World Café report to organisers

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Summary

This world café session was focused on developing community ideas to strengthen the observational-modelling interface towards meeting near term and emerging scientific needs critical to our understanding of climate change. Discussion was vibrant and brought out many ideas for actions to further enhance collaboration and co-development across the modelling, observation and user communities.

Current Bottlenecks:

Developing climate observation networks (Topic 1, Cluster 1 & 2)

The communities need to be brought together to identify priority in-situ reference observation gaps that are needed for modelling evaluation, earth observation validation and improved physical process understanding. For instance, sparsely observed areas such as the deep ocean, coastal areas and biogeochemistry were flagged and there is a need for a focus on, and resourcing for, observing and modelling extreme events, due to their high impact, with extended in-situ reference networks, increased temporal frequency of observations, and high resolution regional reanalyses to support evaluation km-scale model simulation of extreme events and urban climate. Co-located ocean-atmosphere observations were also raised as was the need for ocean reanalyses and coupled reanalyses.

It was noted by participants that there are a number of Earth observation carbon observatories in orbit and in development. These missions need to be cross calibrated for trust in the measurements being made from space, in the data and there should be optimisation of the carbon observing capabilities between agencies. This approach should be considered for other key ECVs with new missions in development and at early planning stages.

Meeting scientific needs in climate science (Topic 2, Cluster 1)

There is, and always will be a need to sustain the global observing system, with regional enhancements. We must also be prepared to evaluate the value of observing systems in regional and global systems.

The modelling and observation communities, particularly as we move to increasingly high resolution models at regional and global scale, need to collaborate on key variables and processes to constrain and evaluate our climate and earth system models.

A shared understanding of uncertainty must be developed across communities together with consistency in regard to origin of uncertainty, and with regard to uncertainty in trends.

Suggestions that coordinated observing systems experiments in S2D predictions required as is coordinated experimentation comparing climate models with observations .

Transforming climate data into information relevant for decision making (Topic 3)

Building collaboration and understanding across scientific communities, such as across the modelling-observational interface, was seen challenging but ensuring climate information is delivered to decision makers is very complex. We do not speak the same language and therefore co-development must be embraced from the start, have relevant, sustained, institutional structures through which communities can engage, and include a wide range of user groups e.g. indigenous communities who can provide local and regional insight and traditional ecological knowledge to enhance and improve climate information.

Building and sustaining climate data records (Topic 4)

Improvements needed in land surface data products; vegetation, land surface temperature and other physiographic fields.

ECVs required for urban modelling, particularly development of evaporation, land surface temperature and soil water content.

Improvements needed in ocean observations, more in-situ observations in particular for verification, at higher frequency. Improvements suggested also include observations of surface fluxes -exchanges between ocean interior and surface at global and regional scales as well as the biogeochemistry. Argo should be sustained but deep and coastal argo enhancements are needed.

Accessing, archiving, and processing climate data? (Topic 5)

Whilst progress has been made, we still need a concerted effort on standardisation in three key areas:

- A common vocabulary between producers and users of data with agreements on standards and format, searchability and discoverability of the data.
- Fair and open access to data - there are considerable challenges for the global south and data sparse areas of the tropics to access high quality data.
- Traceability of data processing throughout the data chain; from raw to product, using consistent and standardised recording methods within the metadata, agreed upon between the modelling and observation communities

Capacity building was raised, but if the measures above are carried out, this will reduce the amount of training required for use of these scientific datasets, analyses and modelling outputs. Cloud computing, particularly with associated analysis platforms, offers the potential for a much wider range of scientists globally to access and analysis observational and model data.

The urgent yet feasible actions for improving the situation

Action is required by GCOS and WMO communities to urgently address open access data for climate science. There are crucial gaps in access, important for both the observation and modelling communities. This is not only causing known biases, errors and assumptions within observation and modelling activities but also is holding back scientific capability from progressing and innovating at the frontiers of climate science in specific regions of the world, namely Asia and Africa based on the discussions during this World Cafe.

With regard to open and fair access to data, particularly in-situ, for climate science, in addition to high level access policy agreements and resourcing, there has been the suggestion of setting up a series of key in-situ data centres to provide focal points for in-situ Essential Climate Variables as well as providing focal points for open access datasets, collaboration, capacity building, sustainment of monitoring and innovation of in-situ priority reference networks.

It was also recommended that modelling and observational communities should focus on some key variables and processes to closely collaborate on improving the monitoring, prediction and projection of high impact climate extremes or urban environments for example.

A transition plan towards standardisation of data formatting, vocabulary, uncertainty and data processing traceability should be developed, with key document requirements stipulated for the initial scoping work bridging modelling and observation communities. Both report the need to improve data product formats, uncertainty information etc. We need a starting point of technical documentation from both communities setting out current requirements and envisioned requirements over short, medium and long term. This needs to be shared with the two communities and an interface working party created to work on the standardisation of a common vocabulary and traceability of data processing together. From our World Cafe discussions it is recommended this is done within a formal institutional setting and that the international metrology community is invited to be a part of, support and perhaps have a role in sustaining this process.There was the suggestion that this type of collaboration could lead to creation and sustainment of a common API for any kind of data to make it use-ready, as well as a metadata repository to pull data sources from.

Where appropriate, citizen science should be embraced with new technologies developed to safeguard reliability and quality to provide high frequency and dense observational information, particularly in urban environments.

Other areas raised through the idea slips by World Cafe participants to plan for include:

- spectral radiation intercomparison, to support model evaluation, uncovering of biases and shortwave deposition and feedbacks with a suggestion of production of ESM spectral radiance output for different experiments
- coupled and dynamic land surface assimilation
- encourage advancement of the technological frontiers for downscaled observations -some variables where it would be useful to have sensors on a meter scale resolution.

Vision for the future emerging from the Roadmap: By 2050, we imagine GCOS to …

- ➢ be sustaining and promoting observation data diversity, quality control, innovation and traceability within a collaborative and efficient global observational framework..
- ➢ be responsible for maintaining, having established, a global common data reference policy for observations. This should include, but not be limited to in-situ referencing systems and agreements with meteorological agencies around the world for fair distribution and access to data for climate science

- ➢ be responsible for coordinating and promoting maintenance of and evolution of, established, harmonised in-situ, earth observation and reanalysis datasets with open access to ensure maximum impact and global equity.

Event legacy

The CMIP IPO, in support of WCRP ESMO and ESA Climate Office, will publish an initial roadmap report, drawing on the ideas shared, challenges identified, and suggestions made during the session, identifying a timeline and steps required for cross-community collaboration and tool development to support a strengthened observation-modelling interface to enhance further understanding of climate change and better support near term and future needs for climate information.

The outcomes of this proposed session will provide ideas and momentum to:

- Practical actions to further strengthen links between the modelling and observational communities.
- The evolving ESMO objectives.
- Relevant WCRP Lighthouse Activities.
- CMIP7 planning.
- Obs4MIPs
- ESA CMUG
- GEO
- The development process for the ESA Climate-Space programme,