METR 104: Our Dynamic Weather (Lecture w/Lab)

FINAL PROJECT (An Investigation): Why Does West Coast Precipitation Vary from Year to Year?

Dr. Dave Dempsey, Dept. of Earth & Climate Sciences, SFSU, **Fall 2013**

Part I: Analysis of Precipitation Records

The last two lab meetings of the semester, on Thursdays, Dec. 5 and 12, will be devoted to supporting the final project, which will be worth 15% of your final course grade. (Some of the last Tuesday class meeting, on Dec. 10, and part of the day scheduled for the final exam, Dec. 17, will also support this assignment.)

The final project is a research project broken into four distinct parts:

1. **Part I:** Analysis of Precipitation Data (described in lab during the week of Thursday, Dec. 5).
2. Part II: Statistical Connections between El Niño/La Niño Events and West Coast Precipitation (to be completed during the week of Thursday, Dec. 12)
3. Part III: Jet Stream Patterns during El Niño/La Niño Events (supported in class on Tuesday, Dec. 17)
4. A final, summative report (due on Friday, Dec. 20; I will provide you with a template for this)

Overall Objectives:

- Conduct a realistic research project to investigate possible connections, both statistical and physical, between variations in sea surface temperatures near the equator in the Pacific Ocean and variations in winter precipitation on the west coast of the U.S.
- Access, analyze, interpret, and present data to test the assertion that there are such connections.

Objectives for Part I:

- Access partially analyzed, monthly-average precipitation records (in the form of PDF files) for four weather stations distributed the length of the West Coast, and understand what analysis has been performed on them, including averaging, plotting, and sorting, to prepare the data for Part II of the final project.

Materials:

- A computer with internet access.
- Analyzed precipitation data for a number of West Coast weather stations

Introduction.

Water is arguably the most vital natural resource for human and nonhuman life. This is particularly true in places where water is relatively scarce, such as much of the western U.S. The water that we depend on for drinking, irrigating crops, industry, and recreation, and that sustains the natural ecosystems on which we also depend, comes ultimately via precipitation.

The ways and places in which we live and work depend deeply not only on the *average* precipitation of the region but on its *variability* from month to month and year to year. To deal with variability and try to provide a reliable supply of water its residents, the state of California and the federal government have built a complex system of dams, pumps, and canals to capture, store, and divert water to places where people grow crops or prefer to work and live but where there wouldn't otherwise be enough water for those activities. However, California only stores in reservoirs, or pumps out of the ground, about half of all of the water that it currently uses, and it will be very hard to change that in the future. As a result, we depend heavily on the snow pack that accumulates each winter in the Sierra Nevada Mountains (in eastern California) to store water for us. As temperatures warm in late spring and summer, the winter snow pack largely melts, releasing the water gradually over a period of months, and we are able to capture and use some of it.

(Note that one of the likely impacts of global warming of greatest concern to California and other western states in particular, is on the winter snow pack. As the planet warms, more precipitation in the Sierra Nevada Mts. will fall as rain rather than as snow and will run off immediately instead of being stored as snow. We won't be able to capture as much of it as we need, and there will also be more winter flooding because the precipitation will run off in short periods instead of over several months.)

Most of the precipitation that falls in California, Oregon, and Washington is associated with midlatitude cyclones in the fall, winter, and spring. These storms form and travel along the polar front beneath the jet stream, so the location of the jet stream has a big impact on where midlatitude cyclones go and how strong they are, and hence where and how much precipitation falls. Although it's not possible to forecast individual storms with any confidence beyond a few days to (sometimes) a week in advance, there are some influences on weather patterns that are longer lasting and that can be predicted with some confidence months in advance. Sea surface temperature in the Pacific Ocean near the equator is one of those influences. Do sea surface temperature patterns affect the position and strength of the jet stream, and hence the path and strength of midlatitude cyclones, and hence precipitation patterns? And if so, how?

In this project, we are interested in the year to year variability of precipitation on the U.S. West Coast, and will try to determine what might account for some of the variability. There is reason to believe that the phenomenon of El Niño/La Niña, a quasi-periodic variation in sea surface temperatures in the equatorial Pacific Ocean that we can predict with some confidence months in advance, might affect West Coast rainfall. We will investigate the extent to which this might be true, and if it seems true, see if it might be connected to the position or strength of the jet stream.

To investigate these connections, we will start in Part I by walking through a partial analysis of precipitation data recorded at several weather stations on the West Coast. This analysis has already been done for you, but you will need to understand how it was done.

