2020 U.S. Climate Normals

Monthly Gridded Normals

Version 1.0

Documentation

February 24, 2022

Introduction

The basis for monthly gridded normals produced by the NOAA National Centers for Environmental Information is a dataset first published in 2014, nClimGrid (Vose et al. 2014). Climatologically aided interpolation was used to transform an extensive set of station temperature and precipitation values into monthly grids at a high spatial resolution of 1/24° latitude/longitude, or approximately 5 km. A baseline set of climate normal grids was generated using thin-plate smoothing splines that accounted for latitude, longitude, and elevation in general. For temperature grids, some local adjustments for coastal proximity and the additional elevation impacts of inversions were applied, and for precipitation grids, slope and aspect effects were included to modify elevation impacts. Anomalies were then calculated at stations and converted into an anomaly grid using inverse distance weighting approaches. Finally, the baseline climatology grids and anomaly grids were combined to create monthly grids, and these were the grids used for calculating the U.S. Monthly Gridded Climate Normals.

The nature of the nClimGrid monthly data allows one to treat each month as part of a nearly homogenous temperature time series and a serially complete precipitation record. Therefore, unlike the complexity of calculating station climate normals (Arguez et al. 2012), monthly gridded normals are simple averages of the maximum temperature, minimum temperature, mean temperature, and precipitation totals for each month of the year. Gridded normals were also generated for climate seasons (1= DJF, 2 = MAM, 3 = JJA, 4 = SON) and the annual period. The conventional 30-year normal, the official normal, is an average of months in the 1991-2020 period. This is the gridded monthly normal to use for most activities. However, some users of normals require the representation of a shorter period closer to the present, so a normal for 2006-2020 is also provided. Finally, for longer term comparisons such as climate change studies, 20th Century Baseline has also been produced, a set of averages from 1901-2000.

Inputs

The input data used to generate the 1991-2020 normals are from the monthly version of nClimGrid, timestamped on May 5th, 2021. The latest version of the data can be found here: https://www.ncei.noaa.gov/thredds/catalog/data-in-development/nclimgrid/catalog.html

Data Files

The final product consists of three sets of four files in NetCDF format:

tavg-1991_2020-monthly-normals-v1.0.nc
tmax-1991_2020-monthly-normals-v1.0.nc
tmin-1991_2020-monthly-normals-v1.0.nc
prcp-1991_2020-monthly-normals-v1.0.nc

tavg-2006_2020-monthly-normals-v1.0.nc
tmax-2006_2020-monthly-normals-v1.0.nc
tmin-2006_2020-monthly-normals-v1.0.nc
prcp-2006_2020-monthly-normals-v1.0.nc

tavg-1901_2000-monthly-normals-v1.0.nc
tmax-1901_2000-monthly-normals-v1.0.nc
tmin-1901_2000-monthly-normals-v1.0.nc
prcp-1901_2000-monthly-normals-v1.0.nc

Primary Variables in Each NetCDF

Monthly Normal: mlytavg_norm, mlytmax_norm, mlytmin_norm, mlyprcp_norm
Monthly Standard Deviation: mlytavg_std, mlytmax_std, mlytmin_std, mlyprcp_std
Monthly # of Years: mlytavg_flag, mlytmax_flag, mlytmin_flag, mlyprcp_flag

Seasonal Normal: seastavg_norm, seastmax_norm, seastmin_norm, seasprcp_norm
Seasonal Standard Deviation: seastavg_std, seastmax_std, seastmin_std, seasprcp_std
Seasonal # of Years: seastavg_flag, seastmax_flag, seastmin_flag, seasprcp_flag
[1 = DJF, 2 = MAM, 3 = JJA, 4 = SON]

Annual Normal: anntavg_norm, anntmax_norm, anntmin_norm, annprcp_norm
Annual Standard Deviation: anntavg_std, anntmax_std, anntmin_std, annprcp_std
Annual # of Years: anntavg_flag, anntmax_flag, anntmin_flag, annprcp_flag

