2.5 OREGON HCN DATA -- NEW OR OLD, WHICH ONE IS CORRECT?

George H. Taylor*, State Climatologist
Amanda Matzke, Research Assistant
Melanie Mitchell, Student Assistant
Oregon Climate Service, Oregon State University

1. INTRODUCTION

One of the primary functions of a state climatologist (or state climate office) is to provide historical contexts to current weather and climate conditions. State climatologists are often asked to answer such questions as:

- Is this a warmer (cooler) summer (winter, year) than normal?
- Have temperatures increased (decreased) in this area?
- What kinds of weather extremes typify this area?
- Are we experiencing climate change?

The key to answering these questions is availability of a long-term climate data set.

2. USHCN DATA SET

In an effort to provide a long-term high-quality data set which can be used to assess large-scale climate change in the U.S., the National Climatic Data Center (NCDC) developed the U.S. Historical Climatology Network (USHCN), a high-quality moderate sized data set of monthly averaged maximum, minimum, and mean temperature and total monthly precipitation developed to assist in the detection of regional climate change. The USHCN comprises 1221 high-quality stations from the U.S. Cooperative Observing Network within the 48 contiguous United States. An additional data set containing 46 stations for Alaska is also available; however, data for these stations are not adjusted for inhomogeneities as outlined below for the USHCN. The period of record varies for each station but generally includes the period 1900-1995.

The data for each station in the USHCN are subjected to a number of quality control and homogeneity testing and adjustment procedures. The result of these adjustments is the "final" version of the data. According to NCDC, the effects of the adjustments were as follows:

* *Corresponding author address:* George H. Taylor, Oregon Climate Service, Oregon State University, 316 Strand Agricultural Hall, Corvallis, OR 97331; e-mail: taylor@oce.orst.edu

1. Time of Observation adjustment: approximately a 0.3F warming from the late 1960's to the 1990's.
2. Instrument corrections: a small warming in the US annual time series during the mid to late 1980's.
3. Station History Adjustment Procedure: increase in US temperatures, especially from 1950 to 1980.
4. Missing data: cooler temperatures prior to 1915.
5. Urban warming: cooler by an average of 0.1F throughout the period of record.

2.1 *Oregon comparison*

We plotted revision 3 data (known hereinafter as "1994") and the final data from the latest revision ("1999"); in the case of the latter, we plotted data only through 1994 so that the two data sets could be compared directly. For each Oregon HCN station, we plotted mean annual temperature (the average of the monthly values) and fit a linear regression line. Average temperature trends for the period of record, and the difference between the 1994 and 1999 data sets are shown in Table 1 below.

As in the case of overall U.S. stations, Oregon stations exhibit a much more significant warming for the 1999 data set than for the original HCN data. Unlike the trend for the entire U.S., however, most of the differences for Oregon stations occurred early in the record. Most recent data are very similar. We can find no reason why this is the case.

3. CONCLUSIONS

The original HCN data showed relatively little warming at Oregon rural stations, with virtually no change since the 1930s. The most recent HCN data set, however, has been adjusted significantly, especially early in the record. This causes linear trends at most stations to be a great deal higher than they were previously.

Table 1. Temperature trends, Oregon HCN stations, 1994 and 1999 data setsand differences between them

Station	Temperature trend (deg F) 1994	1999	Diff.
Ashland	-.20	3.95	4.15
Astoria WSO Airport	-1.13	1.07	2.20
Baker FAA AP	.70	3.16	2.46
Bend	-.67	1.83	2.50
Bly	2.26	2.50	.24
Brookings 2 SE	2.57	2.62	.05
Cascadia State Park	-.71	1.36	2.07
Condon	1.57	1.75	.18
Corvallis State Univ	.70	2.28	1.58
Cottage Grove 1 S	.91	.81	-.10
Crater Lake Natl Park	-2.43	-1.45	.98
Danner	.30	1.69	1.39
Drain 1 NNE	.67	1.64	.97
Dufur	3.09	1.94	-1.15
Forest Grove	3.39	2.90	-.49
Fremont 5 NW	.38	1.73	1.35
Grants Pass	2.18	.07	-2.11
Headworks Ptld Wtr Br	2.91	3.34	.43
Heppner	.99	1.05	.06
Hermiston 2 S	.30	2.55	2.25
Hood River Exp Stn	.33	1.08	.75
Klamath Falls 2 SSW	1.52	2.46	.94
Lakeview 2 NNW	1.56	2.51	.95
Malheur Exp Station	-1.67	-1.11	.56
Mc Kenzie Bridge R S	3.16	3.85	.69
Mc Minnville	.86	1.19	.33
Milton-Freewater	1.09	1.13	.04
Moro	1.37	2.28	.91
Newport	.56	.46	-.10
North Bend FAA Airport	1.06	1.70	.64
Paisley	2.42	2.03	-.39
Pilot Rock	-1.39	1.05	2.44
Prineville 4 NW	1.04	1.76	.72
Prospect 2 SW	3.18	2.87	-.31
Riddle 2 NNE	.74	-.08	-.82
Roseburg KQEN	1.59	3.01	1.42
Three Lynx	-2.42	-1.13	1.29
Tillamook 1 W	.83	.46	-.37
Union Exp Stn	1.11	1.78	.67
Vale 1 W	2.32	2.07	-.25
Wallowa	1.23	1.79	.56

Our experience in "infilling" of data has convinced us that estimating missing values is a very difficult operation. We only conduct such infilling when absolutely necessary, and use a spatially coherent approach when doing so. There is no indication that NCDC used such an approach. We also disagree with the notion of adjusting historical data, even in the case of instrument change. It is our opinion, based on many years of collecting and analyzing data, that there are too many variables involved in data collection to permit "blanket" corrections to be made. Better to use completely separate station identifiers -- treating the data record as having come from two or more separate stations -- than to merge and then "correct" some of the data. We are seeing some regrettable examples of this practice as automated ASOS stations replace manual Cooperative stations, yet keep the same station name and number. We have seen significant changes in precipitation and temperature that appear to be caused by the instrument change, yet no such change in the station identifiers has occurred. We therefore recommend that long-term historical data be left "as is." Users should be informed of possible quality control problems, but adjustment to the measured data is not advised. In view of the complexity of quality control, and the difficulty and arbitrariness of adjusting historical data, we intend to continue distributing "raw" data until the differences between these HCN data sets can be adequately explained and resolved. At this point, we can only urge other climate researchers to do the same.

4. REFERENCES

Easterling, D.R., T. R. Karl, E. H. Mason, P. Y. Hughes, and D. P. Bowman, 1995. United States Historical Climatology Network (HCN) Serial Temperature and Precipitation Data (“1994” data). Data set NDP-019, Carbon Dioxide Information Analysis Center, Oak Ridge, TN.

Karl, T.K., David R. Easterling, Pamela Y. Hughes, Elaine H. Mason, and Jay Lawrimore, 2001. United States Historical Climatology Network (HCN) Serial Temperature and Precipitation Data (“1999” data). National Climatic Data Center, Asheville, NC.