Instructions.

I. *What weather stations will you use?*

You will use precipitation data from four weather stations, including one from each of the following four regions of the West Coast (see map):

A. Southern California on or near the coast (San Diego, Los Angeles International Airport [KLAX], or Santa Barbara)
B. Central California (Watsonville, Mission Dolores in San Francisco, or Sacramento)
C. Northern California or southern Oregon (Eureka, CA; Ashland, OR; or Medford, OR)
D. Washington state (Aberdeen, WA; Palmer, WA; or Bellingham, WA)

We selected these stations because (1) they provide a representative distribution of stations up and down the west coast of the U.S.; and (2) each has a relatively continuous record of precipitation (missing no more than three days from any one month) from the current year going back to at least 1950. We got the data from the Western Regional Climate Center (http://www.wrcc.dri.edu/coopmap).

Attached to this assignment is a list of particular station assignments for each student in class.

II. *Where can you get the partially analyzed precipitation data for your four stations?*

We've partially analyzed the data in Microsoft Excel (a spreadsheet calculating program) and saved them as PDF files. The files (one file per station) are accessible at http://funnel.sfsu.edu/courses/metr104/F13/labs/FinalProject/PrecipData/.

III. *How are the data organized?*

The instructor will illustrate how the data were analyzed in Microsoft Excel.

Each precipitation data file contains monthly precipitation records for a particular station for each year from 1950 to the current year. The first column ("YEAR(S)") lists the years; the next 12 columns ("JAN", "FEB", etc.) lists the precipitation recorded for each of the 12 months; and the last column (labeled "ANN", for "annual total") lists the total rainfall for the whole year (all 12 months). Each row represents one year of observations. (Note that a number of months of the current year haven't been recorded yet, so those months are blank and no annual total is shown.

IV. *How were the data analyzed?*

1. **For each station, the average precipitation for each month from 1950 through last year was calculated. The average *annual* precipitation for the same period was also calculated.**

   (If you're interested in detailed instructions about how the analysis was done in Excel, see "Final Project, Part I: Excel Instructions".)

2. **For each station, a bar chart of the average monthly precipitation was plotted.**

   (For the details about how this was done, see "Final Project, Part I: Excel Instructions".)

   How would you describe the variations in average monthly precipitation over the course of the year for these stations?

   What are the five months with the greatest precipitation at each station? *If you had to pick five particular months that best identifies the "rainy season" for all four stations, what would those five months be?*

   Note also that the five months that you identify won't necessarily be the five wettest months at all four stations, but they should represent reasonably well the rainy season at all four stations collectively.

   Note also that the there is nothing special about five months to identify the rainy season—in some places the rainy season might be longer and other places shorter, and in some places there might even be two "rainy seasons" (though probably not on the West Coast of the U.S.), but for the purposes of our research we want to standardize the definition because it makes comparisons less complicated.

3. **For each station, the total rainfall for each five month rainy season, from late 1950 through earlier this year, was calculated.**

   (For details about how this was done, see "Final Project, Part I: Excel Instructions".)

4. **For each station:**
   a. **the data were sorted by rainy-season precipitation totals, from the highest to the lowest;**
   b. **the "wet" and "dry" years were color coded; and**
   c. **the data were re-sorted by year.**

   "Sorting" the data means organizing it in some particular order. Initially the data were sorted by year, with the oldest data (1950) first and the most recent year last. We wanted to reorganize the data by rainy season precipitation total, with the rainy season with the highest total first and the season with the lowest total last.

   For the purpose of our research project, we'll define a "wet" year as any year in the top 1/3 of rainy season precipitation totals and a "dry" year as any year in the bottom 1/3. Sorting the data by rainy season total makes identifying the "wet" and "dry" years much easier.

   Color-coding the years means changing the background color of the cells in particular rows, so it's easier to tell them apart. The wet and dry years are easier to color code if they are grouped together, as they are after the data are sorted by rainy season total.

For the purposes of using the Part I precipitation analysis for Part II of the Final Project, it is most convenient to have the (now color-coded) data re-sorted by year.

(For details about how this was done, see "Final Project, Part I: Excel Instructions".)

Your data are in a form designed to be analyzed further as easily as possible in Part II of the Final Project.

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Part II: Statistical Connections between El Niño/La Niña Events and West Coast Precipitation

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- Access, analyze, interpret, and present data to test the assertion that there are such connections.