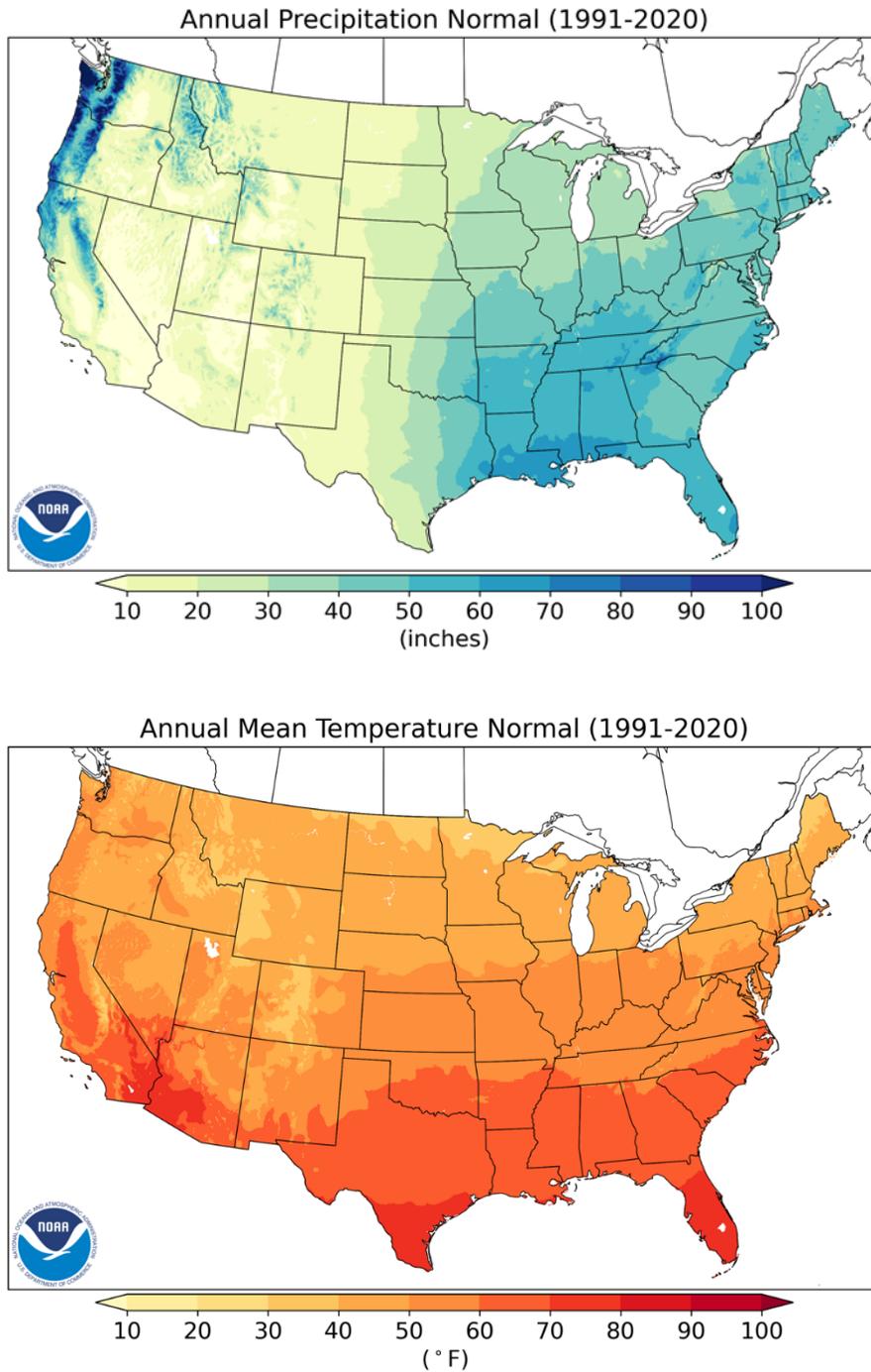**Conventional 30-Year Gridded Normals for 1991-2020**

Figure 1. 1991-2020 annual precipitation and mean temperature gridded normals.

