could you please comment on the context of the models we are using and whether the context is more aligned with predictions or projections?

Response from Louise:
Hi Botelho - you are right about the IPCC distinction between predictions which describe the exact sequence of events in the near-future, vs projection information which describes the range of plausibility over longer timeframes.

Response from Tony:
Terminology is very important in this space and in the climate change space most of the work is discussed in terms of projections, as there are a number of different emission scenarios, called RCPs or Relative Concentration Pathways, that may be possible under different greenhouse gas generation and management responses. Each of these is a projection from current day, not a prediction of where we will be in 20, 30 or 50 years. This distinction is important, as the global response to climate change may significantly alter how each of the RCPs come to fruition, and there will only be one pathway in the end with which predictions would be made.

Question for: Badin
Question from: Aditya Singh (BMT)

That was really good Badin! Penman Moteith is an empirical model (I think). Do you think some of the constants themselves and the whole structure of the model change with variable climate. Do we have any idea of likely impact if any?

Response from Badin: Hi Aditya, Great question. As you indicate a lot of the constants in the equation are from fundamental physics and therefore are not likely to be significantly altered - although most will scale with temperature. In my opinion these types of empirical models are likely to be able to be adapted, but to implement any adaptations we need to first understand how sensitive the outputs of these sub-models are. I think there is a need for some testing in this area.

Question for: All
Question from: Alex Loy DES

How well our models are calibrated against observed information is still an important aspect of the modelling process and needs addressing together with climate change and variability and the range and quality of the data which supports the rigour and reliability of the models and modelling outcomes.

Response from Tony: Yes, this is most important for any modelling and understanding how well our modelling frameworks are at reproducing observed data, and more importantly, where their weaknesses are, is vitally important to understanding which ones will be best at predicting different water related outcomes. This is quite prevalent in the hydrologic sphere where we may choose particular Global Climate Models (also called General Circulation Models) that best represent a particular parameter or driver we are most interested in (e.g. Interdecadal Pacific Oscillations for understanding drought cycles across Qld), but then realise that if those same models are not good for other aspects (e.g. if they are not good at calibration for Indian Ocean Dipole effects, then the models may not represent the characteristics of monsoonal rain well).

Question for:
Question from: Gebiaw Ayele (ARI)

Any idea on how far we can go back in time to understand the historic climate? any better indicator to assess the bias while we only have a tiny bit of observed data?

Response from Tony: Currently, our palaeoclimate estimates suggest we have good climate proxies for some regions for up to 1000 years (see

Kiem et al 2020). This uses ice core climate proxies from the Law Dome ice sheet in Antarctica to evaluate IPO cycles over the last 1000 years and has been shown to have very good correlation with rainfall in Southern Queensland.

Reference: Kiem, A.S., Vance, T.R., Tozer, C.R., Roberts, J.L., Pozza, R.D., Vitkovsky, J., Smolders, K., Curran, M.A.J., 2020. Learning from the past – Using palaeoclimate data to better understand and manage drought in South East Queensland (SEQ), Australia. J Hydrology Regional Stud 29, 100686. https://doi.org/10.1016/j.ejrh.2020.100686

Question for:
Question from: Filipa Pinhati (UQ/SeqWater/QWMN)

What is the level of confidence can we deposit on the current GCMs considering that they aren't able to account with stomatal conductance of plants? As far as I am concerned current GCMs can't simulate the way plants moderate the exchanges of water and carbon between the biosphere and atmosphere.

Response from Louise:
GCMs are the best tool available to us for simulating the effect of global changes to our earth-atmosphere system. They are based on the laws of physics and they operate within the bounds of energy budgets. Earth-system models which contain

Question for:

Question from: Karina (town planner..unemployed)

How you have defined the decision makers?, it seems decision makers refers to public and private sector executives.
individuals are decision makers who slowly take decisions that in long term have contributed to changes. How the modelling is reaching them?

Response from Tony:
This is a good question Karina. As I may have mentioned during the presentation, to me, decision makers are anyone who might be impacted by the outputs from our models. For example, in water resource modelling, some decision makers will be politicians, some state agency staff, some would be local governments and some may be farmers or

landholders. Each one would look at model outputs differently, using different concepts, understandings and risk profiles. We therefore have to ensure that model outputs and decisions are available for all of these if we want to provide each with the relevant information to make decisions about the impacts of climate change.

Question For:

Question From: Gebiaw Ayele (ARI)

Is there any better way to assess the couplage effect of land use and climate?; ↔ sociohydrology (social aspect in water management)→Anthropogenic land use change in our modelling in a very dynamic way. I guess land use is kept static for some period of time.

Response from Tony: In the review work we didn't see many models or research currently focusing on this issue, but we did highlight it as being an area worth exploring. As climate change occurs, is it likely that there will be population movement to areas with more desirable climate, or would changes in temperature or rainfall mean that areas currently used for agriculture become unsuitable. I have seen some fundamental research in these areas, but as yet, the only models really evaluating changes in land use, or really, land cover, is the AussieGRASS framework and GRASP pasture model. Runs of these models have been used to predict changes in land cover under different climate projections and indicate areas where grazing may or may not be favourable in the future, but these don't necessarily predict whether land uses themselves would change.

Question For:

Question From: Phillip Jordan (HARC)

How do we get involved in the workshops that Badin is planning?

Response from Badin:
Hi Phillip, We will make announcements through the QWMN network about the workshops so stay tuned. In summary we are planning to run 2 sessions. The first will focus on sourcing future climate data and establishing time series inputs for a simple hydrological model. The

second part will then focus on how to start interpreting the results. Your feedback on what would be useful would be welcomed.

Suggestions:

From Declan Hearne SEQWater - to Everyone: 02:00 PM
would be great to workshop some further models and case studies!
thanks. very informative session.

Question From Abel.Immaraj Aurecon
There seems to be a drop in GHG emissions over the past couple of months (up to 10%?). Is BoM looking at how this perturbation interacts with GCMs?

Response from Louise: The impact the shutdown is having on global emissions is a work in progress. One investigation was recently published in Nature on this question:
https://rdcu.be/b4hep