Objectives for Part II:

- Using Ocean Niño Index data, identify years when there were El Niño and La Niño events of various strengths from winter of 1950-51 through winter of 2012-13.

- Using precipitation data analyzed in Part I, determine for that period how many El Niño events and how many La Niña events occurred during "wet" years and how many of each occurred during "dry" years, for each of four stations on the West Coast.
- For each type of El Niño/La Niña event, estimate the probability that at least that many events would have occurred during wet or dry years if there were no systematic connection between them; and conclude whether there likely is or perhaps isn't a connection, at least statistically.

Materials:

- A computer with internet access.
- **Analyses of precipitation data** for the rainfall seasons from 1950-51 through the 2012-13 season for several West Coast weather stations (see map).
- Data in the table, "**Three-Month Running Average Oceanic Niño Index (ONI) (Oct–Apr)**", for 1950 to 2013.
- Four blank copies of the table,"**El Niño/La Niña Classification and Probabilities**" (Microsoft Word version or PDF version).
- **Tables of Probabilities** that the observed number of El Niño/La Niña events occurring in "wet" or "dry" years, could have occurred when they did by random chance.

I. Introduction

As you probably discovered in Part I of the Final Project, the amount of rainfall that West Coast weather stations receive through the five wettest months of the year (which are typically November through March, or perhaps October through February depending on the station), can vary quite a bit from year to year. Very low rainfall years, especially several in a row, result in drought, which stresses people, plants, animals, and industry. Very high rainfall years are often associated with increased likelihood of flooding (though flooding isn't related to total rainfall over periods of months quite as simply as drought is).

What could account for this *inter-annual* (that is, year to year) *variability* in precipitation? There is probably more than one cause. Research meteorologists try to identify the most important causes, and operational meteorologists (that is, forecasters) apply that understanding to try to predict whether the upcoming winter rainfall season will likely be relatively wet, "normal", or relatively dry. Being able to anticipate rainfall a season or two in advance can have major economic and other benefits.

To look for possible causes for something like inter-annual variability in precipitation, a common first step is to look for *statistical connections* between it and possible causes of it. However, statistical connections aren't by themselves enough to establish a cause-effect relationship because (a) a statistical connection could occur simply by random chance; and (b) two types of events that have a statistical connection (correlation) might not actually have a direct causal connection, but instead might *both* be caused by *another* cause entirely. However, statistical connections do suggest further investigation to see if there is a *physical* connection by which one phenomenon might in fact cause the other.

In the second half of the 20th Century, research meteorologists began to notice a possible connection between (1) quasi-periodic oscillations of sea-surface temperatures in the tropical Pacific Ocean, called the El Niño/Southern Oscillation (ENSO); and (2) patterns of rainfall in many places around the world, including parts of the West Coast of North America. In Part II of the Final Project, you will look for statistical connections between the two different phases of El Niño/Southern Oscillation (ENSO), namely El Niño and its opposite phase, La Niña, and some of the interannual variability of precipitation at each of the West Coast stations that you have analyzed.

To do this, you will need to do the following:

1. Identify the particular rainy seasons in which El Niño or La Niña events of various strengths have occurred.
2. Count how many El Niño events of various strengths occurred during "wet" years and during "dry" years, and similarly for La Niña events, for each station that you are analyzing.
3. Test the hypothesis that the observed number of El Niño or La Niña events that occurred during wet or dry years could have occurred solely by random chance—that is, that there is *no* statistical connection between El Niño or La Niña events and wet or dry years. If the odds are low that the observed number could have occurred by chance, you'll reject the hypothesis and conclude that there is likely a connection between the two. That will raise the question about whether there is a physical, causal connection, which we'll pursue further in Part III of the Final Project, if warranted.