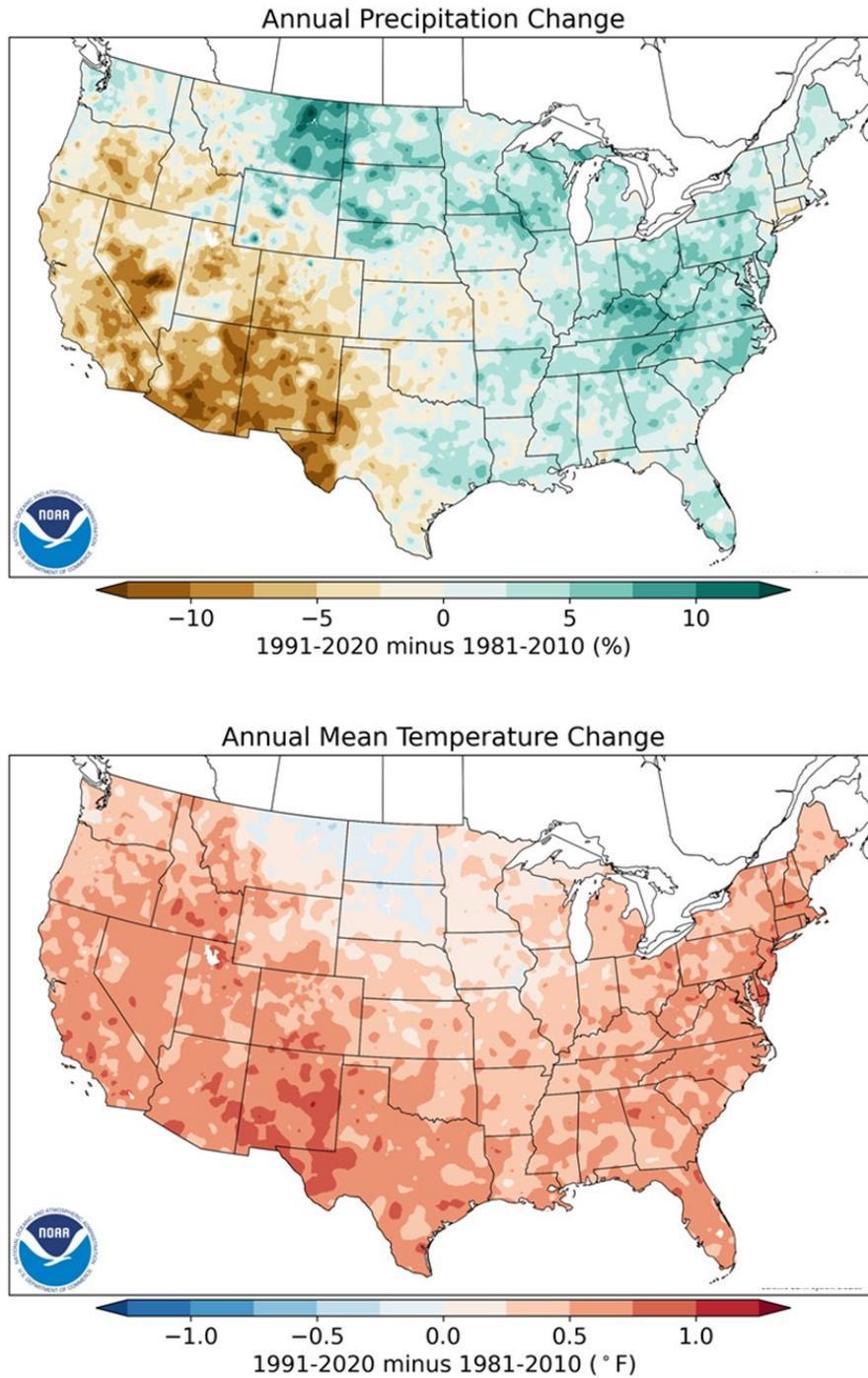**Change in Conventional 30-Year Gridded Normals, 1991-2020 Minus 1981-2010**

Figure 2. 1991-2020 minus 1981-2010 gridded precipitation and mean temperature normals. Annual precipitation is increased 5-10% in the central and eastern U.S., decreased 5-10% in the Southwest. Temperatures are warmer from 0.3 to 1.0°F everywhere except in the north central U.S., which is slightly cooler in places.

References

Arguez, A., I. Durre, S. Applequist, R. S. Vose, M. F. Squires, X. Yin, R. R. Heim, and T. W. Owen, 2012: NOAA's 1981-2010 U.S. Climate Normals: An Overview. *Bulletin of the American Meteorological Society*, **93**, 1687-1697..https://doi.org/10.1175/BAMS-D-11-00197.1

Vose, R. S., S. Applequist, M. Squire, I. Durre, M. Menne, C. N. Willams Jr., C. Fenimore, K. Gleason, and D. Arndt, 2014: Improved Historical Temperature and Precipitation Time Series for U.S. Climate Divisions. *J. Appl. Meteor. Climatol*., **53**, 1232-1251, doi: https://doi.org/10.1175/JAMC-D-13-0248.1.