Summary Rapporteur Reports from the GWF Operations Team Meeting

University of Saskatchewan
Saskatoon, SK
January 22–23, 2019

Forecasting and Modelling, Computer Science and Data Management

Discussion Questions

- Forecasting and Modelling Discussion:
    - What model products do we have/will we have?
    - How do we access field data from the network of over 60 observatories in GWF to evaluate and improve our models? How do we integrate observations, remote sensing and modelling?
    - How can the model products we are developing be used by projects and other core teams? How do these meet user needs?
- Computer Science and Data Management Discussion:
    - How can we archive our data to make it readily accessible through GWF?
    - How do we create searchable databases for discovering and accessing data for modelling purposes and data analysis?
    - How do we enhance collaboration for data sharing?
    - How do we develop visualization tools and share data and research results with the user community and the public?
    - How do we ensure long-term sustainability of the data?

Group 1 (rapporteur: Mark Servos)

- Need communication on what is being done and available (what models, how being applied, etc.).
    - Inventory of the core models and projects
    - Catalogue of what is being done to help connect projects and stakeholders.
    - Use information in inception reports for details
    - Clear simple communication to the public (easy to use and interpret tools)
- GWF blend of two approaches to meet the needs of the researchers and users:
- *Common repository*
    - Need a place/way to make data accessible and easily useable for testing and validating models
- *Federated database model*
    - Need to place/way to archive data with a system to find/search it (with centralized indexing - metadata)
- Idea – create tools to help researchers with visualizing data, etc. Need to make user friendly.

Group 2 (rapporteur: Corinne Schuster-Wallace)

- Need better understanding of data needs of the models to add value to the data collected in the field.
- Need attribution of data and metadata tags.

- Clear ethics and principles about sharing and accessing the data, particularly when co-owned.
- Co-creation of user interfaces (e.g. app-based, web interface, scenario reports, maps) – taking from model output through to what users need, and adds value.
- Data catalogue (search by variable and location)
- Data archiving: Longevity and quality and clear documentation of what those data are; permission-based and agreement controlled.
- Standardizing the data schema for specific variables that are collected.

Group 3 (rapporteur: Saman Razavi)

- Range of models produced in GWF for Canada; how do we standardize? How to look at uncertainty around those and provide measures of uncertainty? When archived, this could be available to other researchers.
- Model output for different contexts. Different types of models. Again, need to be mindful on how to standardize.
- Data availability: for the observatories, data seems to be underused to support modelling. This may be due to licensing issues. Better frame, better metadata, better standardization/harmonization.
- Data not public (e.g. WISKI) – needs to be resolved.
- Social science data. Knowledge embedded in Indigenous communities. Could collect, archive, and make available, but lots of ethics to be considered. Soft data may span centuries, but how to collect and archive.
- Visualization: important and we need to work on it.

Group 4 (rapporteur: Dave Rudolph)

- Sensors group: need input from the modelling group as to what data is required for sensor design and how ingested into models. Need facilitated interactions.
- Research models. Types. Two sets of models: i) those used to study a process or phenomenon, ii) operational models for national forecasting networks. How do we integrate new developments that the research models are producing to inform upgrades on the operational models? This has to be integrated so we capture this information to be sure the operational models are moving forward appropriately.
- WISKI: how do researchers get access to that? Training opportunities? Software to access? What do users need to access? Part of the answer came up in DM discussion about having a workshop on this.
- Unclear what data is being collected at any one of the 60+ observatories. How do we find out what info is available in an area we might work in? What type of data are sitting in the observatories (e.g. parameters, calibration targets, climatic drivers)? This is disperse and having this info would be of value to users of the data.
- Most people don't have the skills to run the models, but could make use of the outputs and datasets. Key is to make a way to access the results of the models, so people can make use of it. Integration with core team needed.

- Metadata. Need to not reinvent. (e.g. Northwest Territories data portal have a set of standards on metadata and way to input). What is industry standard? Can we make use of different formats that exist?
- Incentivize submission of data. Journal special issue ESSD. This is part of the knowledge translation credit.
- Public outreach. Merge series of environmental indices on quarterly basis, that journalists might be waiting for, GWF pronounce the indices.

Group 5 (rapporteur: Philippe Van Cappellen)

- Important questions:
    - What products be useful, and to whom? That is the question to ask.
    - What information do we want out of the models?
- Many projects do not require the large scale, but focus on process level. Then, how do you scale this up and is this integration necessary?
- Think about conceptual aspects of the models (e.g. linking different models, are they compatible, etc.)
- Thought needs to be given on how GWF can play a role as a boundary organization (i.e. how can GWF connect modellers to users, and translate the questions and outcomes among these groups). Visualization plays a big role here.
- In terms of archiving of data, a federated data management approach is likely best, with a central catalogue for searching data. Different repositories that are reliable and long term are needed (i.e. university libraries).
- Early training of HQP on DM is required and provides value. Stress the importance early on in their training.
- Non-numerical data needs consideration on ownership (i.e. research involving Indigenous communities – this needs to follow all the requirements of chapter 9).

