The Office of the Washington State Climatologist

August 5, 2009

Enhancing Washington's Climate and Hydrology Network (eWaCH.net) August 2009 Progress Update

Greetings, eWaCH.net participants and supporters! This supplemental report is serving to update you on the events since our inaugural meeting 2 years ago. Included in this report is an update on NOAA's plans for modernizing the Historical Climate Network (USHCN-M), an update on the station surveys conducted by the Office of the Washington State Climatologist (OWSC), and information on a new research project led by OWSC.

We would also like to bid farewell to our WA State Climatologist, Phil Mote, as he has left to become the director of the Oregon Climate Change Research Institute located at Oregon State University. He will also be the OR State Climatologist and a Professor in the College of Oceanic and Atmospheric Sciences. Phil will thankfully be staying in the Pacific Northwest, and will therefore continue to collaborate with OWSC. The University of Washington's College of Environment is currently working on finding a replacement.

Update on USHCN-M

The United States Historical Climate Network Modernization (USHCN-M) Pilot project is currently underway in the Southwest Climate Region. The pilot region is made up of four states - Utah, Colorado, New Mexico, and Arizona - and approximately 141 stations are planned for the region. Currently, 46 site surveys have been completed and selected for deployment. In June 2009, 5 sites were deployed in Colorado and another 5 will be deployed in New Mexico by August. These sites are not expected to transmit data until the fall because the government forms (Certification and Accreditation and Signed Authority to Operate) need to be completed. The pilot in the southwest is expected to be completed by Fiscal Year 2011.

At this time, there aren't any plans beyond the pilot project in the budget, and no decisions have been made outside of the pilot for the rest of the country. If funding does become available, however, the Pacific Northwest (Washington, Oregon, and Idaho) had been slated for completion in Fiscal Year 2012 in the original plans, with 82 stations.

Station Surveys

Philip Mote and Josiah Mault (former Assistant State Climatologist) performed state-wide surveys of existing Washington HCN stations, as well as a handful of COOP sites, and pictures from 36 of the sites they visited are now available on our website. We found that many of the stations had instruments that were sited in such a way that limited their value as a climate-quality measurement. We have come up with recommendations for improving many of the sites we visited. These recommendations have not been approved by the appropriate authorities and may not be actionable. For example, we recommended that the vegetation should be cleared at the Paradise Rainier site, but that is most likely unrealistic because of its location in a National Park. The pictures from the state tour can be found here: http://climate.washington.edu/statetour/ and show each station from 8 compass points, as well as an aerial photo when available. When USHCN-M comes to Washington, however, NCDC and NWS will need to conduct their own site surveys to implement the new stations. The individual site surveys conducted by OWSC, however, will likely aid in their effort.

The site evaluations by OWSC are not yet fully complete, but Table 1 shows our evaluation and recommendation for many of the sites. Each site was scored based on a set of temperature and precipitation criteria set up in a scoring rubric. For temperature, more points were given to sites that were farther away from artificial heat sources, reflective surfaces, large bodies of water, and obstructions. The slope of the ground that the station sits on, as well as the sensor and gauge heights were also taken into consideration. Specifically for precipitation, more points were given if objects around the gauge were more than twice their height away from the gauge. The scores fit into 5 categories for temperature: Excellent, Good, Fair, Marginal, and Poor, and 4 categories for precipitation: Excellent, Good, Fair, and Poor. For the sites that we evaluated thus far, the average condition of the temperature sensors are "Marginal" and the average condition for the precipitation gauges are "Fair". Again, we stress that NCDC and NWS will conduct their own site evaluations in preparation for USHCN-M, but we hope to provide the work we've done as a starting point.

ID	Name	Start	Temp. Rating*	Precip. Rating*	Recommendations
450008	ABERDEEN	1895	Poor	Excellent	Move temp sensor to west end of site away from artificial heating elements.
450587	BELLINGHAM 3SSW	1895	Good	Fair	Remove the tall vegetation near rain gauge.
450729	BLAINE	1896	Poor	Fair	Wastewater plant is being relocated, relocate station to new location.
450945	BUCKLEY 1NE	1913	Fair	Fair	Move sensor away from artificial heating sources and trees.
451276	CENTRALIA	1893	Marginal	Poor	Relocate.
451504	CLE ELUM	1899	Fair	Fair	Relocate.
451484	CLEARBROOK	1903	Good	Poor	Remove vegetation affecting rain gauge.
451630	COLVILLE	1899	Marginal	Fair	Site too small for additional sensors; relocate.
451666	CONCONULLY	1895	Poor	Poor	Move sensors elsewhere on site.

