REGIONAL COLLABORATION ON CLIMATE CHANGE IN THE PACIFIC NORTHWEST

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Abstract

Climate change is likely to have a significant effect on the future of water management in the Pacific Northwest. Because many rivers in this region such as the Columbia River are operated as a system and involve many different owners and operators, regional coordination among the various entities is extremely important. This is particularly true on issues like climate change, where the effects may vary considerably in different parts of the region.

In collaboration with the Bureau of Reclamation, Bonneville Power Administration, and other entities in the region, the U.S. Army Corps of Engineers Northwestern Division has recently initiated efforts to analyze the effects of climate change on water management activities in the Pacific Northwest using a regional approach. One of the major goals of this effort is to develop a common set of data, models, and tools that can be used by entities throughout the region to analyze climate change. If it is successful, this effort will reduce the possibility for duplication, overlap, and conflicting results on climate change activities undertaken by the various entities, while at the same time improving regional collaboration and coordination.

This paper will describe a regional collaborative effort on climate change analysis in the Pacific Northwest that was initiated in 2008. It will provide some important lessons learned and other information for other organizations involved in water management who are considering similar efforts.

INTRODUCTION

The Pacific Northwest region is comprised of numerous dams and reservoirs that are operated to meet various operating requirements for flood risk management, power generation, navigation, fisheries, and many others. Some of the largest dams are operated by the Bureau of Reclamation (Reclamation) and U.S. Army Corps of Engineers (Corps). The Bonneville Power Administration (BPA) markets the power produced at these projects and operates an extensive power transmission system that extends throughout the region. There are many other entities that own and operate other dams located throughout the area.

Similar to other areas of the world, water managers in this region have always had to adapt to hydrologic extremes caused by climate variability. An added challenge is the fact that snowmelt is a major component of the hydrology, and the timing of the snowmelt can be highly variable. Water management processes and procedures used throughout the region have been developed with the flexibility to adapt to changing conditions and requirements. However, potential future climate change scenarios may impact the frequency and severity of extreme hydrologic events beyond the range of historic information used to develop existing procedures. Therefore, an interagency effort was initiated between Reclamation, BPA, and the Corps to consider the effects...
of climate change on water management activities. Because the dams and reservoirs in the region are operated by multiple different entities and are managed to meet many different objectives, this effort was designed to be very collaborative and involve all of the key stakeholders in the region.

The effort was initiated with the development of a work plan to describe the overall approach as well as the major deliverable, tasks, responsibilities, staffing requirements, schedule, and costs. The key objective of the work plan was to establish a climate and hydrology dataset and set of usage methods that could be used to analyze the effect of potential future climate change scenarios on water management planning and operations. This work plan was developed by Reclamation, BPA, and the Corps. It was distributed to other entities throughout the region for review and comment, and a series of workshops were held with these other entities to discuss the proposed approach and review the results of the work as various work products were available. The entities involved in this effort include the Northwest Power and Conservation Council, British Columbia Hydro and Power Authority, Columbia River Inter-Tribal Fish Commission, University of Washington Climate Impacts Group, and others.

**APPROACH**

This effort was designed to be very collaborative and to leverage existing information wherever possible to minimize duplication, overlap, and conflicting results on climate change activities undertaken by the various entities, while at the same time improving regional collaboration and coordination. Also, recognizing that there is extensive data and information that might be applied to this effort, the work was scoped to feature data and methods that are representative of current research and planning efforts being conducted in the Pacific Northwest. The overall approach used in this effort involved four basic steps:

1. Survey climate projection information available throughout the region.
2. Decide what portion of this information should be utilized and how it can be integrated into water management planning and operations.
3. Adjust traditional approaches and assumptions as needed to be consistent with the new climate context (i.e. assumptions on water supplies and hydrology, water demands, reservoir operations, or regulation constraints)
4. Assess reservoir operations or regulations given those adjusted assumptions, along with uncertainties.

