

**Northwest Power and Conservation Council
Climate and Weather Advisory Committee
August 1, 2024**

Daniel Hua, NWPCC, began the meeting at 1:00pm by thanking members for their participation. Christian Douglass, NWPCC, took attendance and explained how to best interact with the Zoom platform. Hua then reviewed the agenda.

James Adcock, independent, asked what the Climatology Lab on [Slide 4] is. Hua told him this will be explained on a later slide.

Guillaume Mauger, University of Washington, asked Apologies — I believe you mentioned this last time, but I don't recall: How do you plan to address the cold bias at high elevations in the RMJOC-II data, and the associated overestimates of snowpack? In the chat. Douglass said he would make sure this is answered live in the presentation.

He also wrote, Unrelated: There are also downscaled solar radiation data from UW (CMIP5) and UCLA (CMIP6), though these may have biases. Douglass wrote that staff would look into this and contact him if he has trouble finding it.

Douglass asked Mauger's earlier question about cold bias [Slide: Climate Scenario Temperatures]. Hua said he did not know enough about this and asked experts to weigh in. Mauger admitted that this is not an easy question with an easy solution. He said the consequences of too cold mountains create an overestimate of snowpack/climate change effect. He wondered if the upper reaches of the Columbia, because it is so cold, has an underestimate of the climate change effect, suggesting examining warm historical years as a possible complimentary solution.

Mauger asked what the goal of [Slide 25] is. Hua answered that the climate data [Slide 18] is a daily min/max, but the model wants hourly, so this is a way to get to hourly data.

Mauger then asked about historical years on [Slide 24] saying he was confused by the spread. He asked what would happen if you picked one year, wondering if the statistics of all the days are consistent. Hua asked for clarification. Mauger said you would want a representative sample of cold and hot events along with diurnal temperature ranges.

Hua called this a worthwhile consideration, admitting he does not have a deep analysis on the topic. He said looking at the shape of the curve shows a range and anything you picked in the thicker areas would be most representative.

Mauger confirmed that staff need to pick one year. Hua said the load forecast model took too long so they used the purple dashed curve. Mauger confirmed that the year is 1987.

Hua confirmed, reminding him that this is past work for the 2021 Plan analysis and will not be used in the future.

Mauger said in a perfect, impractical world, you would run all the years through the forecasting model. Hua agreed. Mauger wondered if there was a proxy for a representative set of weather events. Hua said he didn't do that, explaining that the purple curve on the slide has the least difference relative to the blue curve.

Justin Sharp, EPRI, asked if the objective is to come up with an hourly, typical, meteorological year that maps to an expected future climate run, confirming that the issue is the daily climate data. Hua said it is not as lofty as that. He said an average (blue curve) could not reach the minimum temps, so they used the historical year that was closest.

Sharp asked if it would be helpful if the climate model data had hourly temperature data. Hua answered yes. Sharp said there's no reason they couldn't get that, and the industry should advocate for it. He then referenced the quantile/quantile regression method saying he could help Hua with that as well.

Allison Jacobs, PGE, said they have used Council data [Slide 25] noting that the purple line plumets between midnight to 1:00am on January 2 to 3. She said that is not something they have seen in the historic data, so they reshaped it. Jacobs was excited to see what the quantile/quantile method shows.

Mauger wrote: "Re: Getting hourly data from climate models. I agree, and we have that with the dynamically downscaled projections I mentioned earlier (UW, UCLA). However, they too have biases and need to be treated with caution," in the chat.

Nathalie Voisin, PNNL, wrote solar and wind speed are linked to temperature (and load). Will you reintroduce some temporal coincidence in the process? Else this might impact your distribution of risk, in the chat [Slide 35]. Hua answered that he hopes to, adding that the climate scenario windspeed is daily, as are the temperature and streamflow so they are consistent. Hua said they will have to look deeper into giving them a more consistent nature.

Casey Burleyson, PNNL, wrote that the temporal coincidence is really important.

Sharp shared his concern with the methodology on [Slide 40]. He said the wind speed from 10 meters to hub height plus working with hour data does not lead to accurate results. Sharp pointed to the diurnal shift in the alpha value, saying it works on averages and not on a diurnal basis, meaning that the data doesn't match loads. Hua agreed, saying they only have daily data so far. Sharp said that this is actually good for daily data.

