

# ENSO Normals 2020

Version 1.0

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## **1. Executive Summary**

ENSO Normals 2020 is a new high-resolution set of climate normals for the contiguous United States that are conditioned for various phase categories of the El Niño – Southern Oscillation (ENSO): Strong La Niña, Weak La Niña, Neutral, Weak El Niño, and Strong El Niño. In addition, the optimal climate normal (OCN) – a 15-yr running average instead of the traditional 30-year normal – is utilized to better reflect the impacts of climate change. Monthly composites are produced for each of the five phase categories. The ENSO normals are the sum of these composites with the OCN for a given month. The result is five sets of normals, one for each phase category, which users may consult with respect to anticipated ENSO outcomes. This new product, which is based on available data through 2020, can assist stakeholders in planning for a broad array of possible ENSO impacts in a changing climate.

## **2. Purpose**

The purpose of this document is to describe ENSO Normals 2020, a product from the National Centers for Environmental Information (NCEI). This includes a general overview of the product, a brief explanation of the methods used to generate the products, and associated references.

## **3. Product History and Version Control**

This is the original release of this product, which is therefore designated Version 1.0 of ENSO Normals 2020. While an earlier calculation of the product was utilized to support the Arguez et al. (2019) publication, those values were never otherwise released publicly. Climate Normals products have historically been released on a decadal basis, and ENSO Normals 2020 is one component of NOAA's 1991-2020 Climate Normals suite. At this time, no additional updates to this product are expected, as Climate Normals are

considered static (as opposed to operational) products. However, in the event that the existing algorithm needs to be re-run (e.g., if a programming bug is identified that materially affects the product), then a Version 1.x may be released as appropriate.

## **4. Product Overview**

This section provides a general overview of the ENSO Normals 2020 product, including a description of the output files and how to access the product.

### **4.1 General Product Information**

ENSO Normals 2020 is a monthly climatology product over the contiguous United States (CONUS) on a  $1/24$  degree grid. Monthly means are provided for daily maximum temperature (Tmax; °C), daily minimum temperature (Tmin; °C), and liquid-equivalent precipitation (Prcp; mm). Critically, these monthly means are provided for 5 different phase categories of ENSO: Strong La Niña, Weak La Niña, Neutral, Weak El Niño, and Strong El Niño. In addition to the monthly means, quantile values are also provided for the 10<sup>th</sup>, 25<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles. Therefore, the product is intended for users in climate-sensitive industries to plan for potential ENSO impacts based on historical climatic conditions.

Each grid cell is ~4.6 km in meridional (i.e., south to north) extent whereas zonal (i.e., west to east) extent varies from ~3.0 km at the northern tip of CONUS to ~4.2 km at the southern tip. There are no missing values, except for grid cell locations within the bounding box that lie outside of the land areas of CONUS. ENSO Normals whose underlying composite anomalies are significantly different from 0 at 90% confidence are identified in a special significance test variable.

## 4.2 Access Information

ENSO Normals 2020 is provided in files structured in the Network Common Data Format (NetCDF), which is a standard format that can be read with many common tools and programming languages. For assistance, users are referred to appropriate documentation of their software application. Additional information about the product is provided in the variable and global attributes contained in each NetCDF file's header. Additional access information is provided in the "readme" file that accompanies the product files.

## 5. Methodology

A thorough description of the methodology employed to effectuate ENSO Normals 2020 is described in the manuscript by Arguez et al. (2019). However, the key points are summarized here.

The overall period of record is 1951-2020. [The Oceanic Niño Index](#) product from NOAA's Climate Prediction Center is utilized as an indicator of ENSO intensity. Each three-month season is then assigned to one of the 5 ENSO phase categories following a terciles approach.

The gridded temperature and precipitation data are obtained from nClimGrid Monthly (Vose et al. 2014). These gridded fields are used to calculate anomalous conditions (known as de-trended composites) for each ENSO phase category over the full 1951-2020 period of record. The composites are then re-centered about the OCN – which is a monthly normal computed over 2006-2020 – resulting in the final ENSO Normals 2020 values. Note that in some cases the algorithm produces slightly negative precipitation normals, and all of these instances are set to zero. In addition, quantile values for the 10<sup>th</sup>, 25<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles are provided, as well as indications of whether an ENSO phase category composite is significantly different from 0 at 90% confidence.

## 6. References

- Arguez, A., A. Inamdar, M. A. Palecki, C. J. Schreck, and A. H. Young, 2019: ENSO Normals: A New U.S. Climate Normals Product Conditioned by ENSO Phase and Intensity and Accounting for Secular Trends. *Journal of Applied Meteorology and Climatology*, **58**, 1381-1397.
- Vose, R. S., and Coauthors, 2014: Improved historical temperature and precipitation time series for U.S. climate divisions. *Journal of Applied Meteorology and Climatology*, **53**, 1232–1251, doi:10.1175/JAMC-D-13-0248.1.