II. What You Did in Part I

In Part I, you were assigned a set of four weather stations with continuous precipitation records since 1950, including one from each of the following four regions (see map):

A. Southern California on or near the coast (San Diego, Los Angeles International Airport [KLAX], or Santa Barbara)
B. Central California (Watsonville, Mission Dolores in San Francisco, or Sacramento)
C. Northern California or southern Oregon (Eureka, CA; Ashland, OR; or Medford, OR)
D. Washington state (Aberdeen, WA; Palmer, WA; or Bellingham, WA)

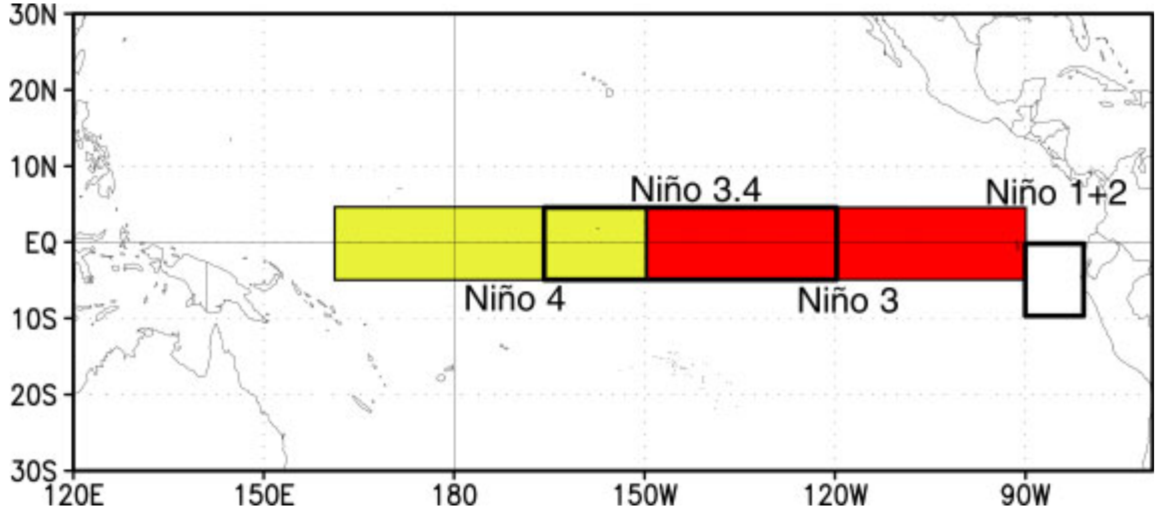
You were given rainfall data for your assigned stations, which were analyzed (mostly done for you) as follows:

1. For each station, the average observed precipitation for each month, from 1950 through the most recent year with a complete precipitation record, was calculated and plotted.
2. Using these results, you identified a single, five-month "rainy season" that more or less described the wettest months for all stations.
3. For each station, the total precipitation for each five-month rainy season, from the season ending in 1951 through the one ending in the the most recent year with sufficient data, was computed.
4. For each station, the rainfall records were sorted (ranked) by total 5-month rainy season precipitation, from highest to lowest, and the rainy seasons were divided into "wet" years, "normal" years, and "dry" years, each representing about one-third of the total number of rainy seasons since 1951.
5. For each station, the wet and dry years were color coded, and then re-sorted by year (that is, chronologically).
6. For each station, the analysis was repeated independently and the results carefully checked against the results of the first analysis to reduce the chance that errors were made, and any errors in the analysis were corrected.

Our goal now see if there is a statistical connection between ENSO events (El Niños and La Niñas) and wet or dry years at each of your selected stations. To do this, we first need to identify when ENSO events occurred since 1950, and to do that we need a criterion for defining the occurrence of these events.

III. Defining and Classifying El Niño and La Niña Events

The **Oceanic Niño Index (ONI).** The **ONI** has become the de-facto standard that the National Oceanographic and Atmospheric Administration (NOAA) uses for identifying El Niño (warmer than normal sea-surface temperature) and La Niña (cooler than normal) events in the eastern and central tropical Pacific Ocean. The ONI is defined as the *3-month running mean sea-surface temperature (SST) anomaly* for the "Niño 3.4" region (i.e., in the region from 5°N – 5°S latitude and 120° – 170°W longitude), as shown in the figure below.



What is a ***3-month running mean*?** For any particular month, it consists of that month's observations averaged with the previous and next month's observations. For example, the 3-month running mean for November consists of the average of October, November, and December (OND), while the 3-month running mean for December consists of the average of November, December, and January (NDJ).

What is a ***SST anomaly***? The sea-surface temperature (SST) anomaly is the *difference* between the observed SST at any particular time and the *long-term average* SST. A *positive* anomaly (that is, an anomaly greater than zero) means that the SST is *warmer* than average, while a *negative* anomaly means that SST is *colder* than average.

Definition of El Niño events. For our purposes, we'll define El Niño events to occur when there are *four or more consecutive months in which the ONI equals or exceeds* $+0.5^{o}C$, *and at least one of the four consecutive ONI values overlaps with one of the months of the five-month rainy season* for your four stations.