The project began with the development of a work plan to describe the overall approach as well as the major tasks, responsibilities, schedule, and cost. The work plan was developed by Reclamation, BPA, and the Corps. Funding and implementation of the work plan is also the responsibility of these three agencies. In scoping the work plan, there were four key considerations:

1. Leverage the ongoing University of Washington Climate Impacts Group (UW CIG) effort to develop a regional climate and hydrologic dataset for use in longer-term water resources planning within the Pacific Northwest region.
2. Utilize two of the information types being developed by UW CIG: (1) information that reflects step-change in climate and hydrology from historic to future periods (i.e. Hybrid scenario data); and (2) information that reflects time-developing climate and hydrologic conditions continuously through historical and future periods (i.e. Transient Climate Projections data). The purpose of considering both types of information is to gain understanding on which type is more appropriate for a given type of longer term planning efforts.

3. For the initial collaborative effort, utilize limited selections of both information types (Hybrid scenarios and Transient Climate Projections data) from the larger ensemble of scenarios and projections being issued by UW CIG.

4. Verify the data received from UW CIG through independent hydrologic modeling performed by staff at Reclamation, BPA, and the Corps, and thereby enable the staff to develop a better understanding on UW CIG data development procedures and information limitations.

In designing the overall work plan and approach, a key focus area was how the new information could be integrated into future planning efforts and the models and tools used to conduct those planning efforts. An important consideration in determining the products from an effort like this is for what types of analysis they will be used. For example, for studies focused on operational performance for water supply management objectives, decisions might be based on a variety of reservoir storage, river flow, and water delivery metrics. For studies focused on operational performance for hydropower resource management objectives, decisions might be based on power generation capability, probability of reservoir refill, power system reliability, probability of meeting power demands, etc. For decisions focused on operational performance in providing flood risk management, decisions might be based on the percent of time flood risk management objectives are met, while attempting to refill reservoirs for other requirements. Flood risk management objectives could include consideration of the frequency and duration of flooding, the risk of economic damages, and the relative priority of a location. All of these factors need to be considered when determining the approach that will be used and the products that will be produced.

Regardless of the water management operating objective, the assessment of operational performance is predicated on being able to translate the climate and hydrology data that is developed into adjusted hydrology-related and water supply-related inputs that feed into the models and tools used to conduct such assessments. Further, it is predicated on understanding how the various method options for conducting such data translation affect portrayal of water management operations performance, and ultimately the decisions served by such analysis.

**PRODUCTS**

This effort will result in a number of very important products that will be used by Reclamation, BPA, and the Corps in water management planning. All three agencies regularly conduct long-term planning efforts where climate projection information could play a key role. Examples of planning efforts where the new climate-related information from this project could be applied in the Pacific Northwest include: (1) Columbia River Treaty 2014/2024 Review, (2) Corps Columbia River Basin Stage Damage Analysis Project, (3) Federal Columbia River Power
System asset management and capital investment analysis, (4) Reclamation studies of potential new water storage sites, and others. The input requirements of models and tools used throughout the region were also taken into account to ensure that the new datasets could be easily integrated. These models and tools typically use daily or monthly information such as streamflows, operating objectives, and other similar information.

The work was organized into three major task areas designed to produce seven deliverables. These tasks and deliverables are summarized below:

1. Task 1 - Climate Projections Survey and Selections:
   a. Deliverable 1: monthly climate change scenarios (UW CIG’s Hybrid data type, a maximum of 10 scenarios) and time-developing climate projections (UW CIG’s Transient data type, a maximum of 10 projections).

2. Task 2 – Hydrologic Data Selection and Verification:
   a. Deliverable 2: daily weather inputs for hydrologic modeling (both data types).
   b. Deliverable 3: hydrologic modeling results (natural streamflow, snowpack).

3. Task 3 – Operations Analyses Preparation and Demonstration to Reveal Implications of Hybrid- or Transient-Style Approach:
   a. Deliverable 4: adjusted streamflows for reservoir systems modeling.
   b. Deliverable 5: adjusted seasonal runoff volume forecasts for reservoir systems modeling.
   c. Deliverable 6: adjusted reservoir storage targets for flood control and adjusted variable energy content inputs, consistent with adjusted inflows and seasonal runoff volume forecasts.
   d. Deliverable 7: demonstration study on reservoir systems analysis using inputs associated with either Hybrid- or Transient-style approach.

Although they are not described as specific deliverables, peer review, revisions, and documentation are also key components of the work. As part of the quality assurance and collaborative process, there will be extensive review of all major products and revisions will be made as needed based on those reviews. Documentation will also be produced to describe the process, procedures, and results.