451939	CUSHMAN POWERHOUSE 2 (formally GRAPEVIEW 3SW – 453284)	1907	Marginal	Fair	Move sensor elsewhere on site.
452007	DAVENPORT	1899	Marginal	Good	Move temp sensor away from artificial heating sources.
452030	DAYTON 1WSW	1900	Poor	Fair	Move sensor elsewhere onsite if possible, else relocate to new site.
452505	ELLENSBURG	1893	Marginal	Fair	Relocate.
452675	EVERETT	1896	Marginal	Good	Relocate.
452914	FORKS 1E	1908	Marginal	Poor	Move sensor elsewhere on site.
453222	GOLDENDALE	1905	Fair	Excellent	Move temp sensor elsewhere on site.
454154	KENNEWICK	1900	Poor	Good	Move temp sensor elsewhere on site.
454748	LONG BEACH EXP STN	1891	Fair	Poor	Move sensors elsewhere on site.
454764	LONGMIRE RAINIER NPS	1909	Fair	Poor	Move sensors elsewhere on site.
454769	LONGVIEW	1925	Poor	Excellent	Move temp sensor elsewhere on site.
455224	MCMILLIN RESERVOIR (formally PUYALLUP EXPERIMENT STN 2W – 456803)	1914	Fair	Poor	Move sensors elsewhere on site.
455946	NORTHPORT	1910	Good	Excellent	Could move temp sensor farther from artificial heating sources.
456039	ODESSA	1903	Marginal	Excellent	Relocate.
456096	OLGA 2SE	1891	Fair	Excellent	Move temp sensor elsewhere on site.
456898	PARADISE RAINIER RS	1948	Fair	Fair	Clear vegetation.
456610	POMEROY	1908	Marginal	Poor	Move sensor elsewhere on site.
456624	PORT ANGELES	1895	Marginal	Fair	Relocate.
456678	PORT TOWNSEND	1895	Poor	Poor	Relocate.
456914	RAYMOND 2S	1895	Marginal	Fair	Move sensor elsewhere on site.
457059	RITZVILLE 1SSE	1916	Poor	Poor	Move sensor elsewhere on site.
457507	SEDRO WOOLLEY	1896	Poor	Fair	Move sensor elsewhere on site.
458059	STEHEKIN 4NW	1906	Marginal	Poor	Clear vegetation around gauge & move temp sensor elsewhere on site.
458207	SUNNYSIDE	1894	Marginal	Fair	Move sensor elsewhere on site.
458928	WALLA WALLA FAA AP	1903	Excellent	Excellent	None.
459012	WATERVILLE	1891	Poor	Good	Relocate.
459074	WENATCHEE	1912	Marginal	Good	Relocate.
459238	WILBUR	1893	Poor	Fair	Move sensors elsewhere on site.
		Average	**Marginal**	**Fair**	

Table 1: Evaluation of the temperature sensor and precipitation gauge on various HCN and COOP stations around the state by OWSC based on a strict scoring rubric. Recommendations for the site are also included, and well as the average state of the temperature sensors and precipitation gauges.

Optimal Network Design Project

OWSC has undertaken a project advised by Greg Hakim (University of Washington, Atmospheric Sciences Department) and Phil Mote in collaboration with Karin Bumbaco and Guillaume Mauger that uses ensemble sensitivity to find the optimal location for weather stations in the Pacific Northwest. In general, the method selects the point that explains the most variance in the chosen metric, then iteratively selects the next most valuable point conditional on the first, and so on, incorporating an estimate of instrumental error. So far, the method has been tested using modeled (MM5) monthly precipitation totals in western WA, and is still being tested. We hope to use this information to work with NCDC in implementing optimal locations for the modernized HCN network (USHCN-M).

