GCASE

Groundwater, Climate and Stakeholder Engagement

Incorporating Climate Information and Stakeholder Engagement in Groundwater Resources Planning

Transferability Workshops • April 22 – April 30, 2014

Four Transferability Workshops for Incorporating Climate Information and Stakeholder Engagement in Groundwater Resources Planning, a project funded by NOAA/SARP (National Oceanic and Atmospheric Administration, Sectoral Applications Research Program), were held in locations where the project methodology is potentially applicable. The project methodology provides support for local water management and planning by combining stakeholder engagement with the use of a hydrologic modeling framework. The modeling framework links precipitation, streamflow, recharge, and aquifer response to analyze outcomes of selected water management scenarios. Projections of future climate were integrated into the modeling. The acronym GCASE, which stands for Groundwater, Climate And Stakeholder Engagement, is used to identify the project.

The Transferability Workshops were part of a series of workshops, including a Kickoff Workshop and two Milestone workshops, where stakeholders participated in discussions of project goals and results. The project's case study focused on the Santa Cruz Active Management Area (SCAMA). The case study was presented at the four transferability workshops, and the transferability of the methodology was discussed.

Location	Date	Co-Host
Prescott, AZ	April 22, 2014	Yavapai County Cooperative Extension
Phoenix, AZ	April 23, 2014	Arizona Department of Water Resources
Tucson, AZ	April 29, 2014	Pima Association of Governments
Sierra Vista, AZ	April 30, 2014	Upper San Pedro Partnership

The project team engaged organizations in each location to co-host the transferability workshops. Agreeing to cohost demonstrated the interest of these organizations and provided a mechanism to reach more local stakeholders. The table shows the location, date, and co-host for each of the four transferability workshops.

The four workshops employed similar formats. The first part of the workshop was devoted to presenting a description of the case study and its results. Questions of clarification were answered at that time, often leading to discussion of the modeling framework and climate projections. A short presentation on transferability criteria followed to open the transferability discussion

Graphs were developed for these workshops that displayed case study analyses based on a suite of scenarios made up of eight climate model projections, three pumping rates and three pumping thresholds. Graphs showed the significance of the choice of rates and thresholds, as well as the greater uncertainty associated with future climate. Much discussion during the workshops centered on interpreting the results displayed on these graphs. (For an example see Figure 1)

The case study presentation was revised following each workshop based on the participants' questions and comments. Stakeholder input was thereby used to increase the effectiveness of communicating the impacts of climate change on water resource planning, the capabilities of the modeling framework, and its potential for informing planning and management efforts. The final presentation is posted on the project web site at http://wrrc.arizona.edu/GCASE/Workshops.

The presentation on transferability that followed listed five criteria: 1) local climate is a major factor in the state of the local water resources; 2) rainfall and streamflow are highly variable and difficult to predict; 3) future climate projections indicate increased variability and uncertainty; 4) informative datasets are available for the region; and 5) local agencies and stakeholders are engaged. These criteria were examined for each transferability workshop location.

A discussion of potential uses of the project methodology followed. Several suggestions were made on where and how the methodology might apply. These included 1) projecting future natural groundwater recharge for the Tucson region; 2) investigating the impact of development on baseflow at the Cienega Creek reserve; 3) assessing the impact of recharge augmentation in the Upper San Pedro sub-watershed; 4) identifying a management strategy to balance groundwater recharge and extraction in the Prescott area; 5) evaluating the impact of a new well field in the big Chino aquifer on the flow at the Verde River; and 6) assessing the impacts on riparian ecosystems on the Santa Cruz River under various scenarios of wastewater discharge. It was acknowledged that transferring the methodology would require stakeholder engagement to define the relevant new questions for the modeling framework to address.

Stakeholders were interested in the capability of the modeling framework to link climate projections with hydrological system responses. It was acknowledged that hydrologic projections based on historical data were not likely to reflect future conditions.