[**An example:** to clarify what we mean by "*...at least one ... ONI value overlaps...*", suppose that your five-month rainy season consists of November through March (NDJFM). Each ONI value consists of the average of three months' worth of SST anomalies, such as September, October, and November (SON), which we would call the "October" ONI value because the middle month is October. Although October isn't one of the five NDJFM rainy season months, November is both a NDJFM rainy season month *and* one of the "October" (SON) ONI months. Hence, we say that the October ONI overlaps with the NDJFM rainy season.

(The rationale here is that an El Niño event that begins in November is going to contribute to the October ONI value *and* potentially influence precipitation during much of the NDJFM rainy season, so we should consider October ONI values when defining El Niño events that might influence the NDJFM rainy season.

Similarly, the "April" ONI, which consists of the average SST anomalies for March, April, and May (MAM), includes March SST anomalies and hence overlaps with the NDJFM rainy season.]

We can further subclassify El Niño events as follows:

- "Strong" (*at least three* of the four+ consecutive SST anomalies equal or exceed +1.5^{o}C)
- "Moderate" (the conditions for a "strong" event aren't met, but *at least three* of the SST anomalies equal or exceed +1.0^{o}C)
- "Weak" (the conditions for a "moderate" event aren't met, but all four+ SST anomalies equal or exceed +0.5^{o}C)

Definition of La Niña events. Similarly, we'll define La Niña events as *four or more consecutive months in which the ONI equals or exceeds -0.5^{o}C, and at least one of those four months overlaps with with one of the months of the five-month rainy season* for your four stations.

We can further subclassify La Niña events as follows:

- "Strong" (*at least three* of the four+ consecutive SST anomalies equal or exceed –1.5^{o}C)
- "Moderate" (the conditions for a "strong" event aren't met, but *at least three* of the SST anomalies equal or exceed –1.0^{o}C)
- "Weak" (the conditions for a "moderate" event aren't met, but all four+ SST anomalies equal or exceed –0.5^{o}C)

IV. Instructions for Part II

We will use Oceanic Niño Index (ONI) data adapted from data downloaded from NOAA's Climate Prediction Center, which also provides a graph showing Oceanic Niño Index (ONI) vs. time from 1950 to the beginning of the current year. [Note, though, that the graph identifies "Strong" and "Moderate" ENSO events based on a slightly different criterion than the one described in Section III above, so you should not rely entirely on these particular classifications to check your own.]

1. **Identify El Niño and La Niña events and classify them as "Strong", "Moderate", or "Weak".**

   a. Using the data in the table, "**Three-Month Running Average Oceanic Niño Index (ONI) (Oct–Apr)**", apply the criteria defined in Section III above to identify El Niño and La Niña events and classify them as "Strong", "Moderate", or "Weak".

      [**Example:** In the 1950-1951 NDJFM rainy season, there were six months in a row with ONI values exceeding –0.5^{O}C, so this was a La Niña event. Only two of those values were as great as –1.0^{O}C, so it was a "weak" event. In the 1951-1952 NDJFM rainy season, there were three months in a row with ONI values exceeding 0.5^{O}C, not enough to qualify as an El Niño event. In the 1954-1955 NDJFM rainy season, there were seven months in a row with ONI values exceeding –0.5^{O}C, with four in a row equaling or exceeding –1.0^{O}C but none equaling or exceeding –1.5^{O}C, so this was a "moderate" La Niña event.]

   b. For each event that you identify and classify, enter the year in the appropriate "Year" column in all four of the accompanying blank tables, "**El Niño/La Niña Classification and Probabilities**". (At this point, all four stations should have identical classification and probabilities tables.)

   c. To reduce the chances of mistakes, compare your results with someone else's and make any needed corrections.

2. **For each station, count the number of each type of event that occurred during "wet" years and during "dry" years.**

   a. Refer to the **precipitation analyses** for your four stations. Pick a station. For that station, for each weak, moderate, and strong El Niño and La Niña event, determine whether the event occurred during a "wet" year, a "dry" year, or neither. In the appropriate column of the "**El Niño/La Niña Classification and Probabilities**" table for the chosen station, enter a "W", a "D", or leave blank, respectively, for the particular event.

b. When you've finished classifying events as "wet" year or "dry" year events for the chosen station, count the total number of each type of event that occurred in wet years and in dry years, and enter the totals in the station's "**El Niño/La Niña Classification and Probabilities**" table.

c. Determine the combined number of moderate and strong events in wet years and enter the total in the table. Repeat for moderate plus strong events in dry years.

d. To reduce the odds that you've made a mistake, compare your results with someone else analyzing the same station, and make any necessary corrections.

e. Repeat the previous steps for each of the other three stations.