ACCOMPLISHMENTS AND RESULTS

Although this project is still in the early stages and is not expected to be completed until the end of 2010, a significant amount of important work has been accomplished and some key information and lessons learned are already available. Undertaking a major collaborative effort like this in a large and complex region like the Pacific Northwest is a significant challenge. This is particularly true in a region where many of the water resource projects are operated by multiple owners as part of a coordinated system to meet various operating objectives such as for flood risk management, power generation, fisheries and the environment, navigation, and others. In this environment, collaboratively developing a work plan and approach for preparing a climate and hydrology dataset is a major accomplishment. The accomplishments and results will be
described in terms of the collaboration on the work plan and overall approach, selection of climate projections, key lessons learned, and other related information.

Collaboration on the work plan and overall approach to this effort has been very successful and provided some great insights for others who are considering similar efforts. Extensive internal collaboration was first required between the three agencies who are leading this effort to reach agreement on the overall approach, scope, schedule, staffing, and funding for the project. Before engaging in this particular effort, these three agencies had already established a collaborative partnership to coordinate on water management throughout the Columbia River Basin called the River Management Joint Operating Committee (RMJOC). Having this partnership and effective working relations in place before this current effort was initiated was a key factor in the success. The agencies were able to quickly form a team to focus on this effort and prepare a work plan outlining the overall approach. They were also able to secure the funding needed to support the major collaborative effort needed to complete the project.

Extensive external collaboration beyond the staff of the three agencies that are leading this effort was also a key aspect of the success of this project. Once the agencies had developed a draft work plan describing the project, they began a major effort of distributing the work plan to stakeholders throughout the region and organized several workshops to discuss the project and get input from others. Several changes were made in the work plan and overall approach based on feedback from these stakeholders.

In terms of specific results thus far, work on the first three deliverables in the work plan is nearing completion. A survey of the UW CIG’s climate projections was completed and a number of different scenarios representing a range of potential conditions were selected for use on this project. Daily weather inputs for hydrologic modeling for both Hybrid- and Transient-Style approaches were selected. Selection of hydrologic modeling results is nearing completion.

Some of the key lessons learned from the work to date on this project are described below:

1. Collaboratively developing a new climate and hydrology dataset for a large region like the Pacific Northwest region is a major undertaking that requires extensive planning, resources, and funding to be successful.
2. Collaboration can reduce duplication, overlap, and conflicting information about the effects of climate change and can result in a more consistent overall approach and regional cost savings if it is managed effectively.
3. In designing a project to develop new climate and hydrology datasets, it is critical to understand how the information will be used and to ensure that the products are designed to be effectively integrated into applicable models and tools.
4. Effective data and information management is a key aspect to success given the multitude of data and methods that are available in terms of climate change.

SUMMARY

Climate projection information is a critical component of long-term water resource planning, particularly in the Pacific Northwest where many of the river basins are operated as coordinated
systems, and the effects of climate change can vary considerably in different parts of the region. This collaborative interagency effort between Reclamation, BPA, and the Corps to evaluate the effects of climate change on water management activities in the Pacific Northwest will provide a common set of data, models, and tools that can be used by entities throughout the region to analyze climate change. By working collaboratively, duplication and overlap of resources can be reduced and a more consistent approach can be achieved.

Although this effort is only in the initial stages of completion, significant work has been accomplished and many very important lessons have been learned that can apply to others engaging in similar efforts. One key conclusion is that the challenge of such extensive collaboration should not be underestimated, and it should be factored into all decisions regarding resources, schedules, and budgets. Another key conclusion is that such efforts are very data intensive and there are a multitude of different sets of data, models, and tools that are available. This makes it essential that there is effective scoping and management of data, models, and tools to most effectively accomplish the objectives. Associated with this, it is critical to clearly define and communicate the overall objectives and goals of the effort. Development of a coordinated work plan and establishment of a collaborative process to implement the work plan will also help ensure success.

REFERENCES

Army Corps of Engineers, Bonneville Power Administration, and U.S. Bureau of Reclamation, 2009: Climate and Hydrology Datasets for use in the RMJOC Agencies’ Longer-Term Planning Studies