

### **What needs can be met with present capabilities?**

- Can meet a variety of needs such as: temperature ranges and impact on demands, outdoor demands, how temperature impacts snowpack, timing of runoff, etc.
- Needs are met because we work with what we have to meet some of our needs --- but data are going to keep changing - so what are our ultimate needs?

### **What are our concerns about present capabilities?**

- Accuracy, uncertainty, risk, -- are we using them appropriately and caveat(ing) them appropriately?
- Issues with downscaling variables such as precipitation.
- Problems with using only one data spot (esp. with hydrologic models)– that is used for calibration over larger land areas -- same calibration begins with one model type then used in another --- is this enough info to drive hydrologic model?
- With hydro models: What happens when you calibrate with historic datasets --- if physics change – then you don't get entire picture.
- Are we capturing full process? Especially if only using precip and temp in hydrologic models?
- Lots of uncertainty within ensemble models – but uncertainties are also created because of the way we are using the climate information (these need to be addressed)
- Communications between modelers and users
- Connections between models and propagation of uncertainties (hydro and clim)
- Credibility issue --- need time or check on modelers and the meaning of the output they produce --- perhaps GCRP and IPCC could be determinant of credibility (but then problem of timing) (Perhaps climate service could provide this service)

### **What are our concerns about future capabilities?**

- We're not sure what will happen in future with demands –e.g. ET (this was followed with a discussion of all aspects of the water demand formula) --- e.g, if there is a change in temp. – what happens to ET and soil moisture? We don't have past experience with how projected increases in temperatures will impact ET and soil moisture

### **What needs are not being met with present capabilities?**

- Access to data - difficult to get what one needs in the scale and timing that fits needs (effort was to be made in Hamburg – but not staffed sufficiently)
- Improved understanding/training of use of current/future variables (including the ways they are created and use as well as the associated uncertainties and inter-relations)
- Correct use of model outputs - discussion of how a climate service could take model outputs and provide expertise to interface with potential users
- Above bullets are “value added” - one suggestion would be to create a value added handbook
- Want more ensemble runs
- Want to know about natural variability issues in more detail
- Each sector is different – may want to assess each separately – on the other hand, also have some commonalities – (e.g., tourism,) (so would be value added)
- Guidance as to which models to use– what are the best models for our region (right now no consensus of best models – so advice is to use them all) – community has not come up with a metric that restricts use of all models – a climate service could do this – narrow down scenarios – not been done systematically
- Including emissions with climate models.

## **What more can we get out of existing model outputs than we already do?**

- For water utilities: heat wave intensity – it is available – but utilities haven't been using
- Land surface changes – vegetation changes – land use land cover changes
- Reliability of information – most models can get heat wave- but many people are not getting length of heat wave
- Are there changes in seasonality of precipitation? --- Issue particularly important in Pacific NW. (Notes missing for this item)
- Wildfire issues (notes missing)
- More info about extremes. This could be more important than looking at trends (for better understanding of climate and in case climate changes quicker)
- More info on ET and how it could change in future based on existing info
- Indices of major atmospheric patterns (e.g. jet stream) – would be useful to planners on a local scale making system more flexible --- This info could be qualitative – as qualitative approach may be more useful for planners than a quantitative one. Info could include influences such as teleconnections and ENSO, North Atlantic SST, etc. This is where a climate service could help
- Really good understanding of this information – from a decision makers viewpoint – when they come up against providing info to a Board – need to know more and have to be able to justify and explain in terms that a city council and the press would understand
- Would like advice on appropriate uses for data (having parameters on data would be helpful)
- WUCA recommendations:
  - Develop and enhance GCM ensembles
  - Improve use of observations to constrain climate models' projections
  - Improve modeling of the tropical Pacific
  - Evaluate decadal prediction efforts for water utilities' planning

## **Other – for future:**

- Model Paradigm shift – from modeling to use of info --- Discussion of usability of information – need new thrust of how to frame models needs to be framed by questions being asked now
- Modelers need better understanding of how hydrologic modelers are using information and how it is being used after – need more dialogue at a detailed level
- Need to have water modelers involved in climate discussions
- Need to sustain efforts for 5-10 years --
- Needs funding – including scholarships and fellowships