Sharp did not want to be a "Johnny Rain Cloud" but didn't think modeling cold snaps was viable due to the cold bias in the data [Slide Regional Cold Snaps]. He said the model does

not accurately represent the topography, leading to interior cold reaching Seattle and Portland. Hua said this should be discussed offline in a meeting between the two of them. Sharp said that models are good at understanding trends but not absolute values.

Jennifer Light, NWPCC, noted that some Council members are concerned about cold snaps in Montana and wondered what he thought about those areas of the region. Sharp qualified his expertise and said GCMs and the data they yield are like looking at lower resolution weather models. He said they tend to overdo the cold air into the region because the mountains are not represented to be as tall as they really are. He said this applies to Montana as well.

Sharp said this is why regional downscaling is important and can't be statistically corrected for. He agreed climate change could increase the frequency of events, but you can't both warm the arctic and have so many extreme cold snaps.

Ronda Strauch, SCL, wrote Agree with Justin...when we looked at SeaTac data, we had to bias correct the cold as the future simulations had way colder days than historical days for the reasons Justin mentioned in the chat. Burleyson also voiced agreement.

Hua noted that these climate temperature data are in fact downscaled. Sharp asked what the resolution was. Hua said it was to 1/16th, creating a four- to five-mile grid. Sharp asked about the dots. Hua said they represent the maximum daily temperature for the four cities.

Sharp said he will have to think about that more, admitting that it is not impossible, but it would have to be really cold air that got over the mountains. Hua asked if the cold air could come from Alaska itself. Sharp said that could happen and was more plausible if those points were east of the Rocky Mountains, but getting cold air west of the Rockies comes from higher terrain in BC.

John Ollis, NWPCC, agreed with Light's comment, saying Council staff have used the cold snaps as a justification to show that we still have a climate possibility of cold events. He said it will be important to feel solid on this and get the data as right as possible.

Mauger "plus 1" Sharp's comment, adding that he has a paper that documents the issue but doesn't offer solutions. He agreed that there is a topographical barrier and didn't think Alaska air would be a factor but has seen temperatures 10-20°F colder than the record at Sea-Tac, admitting that it doesn't seem feasible.

Mauger said that statistical downscaling doesn't address this issue, but dynamical downscaling might even though it doesn't go far enough.

Burleyson wrote "with the increased penetration of heat pumps the cold snaps will become increasingly important in the future even if they don't increase in frequency or severity" in

the chat. Douglass said that tees up nicely with topics to be covered in the next CWAC/CRAC meeting where these issues will be discussed.

Jacobs thought that adding a fourth climate scenario would give you more variation [Slide 74], acknowledging that more data leads to more work. She echoed concerns about CNRM (G) having really low temperatures thinking that adding J could be a moderating effect. She didn't see a downside aside from the extra time.

Greg Brunkhorst, Tacoma Power stated that Tacoma Power favors more, adding that the wind process data seems complicated. He wondered if that could be skipped or streamlined. He said hydro is more important to Tacoma Power, but inflows also play a role. Brunkhorst also suggested using recent historical data, admitting that this doesn't get at climate trends but could be a valuable comparison point.

Sharp thought the signal-to-noise ratio on wind data is so low that teasing out the actual signal might not be worth it. He wondered if it could be better to use existing data. He acknowledged that it would be difficult to time match this data with the future. Sharp thought it might not be worth worrying too much about how wind data changes with the climate.

Sharp said it is a valuable research area, but is presently very inconclusive except for a slight downtrend with a lot of spread. He did not think it was worth getting too stressed over.

Mauger wrote '+1 to Justin's comment about wind. To specifically answer his question, I would suggest looking at the model projections to see if there are detectable changes in load-relevant measures of wind speed / direction. Or a literature review. i.e.: a simpler analysis that can back up the decision to drop the future wind analysis in the chat.

Mauger then wrote I think the same approach may be best for solar radiation.

Hua said people worry about lower wind generation when it is very cold or hot and was hoping to capture that effect. He said staff have seen some of that already, picking up the coincidence effect but asked for help with how to use historical data. Sharp agreed that coincidence is very important.

Mauger wrote I would suggest looking into « pseudo global warming » approaches to get at the climate change impacts in the chat. He then said was impressed with how sophisticated the approach is, adding that there are multiple ways to get at this information and there is not wrong way. He said this is a challenging problem with tricky biases. Mauger suggested looking to a pseudo global warming approach, explaining the process. He said this could be a valuable exercise that could complement the presented work.