3. **For each station and each type of ENSO event, test the hypothesis that the number of events actually observed in wet or dry years (or more) could have occurred by random chance.**

   a. Refer to the accompanying **Tables of Probabilities**. Pick a station. For each type of event, determine the probability that, out of all weak El Niños observed to occur since 1951, the number that were *actually observed in wet years*, or more, could have occurred by random chance. (See below for more detailed instructions.) Repeat for moderate and for strong El Niños. Enter the results in the appropriate cells of the "**El Niño/La Niña Classification and Probabilities**" table for the chosen station.

   [**Example:** Suppose that a total of eight "weak" La Niñas have occurred since 1950, and suppose that five of them occurred during years that were "wet" at a particular station. According to the **Tables of Probabilities**, the probability that five or more out of eight weak La Niñas could have occurred during wet years by random chance is only 8.8%. (Note that the probability that *exactly* five out of eight could have occurred during wet years by random chance is even lower, but we're giving the "random chance" hypothesis the benefit of the doubt to increase our confidence that we're right if we reject the hypothesis.)]

   b. Repeat for El Niños of each type that occurred in dry years

   c. Repeat for weak, moderate, strong, and combined moderate plus strong La Niñas in wet years and in dry years.

d. Which type(s) of El Niño and/or La Niña event(s) would you say had a high likelihood of being statistically connected to the occurrence of wet or dry years? (See below for guidance about how to decide.)

e. Repeat for each of your other three stations.

Using the Tables of Probabilities. Suppose that you picked a year at random from the period from 1951 through 2013. The chances that it would be a "wet" year", "dry" year, or neither (using the definitions in Part I) would each be about 1/3 = 0.3333333... (that is, 33%).

If you picked not one but *two* years at random, the probability that *both* are wet years is 1/9 = 0.111... (that is, 11.1%). (The probability that any two events both occur, is just the probability of each event multiplied together, which in this case is 1/3 × 1/3 = 1/9, or 11.1%.) The probability that both years are dry years is the same (1/9, or 11.1%).

If you picked *three* years at random, the probability that *all three* occur in wet years or all three in dry years, is 1/3 × 1/3 × 1/3 = 1/27 = 0.37 (that is, 3.7%). Similarly, if you picked three years at random, we could (with a little more effort) calculate the probability that *at least* two of those three years (that is, *either* two years *or* three years) are wet years. (That turns out to be 25.9%.)

As a result of your analysis of ENSO events and the precipitation analyses, you known how many El Niño or La Niño events of each type have occurred at a particular station since 1950-51, and you know how many of each have occurred in "wet" rainy seasons and in "dry" rainy seasons. If there is no connection between any particular type of ENSO event and wet or dry rainy seasons, then the association between them would be purely random. In that case, we can calculate the probability that what we observed could have happened by random accident.

However, if the probability is low enough, we might justifiably conclude that there is probably a (non-random) connection between that type of ENSO event and wet or dry rainy seasons. In the language of statistics, we say that we would "reject the hypothesis" that at that station, ENSO events of that type occur in wet or dry years solely by random chance.

To test the hypothesis that ENSO events of a particular type occur in wet or dry years solely by random accident, proceed as follows:

a. For a particular station, in its "**El Niño/La Niña Classification and Probabilities**" table, look up the total number of ENSO events of a particularly type (or combination of types) that have occurred during the period from 1951-2013. On the accompanying **Tables of Probabilities**, find the particular column (A) (labeled "# of Events") that corresponds to that total number of events.

b. In the table for a particular station, "**El Niño/La Niña Classification and Probabilities**", look up the number of events of that type that occurred in "wet" or in "dry" years. On the section of the **Tables of Probabilities** that you located in Step (a) above, locate the row in column (B) (labeled "# Wet or Dry Years") containing the number of events that you counted in wet or dry years.

c. In column (C) (labeled "Probability"), look up the probability that, from among the observed *total* number of ENSO events, the number of them (or more) that would have occurred by random chance in wet or in dry years.

d. If the probability is low enough, then *reject* the hypothesis that there are only random, accidental associations between wet or dry rainy seasons and ENSO events of that type. This encourages us to pursue questions about whether, and how, ENSO events might lead physically (that is, cause) wet or dry rainy seasons, which in turn might help us predict the occurrence wet and dry rainy seasons with greater accuracy than we could otherwise.

