eWaCH.net

enhancing Washington's Climate and Hydrology networks
Workshop Summary and action plan

On June 15, 2007, the inaugural workshop of eWaCH.net took place in Seattle at NOAA's Sand Point facility, hosted by the National Weather Service and funded by Washington Department of Ecology and NOAA's Regional Integrated Sciences and Assessment (RISA) program. The purpose of eWaCH.net is to make better use of existing observation networks for purposes of climate monitoring, drought diagnosis and prediction, and streamflow forecasting on timescales from days to months. The workshop began with a description by Kelly Redmond (WRCC) of about a dozen networks currently in operation in Washington (see appendix A), and general advice on establishing and maintaining networks. He also discussed costs and benefits of new stations and the value of an entire network vs the marginal value of a single new station.

Roger Pulwarty contributed a presentation (in absentia) on NIDIS, the National Integrated Drought Information System. Prompted by the Western Governors' Association, NIDIS was established by federal legislation in late 2006 and seeks to coordinate drought information among federal agencies in order to provide users with decision support tools to identify and manage emerging droughts. In its early stage it includes plans for five pilot projects; the Pacific Northwest is on the list of probable second-stage pilots. NIDIS provides little money for observations but there is some prospect for leveraging the "enhancement" aspect of eWaCH.net with NIDIS money. There are also synergies between NIDIS and eWaCH.net in the emphasis on observations/monitoring and medium-term forecasting, e.g. the west-wide hydrologic forecasting system implemented at UW by Andy Wood.

Andrea Bair described the NWS plans for modernization of the Historical Climate Network. Nationwide 1,000 HCN sites are slated for modernization by 2013; of these, 32 are in Washington (Appendix B).

Chris Fiebrich described the Oklahoma Mesonet, how it came about and some of the challenges in maintaining it, both technically and politically. Its success stems from several factors: (1) Standardized hardware, siting and maintenance procedures at each site; (2) Reliable two-way communications with each remote site and near-zero ongoing communication costs; (3) Aggressive data quality control and quality assurance procedures; (4) Tailored products, relevant to each sector of users; (5) Strong educational outreach programs that support individual user groups with a variety of products; and (6) Data of research quality, provided in real time.

Discussions

<u>Climate networks</u>.

- Another avenue to consider is the integrated role of weather and climate observations in testing climate models, on the one hand, and the role of climate reanalysis (using those same models) in assessing the quality of observations and the strengths and weaknesses of networks on the other hand. Also need ocean observations to do good climate modeling. Cliff Mass and Greg Hakim (UW professors of Atmospheric Sciences) have projects for assessing station and network quality.
- Other QA/QC tools developed at OK mesonet, also ACIS (Applied Climate Information System).
- Growing citizen weather data (e.g. Weather Underground) – how should these be incorporated? What about examining the quality of such stations and "certifying" some as high-quality?
- Most applications require data that are **relatively** accurate, not absolutely accurate
- Costs for installation: $21K OK mesonet, $38K Coop.
- USHCN siting: quality of site and of data, long-term consistency, special value (e.g. mountain sites). Need complete site photography (16+ directions, 8 compass points toward and away from station). WFOs don't have many site photos but might have some. Develop a grading scheme as with NERON.

<u>Hydro-climate networks</u>

- Need better groundwater monitoring.
- WA Dept of Ecology is working on naturalizing Columbia Basin streamflow (HB 2860)
- SNOTEL network – NRCS adding several new SNOTEL sites. avg site maintenance cost is $2500/yr, but personnel are near limits for number of sites in the state – simply paying NRCS for site maintenance of new sites may not be possible – "soft" money cannot pay for new staff

<u>General remarks</u>

- Funding: need to identify long-term funding sources to ensure maintenance
- Private industry may have a stake in this effort – e.g., energy industry, insurance. Sprinkler company co-funding Agrimet to use the data for automatic water systems.
- Other potential partners include tribes, municipal water suppliers, fisheries.
- Attempt an economic valuation of the networks

Action list.

1) HCN modernization: provide recommendations to NCDC on the list of HCN sites slated for modernization.
    a. photo documentation of all 48 HCN sites – WFOs may have some
    b. rating them by quality and value
    c. considering additional needs (e.g. mountain sites) for recommendation to the State for modernization
    d. which sites need to be moved to be climate-quality
    e. GIS study – where they could be moved

2) homogenize HCN and Coop precip records
    a. apply to the State for funding – would support Columbia Basin water supply planning
3) Soil moisture/SNOTEL/groundwater sensors
    a. Evaluate where best to deploy new sensors using VIC forecasting
    b. Approximate priority list
4) Quality check the citizen weather observers to determine which might be worth considering for climate monitoring purposes
5) Use gridded analysis to redesign network
6) Perform economic analysis to estimate the cost/benefit ratio for various levels of effort (NRCS has an economist who does this for SNOTEL/water supply forecasting)
7) Engage with federal and tribal partners