Group 6 (rapporteur: Stephanie Merrill)

- Lots of discussion focused around users and their needs. The models can be useful in understanding environmental change and addressing relevant community concerns.
- In northern regions and Indigenous communities, technical limitations and accessibility can restrict the ability to make full use.
- Capacity challenges around the ability to manage data – there is need for training and best approaches.
- Challenges around sharing data that is culturally sensitive, yet important.
- The Radium and Cuisinart systems presented may be sufficient and a good combination for data mining, specific to questions.

Group 7 (rapporteur: Sean Carey)

- There is a need for open source, and user-friendly models. Need emphasis on useable models through MB
- “Big data needs a big display”. We can move forward with new tools and visualization approaches. This would help us to better get our results to the public.

- Other data stream can be used as well as new systems and products come online.
- DM activities were discussed. In cases of extremely large datasets, how do we decide what to keep? TBs of data are being collected in some studies. Difference between provisional and final data – we need a "clean room" for data.
- Ease of getting data. Why do people resist sharing data. It's not that they don't want to share, but that it is a lot of work, and we need to facilitate the process to make it easier. Simplify methods, common methods to ease the transfer
- Students can contribute. Simple lists and wikis can help, and get them started on metadata and long-term provision.
- A federated system is best, and should probably be kept in university libraries. This will be the best way for long-term preservation. We will need to keep an eye on resources to do this.

Group 8 (rapporteur: Martyn Clark)

- The group discussed a few of the models and products used in the group.
- For data, there is a lot of in house data and many are not using data from the observatories.
- There is a lot of post-processing of data required for model input, and it was posed whether this could be streamlined using common structures and standard APIs, and whether the data team could assist with this?
- The FAIR conceptual model deal with the issues we are facing
- How do we use data for modelling? Model forcing and evaluation.
- Long term sustainability of the data is a huge challenge, and we need to shift the data to institutional depositories.

Group 9 (rapporteur: Jennifer Baltzer)

- There are two types of model output users: those that want the raw data and those that want a derived product. Need to consider the different needs (storage, tools) for each.
- Need to improve understanding of who is using what outputs, and for what purpose, and when. A data workflow (who doing what, and when) could create efficiencies among projects. This can reduce worktime and streamline efforts, and foster collaboration among projects and sharing of outputs.
- It could be hard for TM team to support some of the questions, because they may not have adequate metadata to be able to answer questions of what they have in hand. Are there faster ways for researchers to make available info about their data? E.g. wikis. Standardized templates are needed (for searchability, connect researchers).
- Concerns about where to archive data. Some projects creating huge amounts of data but do not have long-term storage.
- We have a real opportunity to train the next generation of water scientists on best practices in DM.

Group 10 (rapporteur: Helen Baulch)

- Common theme is data discoverability and products. How do we make sure we know what's out there and that we are using the best products available?
- Is there a one-size fits all solution?

- Data gathering is slow and intensive – this is a human problem and highlights the need for a culture shift. How do we ease this problem? A certification box, perhaps, or a control to say where the data came from.
- Across our disciplines the approaches are very different. Need to store in discipline-specific ways and use metadata index to find it.

Knowledge Mobilization, Communications, and Integration across GWF

A KM summary is provided as a separate document (GWF_OPsMtg_KMSummaryActions_.docx)

Discussion Questions

- Knowledge Mobilization and Communications Discussion
    - How do we strategically address the challenges of governance, decision making and the science–policy interface in GWF?
    - What specific activities, tools and resources would help researchers be successful in KM strategy implementation as we move into the late stages of Phase 1? Which activities, tools and resources have been most helpful to date?
    - What are the best ways to support two-way dialogue with end users throughout the project to promote the exchange of ideas and information (i.e., workshops, webinars, conferences, newsletters, etc.)?
    - How will we know if GWF research is having impact (i.e. how do we best document the impact of research on society and the economy?)
    - How can we better coordinate interaction with our partners and stakeholders, given multiple points of contact and their interests across a range of research areas and results?
    - What is currently missing from the GWF website? How can it be improved?
- Core Teams Integrative Discussion
    - What is the role of knowledge mobilization and communication in connecting the work across projects and core teams and engaging internal and external audiences? How?
    - How can GWF improve internal communications at the staff level between partner universities?
    - How do we foster the links among all core teams and projects?

