Oregon Bias-Corrected Climate Modeling Methodologies

Wednesday, December 4th, 2019

ASCE Environmental Water Resources Group (EWRG) Lunch and Learn Webinar Series

Abstract: Using new regional bias-corrected climate modeling methodologies, King County, WA in partnership with the University of Washington Climate Impacts Group (UW CIG), has examined different precipitation regimes through the remainder of the century. Using this data, King County staff are developing new "mock stormwater structures" to test how they behave in different future climate change precipitation regimes. Building on this work, a coalition of stormwater management utilities are engaging with the UW CIG to produce the same kind of data outlooks for Oregon. Using that data, and building on the work done at King County, Oregon stormwater managers will be able to better understand how to design infrastructure for future shifting peak rainfall events.

Speaker: Matt Glazewski, Public Policy Analyst, Clackamas County

Biographical summary: Matt holds a B.S. in Meteorology from Penn State, a Master of Public Administration (M.P.A.) in Natural Resources Policy & Administration from Portland State University and has completed work toward a M.S. in Climatology at the University of Maryland. Matt manages the climate change portfolio at Water Environment Services of Clackamas County, teaches courses on climate change, meteorology, and oceanography at Portland Community College, servers a FEMA reservist for weather-related disasters, and is actively working toward climate change mitigation and adaptation strategies, efforts, and solutions within public utilities across the Pacific Northwest.

EWRG Announcements: Tomorrow, Dec. 5th, Clack Co WES has a sanitary and stormwater rules and updates open house at Clack Comm College, Tuesday Dec 10th as well.
ASCE, YMF, and EWRG Tues Dec 10th Kennedy School 6:30 PM Holiday Party
January 23rd 5:30 PM Wayfinder – river cleanup meeting

This November was one of driest Novembers on record – adds impetus to this work. Usually work with colleague at King County, not present today for this presentation. This presentation is on how climate change projections will continue to help us design stormwater structures here in the NW going into the 21st Century. King County pioneered the work and it's being borrowed here.

Lot of elevation change in Washington State means variation in mean rainfall – 33 – 173 inches per year due to orographic lifting: warm moist air from the Pacific rises over the mountains. Temperature decreases with height, and air cools as it moves up the mountain and can't hold as much moisture as the incoming warm air – so rainfall is greater in the mountains. Showed map of Washington St with rainfall across different topography. Just focusing on western Washington.

Global climate change model – considers all details, but it's quite a course model. A grid in the CCSM4 (?) model is many miles across. So, at the University of Washington (U of W) the Climate Impacts Group are using a finer resolution model – WRF Model, 12 kilometers across. Uses same model (modeling technique?) but using finer data.

Most of the rainfall during the wet months comes from a phenomenon called the "atmospheric river", aka the Pineapple Express. [In what part of the atmosphere?] This summer, we got intense precipitation but not from atmospheric rivers: from thunderstorms instead. One inch of rain in ten

minutes occurred. It's much harder to predict intense rainfall of thunderstorms that is so localized. Future: atmospheric river will be happening closer in time to each other according to The Oregon Climate Change Research Institute (OCCRI): see https://osuoccri.wixsite.com/ocar4. [Speaker referenced IPCC Intergovernmental Panel on Climate Change.] The global models show an increase from baseline in average global temperatures, which have been verified by recent lived experience.

The 2015 winter was a harbinger for how 2100 AD climate may be – *temperatures* higher. Not a big a change in *average rainfall* in 2100, but more precipitation extremes. Wet season shorter and more intense, summers drier. U of W projected out to 2100 and then designed stormwater conveyance systems based on modeled data to know how much more robustness was required.

What models for UW to use for their study? They chose ones that had a wide spread in normalized error score. See http://onlinelibrary.wiley.com/doi/10.1003/Jordan.50843/full [link appears to be broken].