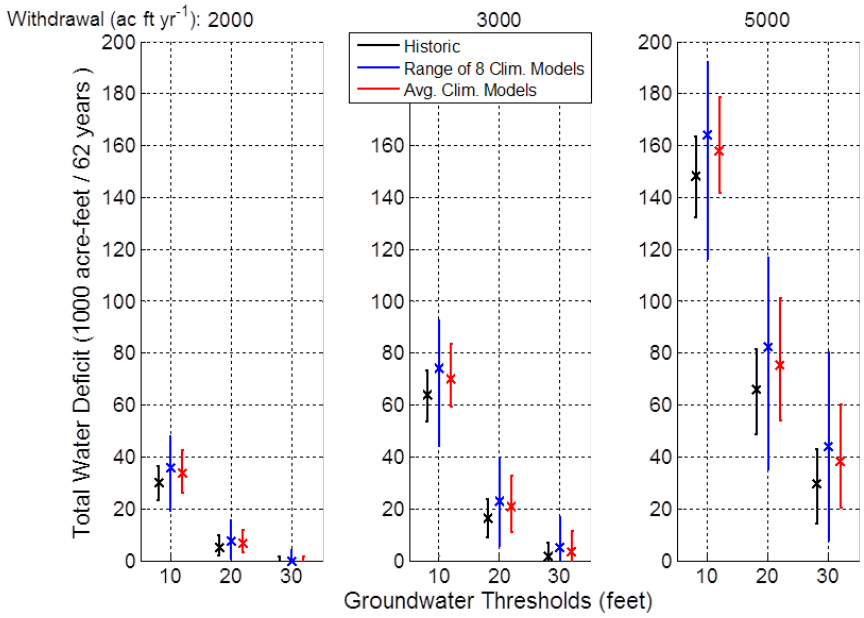

Figure 1. The total water deficit over 62 years resulting from failure to meet pumping goals of 2000, 3000 and 5000 acre-feet per year if pumping is halted when groundwater levels reach 10, 20 and 30 feet below ground surface. The black lines represent an ensemble based on historic data, the blue lines represent a combination of ensembles using information from the eight climate projections, and the red lines represent an ensemble using information from the average of the eight climate projections. The asterisks mark the positions of the median values. Key notable results are 1) the water deficit is dependent on the annual water management plan selected, and 2) the climate projections indicate an overall increase in the projected deficit and large uncertainty.

Concerns were expressed about the large uncertainty associated with future climate, but the capability of the framework to capture the range of uncertainty was considered useful to water resource planning.

Participants noted recent changes in the inter-arrival times and magnitudes of storms. Natural recharge is likely to be affected by these changes. For the SCAMA case study, the principal difference between historical data and climate projections was in the distribution of wet and dry winters and summers. Although the analysis did not detect any other important changes, the modeling framework is capable of reflecting changes in factors such as magnitude, timing and duration of precipitation.

Stakeholders noted that climate projections for the SCAMA were likely to be different from other locations. Other places where the project methodology is applied would need location specific climate projections.

Participants observed that a useful feature of the framework is its ability to link precipitation to groundwater through streamflow. There were several questions regarding impacts of climate and groundwater pumping on baseflow in streams. While the SCAMA case study looked at the effects of streamflow on aquifer recharge, the modeling framework could be used to estimate effects on baseflow as well.

For the Prescott region, the existence of multiple models and stakeholder skepticism of another model might be an impediment to applying the methodology in the region. This is particularly true for the issue of base flow in the Verde and plans for the Big Chino aquifer. For Phoenix workshop participants, the main challenge to transferability is the large water storage of regional aquifers and their greatly attenuated climate response. Similar caveats were raised at the Tucson workshop. However, suggestions were made that smaller scale, local areas of surface water-groundwater interaction such as Cañada del Oro and Cienega Creek could benefit from information the modeling framework could provide. The workshop in the San Pedro River region focused on local efforts to maintain flow in the river despite heavy groundwater use. The importance of natural recharge to the Upper San Pedro basin suggests that it is controlled by climate, making the basin a good candidate for the project methodology.

A recurrent theme was the importance of communicating the complex technical information regarding climate change projections and the modeling framework results in clear, understandable terms. The needs of the targeted audience must be considered in choice of content, timing and level of explanation. The public and policy makers will need modes of communication that will differ from those used for more technically sophisticated audiences. Focus should be on the key unique features of the project's methodology.

The potential for additional presentations and transferability workshops for targeted stakeholders was discussed. Participants encouraged the project team to continue developing partnerships.

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