Long-term Western precipitation trends are stable, says atmospheric scientist

December 16 2022, by Liz Junod

December 1968

UA hand-written snow report from December 1986 at Dr. Christy's home in

Although the West has experienced major ups and downs in its precipitation patterns from year to year, over the past 130 years regions that provide the major source for spring and summer runoff have not shown a long-term pattern that indicates a permanent decline in precipitation, according to research by Dr. John Christy, a distinguished professor in the Department of Atmospheric and Earth Science at The University of Alabama in Huntsville (UAH).

The results of Dr. Christy's construction and analysis of the longest, regional-scale time series of snowfall accumulations for Washington, Oregon and California from 1890–2020 are in a paper in the December 2022 issue of the American Meteorological Society's *Journal of Hydrometeorology*. As part of a joint project between UAH and the Department of Energy, Dr. Christy examined archived snowfall data dating back to 1890 from over 700 stations located in the three states.

"This research informs the water users who depend on snowmelt out West that even though some areas are experiencing a severe drought today, this current pattern, at least to this point in time, is not part of a long-term trend," says Dr. Christy, who is also Alabama's state climatologist and the director of the Earth Systems Science Center at UAH, a part of the University of Alabama System.

"As seasoned water resource officials out West already know, it's usually feast—floods—or famine—droughts—and not a whole lot of average in between," he says. "Yet, over 130 years, the trend with these ups and downs is fairly flat."

While examining the data from an archive of computer-readable files

and images of the original documents maintained by the National Centers for Environmental Information (NCEI), Dr. Christy encountered time consuming obstacles. First, many snowfall observations prior to 1940 were not digitized into computer-readable files. Dr. Christy had to examine original handwritten records for these stations, digitizing more than 10,000 station-months of data.

Second, Dr. Christy noticed variations in how digitization of these observations was performed. Especially for observations recorded after 1980, Dr. Christy says that he often found that missing data were recorded as zero, giving the impression that snow had stopped altogether in some stations when in fact it simply had not been measured.

Other observers simply left the daily entry blank when no snow fell rather than entering zero, he says, but entered values on days when snow indeed fell. This discrepancy caused the NCEI to misinterpret the blanks as missing data rather than zero, Dr. Christy says, disqualifying the station from creating monthly totals.

Dr. Christy says that once he digitized observations and corrected the data-entry problems, he then merged the data into a single time series for each region in each state based on elevation and geographic commonality. The result indicated no significant snowfall trends in the mountainous areas, mainly the Cascades, spanning 120+ years for Oregon and Washington.

Dr. Christy also updated California's Sierra Nevada Mountains snowfall dataset to include the 2010–2020 decade. During this decade, he says that the lowest snowfall totals ever recorded since 1878 occurred during the 2014–2015 year, the fifth lowest in 2013–2014, and the 14th lowest in 2012–2013. Even with these exceptionally low snowfall totals during this decade, he says that the additional data did not indicate a significant trend in California's long-term snowfall amount.

As a native of California, Dr. Christy, a weather nerd since childhood, would watch the impacts of winter storms as they draped snow across the Sierras from his home in Fresno County. With a longtime interest in Western snow, Dr. Christy says he was enthusiastic about partnering with DOE on this project.

 More information: John R. Christy, Time Series Construction of Oregon and Washington Snowfall since 1890 and an Update of California Snowfall through 2020, *Journal of Hydrometeorology* (2022). DOI: 10.1175/JHM-D-21-0178.1

Provided by University of Alabama in Huntsville