Appendix A, largely from Kelly Redmond

climate-relevant networks in Washington

Network	# Sites	Began	Reporting Interval	Purpose	Variables
NWS Coop	243	1880s	monthly, most daily	general climate of the US	Tmax, Tmin, P, Sf, SD
HCN (subset of Coop)	44	1880s	Monthly, most daily	climate trends	Tmax, Tmin, P
RAWS	114	1983	hourly	forest fire risk	T, RH, P, û, S, fuel moisture
SNOTEL	71	late 1970s	hourly, 3h or 6h	water supply evaluation and forecasting	T, SWE, P since Oct 1, some SD, soil T and soil moisture
PAWS	61	late 1980s	15-minute	ag weather and climate	T, P, S, u, soil T, soil moisture, leaf wetness
Agrimet	24	1983	hourly	ag, water use	T, p, u, RH, S, soil T, leaf wetness, pressure, evap
ASOS*	38	1994 (1948)	hourly	aviation safety	T, p, û, Td, p, visibility, cloud ceiling
AWOS*	5	"	"	"	"
CRN	2	2004	hourly	climate change detection	T, P, u, wetness, surface skin temp
SCAN	1	1994	hourly	soil moisture	T, P, RH, S, pressure, û, soil moisture and temp at 5 levels
Hanford	30	1955	hourly	Hanford operations, radiation	T,û, RH. at HMS also sky conditions, pressure, S, visibility
RWIS	65	mid 1990s	hourly	road weather conditions; not suitable for climate	T, Rh, û, soil or road temp
buoys (NDBC, NOS, C-MAN)	17	1982	hourly	marine conditions	T, water temp, û, RH, wave height, pressure, wave period

* ASOS is generally better than AWOS, AWOS precip often not present or inaccurate