An offshoot of this project involved evaluating the effectiveness of the Climate Reference Network (CRN) in explaining the variance in precipitation throughout the Northwest. The CRN initiative was deployed by NOAA, and is meant to be a climate-quality network that measures the climate change signal in the United States. The eleven CRN sites in Washington, Oregon, Idaho, and western Montana were used to perform a multiple linear regression with March 2004-September 2007 MM5 gridded precipitation to find the percent variance explained by each grid point. If a CRN station record wasn't long enough, then the closest MM5 grid point to that location was used instead. Figure 1 shows the percent vari-

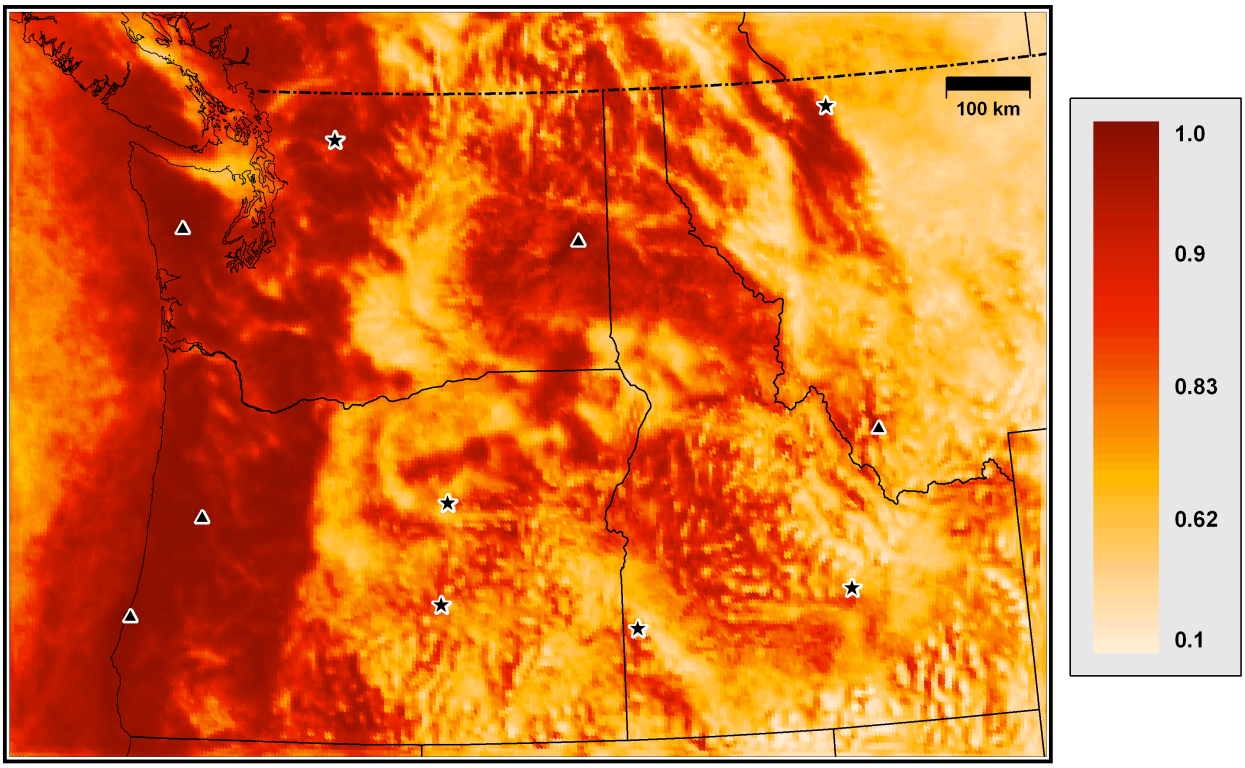

Figure 1: The variance explained at each 4-km MM5 grid point by a linear regression on the 11 Climate Reference Network stations in the Pacific Northwest. Six CRN stations have a complete dataset (star) and five were deployed after March 2004 so the closest MM5 grid point was used for the station time series (triangle). [Figure by Rob Norheim]

ance explained by the 11 CRN stations. Our analysis shows that the precipitation variance in western WA and OR is explained well, and is actually redundant. Marblemount and Quinault, WA are nearly redundant stations, each representing the wetter parts of the region. The drier parts, however, like the northeastern part of the Olympic peninsula and the Yakima valley in WA, are poorly explained by the existing CRN sites. This suggests that for monitoring long-term trends in drought, climate-quality stations in those areas (as well as in other poorly explained regions in the Pacific Northwest) should have been a higher priority than redundancy.