Group 1 (rapporteur: Mark Servos)

- Commend the efforts of the KM group and their role in encouraging and supporting co-creation of research.
- The engagement with end users takes effort and time; continued engagement is important and is about personal relationships. Usually a champion(s) within the organization to push forward.
- Regular communication and interaction is essential. It doesn't take much to lose the attention or interaction.
- Demonstrate the value, not at the end, but through continuous dialogue. Make use of the talents of the people in the project. Not all are good at KM, but some are very good and enthusiastic – students generally love doing and are a key resource to participate and learn.
- More sharing of success stories, what worked and didn't.
- Enhancing communications continually: within projects, between projects and across GWF.

- Need to consider how we get our partners active within our annual science meetings so they are co-creating at the meetings, not just there to receive.

Group 2 (rapporteur: Corinne Schuster-Wallace)

- Governance, decision making, and the science–policy interface occurs at two levels: the individual researcher/project level and the GWF level. We need greater opportunities for communication between projects to be able to identify and act upon collaborative opportunities. A social network analysis of GWF would be a useful activity to undertake.
- There is a need for direct communication with the public. We've got to do more to get our research outcomes in the hands of the general public.
- When engaging stakeholders, there can often be a transition with people moving on, and so we need to consider a framework and continuity planning (e.g. when people are being moved, promoted, or overloaded).
- KM is when, why, how, and who, the form and the format, but also the perspective. E.g. what framing (positive, negative) do we take when we are mobilizing knowledge? KM is actually knowledge co-production and goes back to the 'when', which is at the beginning.
- Building trust is important and it takes time.
- Games are a potential way of mobilizing knowledge and helping change behavior and getting information across to people.
- Meeting people where they are is important. To keep the regular contacts, we need to go out to them; going places where they meet (e.g. non-academic conferences, AGMs of organizations, practitioner conferences, etc.).
- To assess impact, we need to go beyond basic measureable elements and we need to capture stories and anecdotal evidence of influence, and there needs to be a repository to capture that.
- GWF really needs to be thinking about recommendations at the end (for policy, practice, process), and to be capturing lessons learned, particularly failures. The learning points are in the failures. What are the building blocks that are needed in the process of transformational research?
- For communications, having scheduled meetings for different groups to touch base is important. Ideas for internal integration: sharing infographics, focus on young professionals, coordination opportunities, 'find-an-expert' space in the newsletter.

Group 3 (rapporteur: Saman Razavi)

- Approaches for enhancing KM could include visiting users and interacting with them, regular communications, creating videos for social media.
- We need more private sector involvement and co-creation.
- The MAGS experience was noted: they did a tour of northern communities with presentations, used citizen science approaches and involvement with field activities.
- Different users may want different levels of engagement.
- For documenting impact, tracking interactions and asking for feedback is important. Incentivize researchers to reach out and try to make an impact.
- Better coordinate interaction: invite users to co-author papers.

- A challenge for KM team may be that some people are protective of their contacts in different organizations and do not want to share this.
- Website: have to dig deep into the websites to see what is going on. A lot comes up from a Google search and there is a need to reconcile all the different sites to show how the program is organized from top to bottom. Need a list of core team modellers and their profiles.

Group 4 (rapporteur: Dave Rudolph)

- The discussions come down to effective communication. Externally with the partners and public, internally with the projects and core teams. The overarching theme that came out was that there should be tremendous opportunity to come up with models that work, and to emulate these in other projects.
- For governing and decision making, an effective way is to participate on panels and ad hoc committees that address strategic government priorities. Some of us would be naturally invited, others could be recommended. We need to be ready to engage proactively and effectively.
- To be effective in KM, we can use the professionals in the core KM team, some researchers can offer mentorship, the young people can help to train the senior people in how to use new tools, e.g. social media.
- End users need to be integrated into the research and involved directly. Student co-ops, tangible deliverables, invite people to conferences (but this can be counter-productive if we don't give the users and opportunity to contribute and simply download our science into them).
- The projects that are engaging with Indigenous communities could probably provide the rest of us with guidance in how to have effective two-way dialogues.
- Need to be able to pivot and refocus efforts to address needs of partners.
- Impact may not be known until after GWF ends, but short term success can be evident through media (can count and tally this up).
- There are many users and there will be various levels of engagement. We need to continually follow up and ensure that we address where this is not going smoothly.
- Challenges with internal communication: there is a lack of information about what is happening across projects, different roles across institutions, geography is against us. We need better sources of information (e.g. an internal website, org charts, profiles of people).