Strauch wondered if there was enough time to add a 4th scenario saying there may be more important issues. She suggested spending effort on the quantile/quantile bias correction approach. Hua and Douglass agreed pointing to the work of adding another scenario.

Sharp wrote +1 to Guillaume. Basically, the point I was making, and probably a good way to tackle the difficulties around wind and solar.

Adcock voiced concerns with bumping up temperatures in the historical data (pseudo global warming approach). He said the last 50 years show very large changes in the distribution of extreme temperatures.

Light thanked everyone for their feedback, stressing that they need to get to a decision very soon. Ollis added that this will go into the GENESYS model and is also used for the resource strategy analysis. He said the weighing of the distribution affects this work and asked people to keep this in mind.

Adcock asked if [Slide 76] means there is no updated climate modeling so staff must use the same data. Hua said they have data from the RMJOC which goes from 1950-2099 but have two sets of hydro operating curves, which are important. He said the 2050-2059 recently became available but the Power Plan years are just a 20-year envelope.

Adcock said the proposed climate scenario years of 2020-2049 implies that the data hasn't changed. Hua said those years don't have to match in lock step. Adcock was still confused, saying climate models come and go and a four year span sees great improvement in models and science. He wanted to know if newer, better models were being used. Hua said they are using the same data as the 2021 Plan. Adcock was uncomfortable with that.

Hua said the data does not come from the model themselves but processed through hydrological modeling as the model does not produce stream flow data. Adcock summarized that this is hard to do so staff are not incorporating new data this time around. He then asked how often an update is planned.

Light said the work Hua described is done outside of the Council and staff rely on that process. She said staff are not in a position to do this kind of work. Adcock asked that his frustration be noted. Hua and Light said they heard him.

Burleyson wrote No issue with the years used. A note about the suggestion to potentially include an RCP 4.5 scenario: We have some work about to come out that shows the weather (and subsequent load) differences between 4.5 and 8.5 only becomes apparent after 20+ years. Given your study horizon this implies that you might not see that much difference between RCP 4.5 and 8.5. in the chat.

Mauger thought that a smaller, simpler analysis would be valuable for looking out beyond the years on the slide. He noted the long life of the infrastructure and impacts that get

clearer later in the century. Mauger said in the near term it's not that important to look at both RCP 4.8 and 8.5 saying that one scenario is sufficient.

Mauger then addressed the earlier objection to the pseudo global warming approach, saying he understood but disagreed and was willing to continue the conversation offline.

Strauch addressed the 9th Plan going to 2046 with the climate scenarios going to 2049, wondering if there was an issue of not having very many data for the distribution when you get to forecasting 2046. Douglass said that makes sense and ties into Mauger's point.

David Graves, CRITFC, wrote It seems appropriate to me to use the same period for the new Power Plan in the chat.

Hua asked all the members to weigh in with more input via email. Douglass said decisions around which scenarios and what years to use need to be made very quickly, while other decisions can take more time. Douglass then pointed to the next CWAC/CRAC meeting urging members to attend.

Hua thanked everyone and ended the meeting at 3:00.

Attendees via Zoom

Christian Douglass	NWPCC	Ted Light	Lighthouse Energy
Jennifer Light	NWPCC	David Graves	CRITFC
Dan Hua	NWPCC	Dor Hirsh Bar Gai	NWPCC
Konstantine Geranios	WA UTC	Tomás Morrissey	NWPCC
Landon Snyder	Snohomish PUD	Guillaume Mauger	Univ of WA
Justin Sharp	EPRI	Jonathan Belais	NEEA
Amber Riter	PGE	Annika Roberts	NWPCC
Casey Burleyson	PNNL	Nathalie Voisin	PNNL
Rick Williams	PSU	John Ollis	NWPCC
Brenda Pracheil	PNNL	Fred Heutte	NW Energy Coalition
Mary Kulas	Nuclear		
Michael Vieira	MB Hydro		
Mattias Jarvegren	Clallam PUD		
Verene Martin	SCL		
Christina Steinhoff	NEE		
James Adcock	independent		
Eugene Rosolie	NWEA		
Brian Dombeck	BPA		
Adela Arguello	BPA		
Kule Maki	ID Wildlife		
Devin Mounts	PGE		
Sanjeev Joshi	CRITFC		
Allison Jacobs	PGE		
Leanne Bleakney	NWPCC		
Cindy Strecker	CLEAResult		
Ronda Strauch	SCL		