Intensity/duration/frequency (IDF) 100-year return intervals: by 2050 not a big change from 2020. But by 2100, big changes in extremes. 30-year 'bins' for modeling climate because removes 'noise' of outlying years. Issue with this is every time we leave a 30-year-old decade by hitting the next decade, it changes the intensity of the calculation by referencing a different set of decades' data. Running averages are better and are updated more often. What is 'normal' changes from a climatological perspective. It depends on how much risk you're willing to take on by looking at things with increased or decreased discretion.

King County evaluated stormwater facilities – by different types: detention ponds, infiltration, sand filters, etc. 12 km grid spacing over King Co covers the County area well. Rain gages in the County shown with WRF Model grid spacing – gages spread out well. Airports have longest running rainfall data – SeaTac gage data included for this reason. Want to be able to bias-correct data moving forward for locations where data is available. Simulated localized data out to 2100.

Then, they looked at BMPs. Detention units had largest relative percent change – low permeability. High permeability, basic sand filter had the highest because of the size of the facility (small). Otherwise, detention had the largest relative percentage again vs. other BMPs. Extreme rainfall intensities increase overall. Till soils – BMPs generally increase 20 – 40%. Outwash soils – 50 – 200%. A more disturbed landscape has less effect on BMP designs.

Insurance companies buy 90% of municipal bonds. Insurance companies are watching to ensure that local governments are taking climate resiliency into account noted a keynote speaker at a PNW regional climate change conference Matt attended. Are local governments building in resiliency for their capital projects? Reserving land for future expansion of BMPs. Free tool called CREAT – risk analysis tool that can be used for any municipality.

In the future: use more climate model scenarios. More are coming. King Co spent hundreds of thousands of dollars to work with the Climate Impacts Group. But more data and models are coming. Evaluate at more locations, evaluate at different time periods, more strategies to mitigate (design-adapt BMPs, reduce time of initial abstraction (TIA), tree planting/forest retention).

Sandy River Watershed Council at Sandy River delta planted a lot of cedar incense – a drought resilient tree, though not a native of this localized area – because of climate change. 'Assisted migration' of plant species like this is going to help.

In Oregon – following King Co lead. Model domain included all of Oregon, so can use it here based on Oregon weather stations. CWS, WES, and City of Gresham are splitting the cost to get Portland area into model. Running Portland area models in 2020. Can supply with Oregon City data to add to model if we have any rain gage data.

There is a water utilities climate alliance group for water utilities. Contact Matt if want to get on quarterly alliance meeting list. [I put my name on the list.]

Clackamas County WES is moving to a continuous simulation model instead of the 24-hour synthetic rain storm that most of Oregon communities use. Audience member asked that we go back to our basic assumptions because the 24-hr synthetic model has built in conservatism.

Audience member asked how departments are working together to understand future impacts, so work doesn't get siloed.

Audience member asked how rain data can be corrected for future change – the data is historic, and a model run in the future will have different output when based on future rainfall data vs that of the present. Re-analysis data can be run by modeling from the point of view of the past using past as well as recent data to calibrate models was the presenter's answer.

Audience member asked about CMP5 and CMP6 models from International Panel on Climate Change – how different from each other. Presenter's response: computer models are limited by amount of computer power available at the time. Each iteration of the model gives better resolution because of more available computing power. Also, there will be other variables moving forward in the model – climate drivers – because of having the additional computing power to be able to handle them. Can run several different initial conditions which will result in different model output (differential equations).

Audience member asked if future models will account for more intense rainstorms due to new thunderstorms in the PNW? The presenter responded: how thunderstorms occur – Spring/summer and summer/fall, shoulder season – is when 'convective' activity occurs. Can we include convective activity in model? It is still seldom in Oregon, so can't really include. Also, these events are highly localized so can't add to a more generalized model. Not worthy of the time to model [but can add margin of error for this potential?]

Audience member asked if larger pipes which have longer design lives than the facilities themselves were accounted for in this long-term study.

Presenter stated that the Willamette and Columbia Rivers are tidally-influenced – so could have a King tide or sea level rise in the Pacific and a large water event at same time such as during the 1996 flood.