Group 5 (rapporteur: Philippe Van Cappellen)

- With governance and decision making, recognize certain projects have more policy relevance than others. Those that have, it is important to proactively engage the right decision makers and to bring in the right boundary people, but also to advocate to the right stakeholders. Effective products are needed (briefs, infographics – a repository is needed for these).
- Importance of KM team for the projects is to help identify who the audience should be.
- We can increase visibility of water issues at the annual Canadian science–policy conference.
- HQPs and PIs need more training, particularly workshops where people work through real life examples of science–policy interaction.
- When there are KM and communications activities, there is a need for good follow up. Take feedback to produce policy briefs. PIs can then nurture their networks, ID key persons within the user institutions.

- Internships for HQP in the partner organizations can help. Make this more visible by sharing success stories, build GWF alumni group focused on YPs.
- Impact depends on the nature of the project itself. Feedback from the community helps.
- Interaction with partner organizations – need multiple points of contact, as people move on. Engage through co-authorship, reciprocity.
- Website: interactive maps to identify GWF activity in different regions. Need more coordination between content.
- Internal communication: need more systematic mechanisms for communication between the core teams, between universities, and between upper management and the core team members. There is an opportunity for the DM and computer science teams to engage the KM and communications teams.

Group 6 (rapporteur: Stephanie Merrill)

- Discussion around what KM success looks like: trust, honest communication and information flow, ongoing commitment, evolving research projects, community making own decisions about how research is used.
- Different needs and interest for KM across GWF. KM specialists can help anticipate what the questions/needs are going to be, so researchers can be proactive and prepared.
- Challenges around KM not being properly valued, but this is changing. Could broaden this – go into schools.
- Website: personal stories are still missing, need to build on successes, include quotes and interactions with users and partners.
- Linkage among projects and core teams: everyone needs to work from the same information. There are different platforms we can use, but everyone needs to buy in. Need to consider more effective approaches for staff, core team members, managers to work together and integrate.

Group 7 (rapporteur: Sean Carey)

- GWF could do better to engage the policy community. This goes to impacts. Leverage our relationships and capitalize on our personal stories. Can use policy to advance our values across range of foci.
- KM success. Good work being done by the KM team to present tools and ways to measure success and what that means. Surveys are a good way. Benchmark and update. See how to improve two-way communication.
- Impact will extend beyond the end of GWF. Need to assess how this influences behavioral change, social change.
- Website: the website is static. We could put real-time data up. Twitter-storm.
- KM aspects. GWF has really put this up front and it is active. Need to develop curricula, materials, handouts, webinars.

Group 8 (rapporteur: Martyn Clark)

- Many KM activities were discussed. Repeat of much was already raised.
- A KM sabbatical or exchange was suggested, where people could spend time at other boundary organizations. A difficulty is because often we don't understand how the information or

products are used, and how these influence decisions. Need to understand the extent that our values affect how information is used.

- Advertising helps get invitation to local conferences. Most important dialogue with end users is co-creating of knowledge and work on common problems.
- We need bridges between the different scales of interaction (small collaborative efforts and big workshops, and between high level meetings and on the ground implementation). A need to better stitch together individual elements.
- Website: it should focus more on results and what has been discovered. Agree that it is static, and there is a need for more interactive elements (data visualization, scenario analysis, games, etc.).
- Outreach. Need to influence curriculum. More open houses or summer camps for students to engage the younger generation. A GWF museum and interactive science centre was suggested to help with outreach. More storytelling.
- Impact: can be gauged by decisions that we influence, but this can be beyond the timescale of the project. Promotion documents. Modelling advances used in operational systems, but this depends on random components as well.
- Integrative discussions: we could think of groupings, specialization of KM personnel. Think of them in thematic areas, that could help with coordination. We could organize short courses that are regional and thematically based. Synthesis papers defining what we know, what we don't, and what are the main research challenges and how we will address these?

Groups 9 and 10 (rapporteur: Jennifer Baltzer)

- Governance side of things. Overlap among projects on end users groups. There are shared end user groups and we need to think about ways to coordinate among projects so we aim for the outcomes we want. Look for opportunities from across projects to bring together similar pieces to develop broader national or regional frameworks for certain topics. We should look for what projects have shared target policy groups and perhaps host a working group, and identify goals and outputs. Co-develop white papers and focus on sectors of interest.
- There has been a lot of success in research partnerships when bringing people out to research sites or important sites from the context of the research. This helps to make a connection. Then overall figuring out what the key products are for various groups. One on one work is key.
- Impact: GWF is producing huge number of trainees.
- Website: there is a lot of jargon on the website. Navigation should be more problem or interest driven.