T = temperature at sub-daily timescale

Tmin, Tmax = daily min and max temperatures

Td = dew point

P = precipitation

Sf = snowfall

SD= snow depth

SWE= snow water equivalent

RH = relative humidity

S=solar radiation

u = wind speed

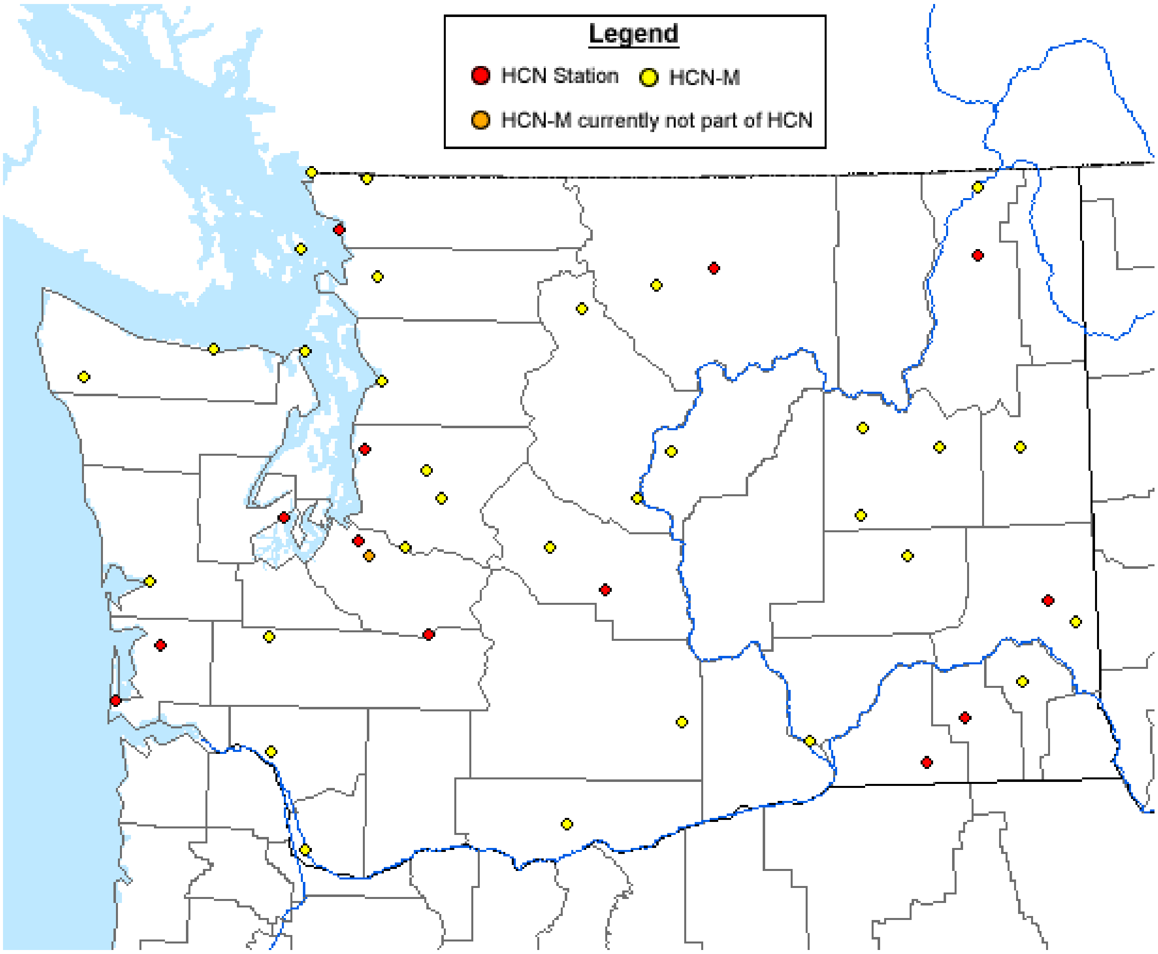
û = wind speed and direction

In addition, the USGS and Ecology stream gauge networks monitor river flows at 243 and 213 sites respectively. USGS gauge data date back to 1890s and Ecology to 1996 (majority after 2000).

Appendix B. Washington Coop stations currently slated for HCN modernization. Not all are currently HCN stations. CD= climate division.

Coop #	CD	Station Name	County	Began		
				M	D	Yr
450008	1	Aberdeen	Grays Harbor	4	1	1891
450729	3	Blaine*	Whatcom	8	1	1893
450945	4	Buckley 1NE	Pierce	1	1	1913
451233	5	Cedar Lake*	King	7	1	1898
451276	3	Centralia	Lewis	1	1	1893
451484	3	Clearbrook	Whatcom	3	1	1903
451504	6	Cle Elum	Kittitas	1	1	1899
452007	7	Davenport	Lincoln	3	1	1893
452675	3	Everett*	Snohomish	8	24	1894
452914	1	Forks 1E	Clallam	11	1	1907
453222	8	Goldendale	Klickitat	6	1	1948
454154	8	Kennewick	Benton	11	1	1884
454769	4	Longview*	Cowlitz	11	14	1924
455224	3	McMillin Reservior	Pierce	6	1	1948
455946	9	Northport*	Stevens	4	1	1910
456039	7	Odessa	Lincoln	12	4	1902
456096	2	Olga 2SE	San Juan	1	1	1890
456610	10	Pomeroy	Garfield	6	1	1881
456624	2	Port Angeles*	Clallam	1	14	1883
456678	2	Port Townsend	Jefferson	1	1	1857
456789	10	Pullman 2NW*	Whitman	1	1	1893
457059	8	Ritzville 1SSE	Adams	3	18	1899
457507	3	Sedro Woolley	Skagit	8	6	1896
457773	4	Snoqualmie Falls*	King	10	1	1898
457938	9	Spokane WSO AP	Spokane	8	4	1880
458059	6	Stehekin 4NW*	Chelan	1	20	1906
458207	8	Sunnyside*	Yakima	2	1	1894
458773	4	Vancouver 4nne	Clark	12	1	1849
459012	7	Waterville	Douglas	1	1	1890
459074	8	Wenatchee	Chelan	4	20	1912
459238	7	Wilbur	Lincoln	3	12	1892
459376	6	Winthrop 1wsw	Okanogan	4	1	1904

* station has hourly precipitation data


Legend
HCN Station
HCN-M
HCN-M currently not part of HCN

Appendix C. Participant List

Albertson, Skip	Department of Ecology
Albright, Mark	University of Washington
Baccus, Bill	Olympic National Park
Bair, Andrea	NWS Western Region
Bower, Brent	NWS Seattle
Brooks, Rhonda	WA State Department of Transportation
Colman, Brad	NWS Seattle
Coleman, Lynn	Department of Ecology
Evans, Christopher	Department of Ecology
Fiebrich, Chris	Oklahoma Climatological Survey
Krebs, Bob	Washington State University AgWeatherNet
Keirns, Daniel	NWS Portland
Kimbrough, Bob	USGS Washington Water Science Center
Livingston, John	NWS Spokane
Mault, Josiah	Office of Washington State Climatologist
Mitchell, Todd	University of Washington
Mittelstadt, Jon	NWS Pendleton
Mote, Philip	Office of Washington State Climatologist
Norheim, Robert	Office of Washington State Climatologist
Palmer, Peter	US Bureau of Reclamation
Pattee, Scott	USDA / NRCS
Redmond, Kelly	DRI / WRCC
Samora, Barbara	Mount Rainier National Park
Sarachik, Ed	University of Washington
Unger, Kurt	Department of Ecology
Vano, Julie	University of Washington
Waddell, Elizabeth	National Park Service - PWR
Witecki, Matt	WA State Dept. of Transportation
Wood, Andrew	UW, Dept. of Civil and Environmental Engineering