



# Comparing 30 Years of Local Precipitation in Kingsburg, California to Global Patterns

Kingsburg High School

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## Abstract & Research Question

Since 1995, Kingsburg High School has collected rainwater data on campus as part of the GLOBE Program, started by former science teacher Peggy Foletta. Since November 2024, rainfall has been collected more consistently, and observations continue to be collected and recorded.

After looking through the data, the following research question was posed: *Is there a correlation between El Niño and La Niña (El Niño Southern Oscillation, ENSO) weather patterns and precipitation in Kingsburg, California, over the past 30 years?* El Niño is a climate pattern in which weakened trade winds allow warm water to shift eastward, often increasing rainfall in the eastern Pacific and drought in the western Pacific. La Niña is the opposite, with stronger trade winds that push warm water westward, resulting in cooler waters and generally drier conditions along the west coast of North America ([oceanservice.noaa.gov](https://oceanservice.noaa.gov)). These events occur approximately every 2-7 years, though not always in a fixed schedule ([ggweather.com](https://ggweather.com)).

Analysis of the liquid accumulation data from 1995-2025 shows that rainfall patterns in Kingsburg slightly align with California drought conditions and ENSO cycles, with reduced precipitation during droughts and La Niña years, and increased rainfall during strong El Niño events. These findings indicate similarities to broader Pacific climate patterns with a slight correlation, but more consistent and accurate data would be needed.

## Research Methods

Rainwater samples were collected from the rain gauge and rounded to the nearest tenth of a millimeter. Data must be recorded each day, even when there was no rainfall (in this instance, it would be recorded as 0). If there was less than half a millimeter of rain in the gauge, report the sample as "T" (trace) as the total amount. For precipitation levels, it must be recorded as days accumulated if the data is left uncollected for multiple days. For days that data was unable to be recorded, it must be recorded as missing to separate it from days when samples were not collected. If there is 30mL of the precipitation, it is used to measure pH, but in this study, it is not related to the current research question.

The GLOBE protocol was mostly followed except for some missing and/or unrecorded data. In that case, data had to be acquired from other websites, such as the National Weather Service, specifically its coverage of monthly Fresno precipitation from 1878 to the present day.



## Data Analysis & Conclusions

Over the last 30 years, California has experienced three periods of drought that have negatively impacted the state's accumulated precipitation. From 2007 to 2009, 2012 to 2016, and most recently from 2020 to 2022, each one of these major droughts has fostered an 11% decrease in agricultural revenue for the Central Valley (Escriva-Bou, [ppic.org](https://ppic.org)). The droughts do not strictly follow the expected La Niña event, but instead consists of neutral and El Niño events. These inconsistencies in drought periods and their correlation to ENSO cycles could be due to the rising issue of climate change. ENSO can face extreme changes as climate change continues, with a two-times increase in frequency by the end of the 21st century ([research.noaa.gov](https://research.noaa.gov)).

However, the measured rainfall does not account for all the moisture within the Central Valley due to excess humidity from the fog. The fog, which has unaccounted moisture levels, does positively affect the agricultural business, supporting and protecting some of Kingsburg's highest earning crops such as grapes and strawberries (Bardeen, [ppic.org](https://ppic.org)). In addition, the liquid accumulation data does lightly follow ENSO patterns, with droughts having lesser amounts of recorded data, but once again not applying to the expected patterns.

Overall, the liquid accumulation data collected in Kingsburg, California, throughout the past three decades have a slight correlation with the state's drought and El Niño/La Niña patterns, with less rain during droughts and La Niña seasons, and more rain in El Niño seasons, but more data would be needed to finalize this conclusion.

## Limitations

In this experiment, there were many limitations with data collection as different people collected data over time. The protocol wasn't always followed, resulting in inconsistencies and mistakes that impacted the collection. The website caused some issues due to its having a limited amount of inputs, such as restricting to 7 days of data collection despite some days experiencing more data collection. There are inconsistencies in "0" measurements, as the students did not put in a measurement every day (such as putting "0" each day when there was no precipitation), following the protocol.

Furthermore, between 2016 and 2017, the weather station was moved to a different location on campus, which affected data collection and created some minor changes due to the location change. Data was not recorded from June to August, as this was summer vacation, so no one was manning the data collection. The gauge for collecting precipitation is also located at 1.92 m, which is twice the height that is correct. This is due to it being surrounded by fences. Some precipitation also evaporated before it could be collected.

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