How low is "low enough"? It really depends on how sure you want to be that you're not reaching a wrong conclusion. A probability less than 5% (or even 1%) is best, but for our purposes we'll settle for less than 15%. If the probability is less than 15% that a particular type of event could have occurred in wet or dry years as often as it actually did by random chance alone, then we could be at least 85% sure that the association wasn't actually random.

[**Example:** In the example given in 3(a) above, we noted that the probability that at least five out of eight weak La Niñas could have occurred during wet years by random chance alone was only 8.8%. If the probability that this could happen by random chance is only 8.8%, then the probability that it *didn't* happen by random chance is 100% – 8.8% = 91.2%.

Since 8.8% is less than the 15% threshold that we decided upon, we would *reject* the initial hypothesis and say that we're 91.2% confident that since 1951, weak La Nina events did not occur in wet years by random chance. Rather, there is probably some sort of (non-random) connection between them.

We have to be cautious in the claims we make, though, because if there were errors in the data, or if some of our underlying assumptions were faulty, then our conclusion would not be justified. (Note that in such a case the conclusion might still be right, but we simply couldn't claim to have offered acceptable evidence supporting it.) We can't even conclude that La Nina events might cause wet years (or vice versa) at the chosen station because it's possible that both are caused by some other, third type of event or phenomenon. However, if the data are good and our assumptions reasonable, then the probability that these events are connected in some way seems high enough to justify looking for a physical, causal connection between them.]

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Part III: Jet Stream Patterns during El Niño and La Niña Events

Part III of the Final Project completes the background investigative work needed for the Final Project. (A separate document describes the format of a report summarizing the results of your investigation.)

The Final Project is a research project broken into four distinct parts:

1. Part I: Analysis of precipitation data (done for you, but you need to understand how it was done in order to interpret it properly).
2. Part II: Analysis of Pacific equatorial sea-surface temperature and statistical connections to precipitation data (completed in lab on Thursday, Dec. 12)
3. **Part III:** Jet Stream Patterns during El Niño/La Niño Events (in class Tues., Dec. 17)
4. A final, summative report (due on Friday, Dec. 20; I provide you with a template)

Overall Objectives:

- Conduct a realistic research project to investigate possible connections, both statistical and physical, between variations in sea surface temperatures near the equator in the Pacific Ocean and variations in winter precipitation on the west coast of the U.S.
- Access, analyze, interpret, and present data to test the assertion that there are such connections.

Objectives for Part III:

- Using observations analyzed for use with computer forecast models, calculate and plot averages ("composites") of wind speed in the upper troposphere (in particular, where the pressure is 300 mb) during the five-month rainy season that you identified for your four weather stations in Part I of the Final Project, for the following years since the 1950-1951 rainy

season:
   a. all years from 1950-1951 to the most recent rainy season for which you have data;
   b. years in which strong El Niño events occurred; and
   c. years in which strong La Niña events occurred.
- Based on any differences among these plots, decide whether jet stream position and strength might depend in some way on sea-surface temperature patterns in the equatorial Pacific, and hence possibly affect winter rainfall totals at various locations on the West Coast of the U.S.

Materials:

- A computer with internet access.
- Completed and verified analyses data from Part II of the Final Project.

Introduction

In Parts I and II of the Final Project, you probably discovered the following:

1. The amount of rainfall that West Coast weather stations receive during the five wettest months of the year can vary quite a bit from year to year.

2. For stations in some regions, at least, there might be statistically significant connections between rainy season precipitation totals and the occurrence of some types of El Niño and/or La Niña events (that is, ENSO, or El Niño/Southern Oscillation, events).

However, statistically significant connections don't, by themselves, demonstrate cause and effect—for that, we have to demonstrate that there is also a *physical* connection.

One possible physical connection between ENSO events and West Coast rainfall is through ENSO's influence on atmospheric temperature patterns in the lower troposphere. These influences most directly affect the tropical Pacific Ocean but can affect other areas indirectly, too. Here's how the connection might work:

1. During El Niño events, the higher-than-normal sea surface temperatures (SSTs) in the central and eastern tropical Pacific should warm the lower atmosphere there through:
   a. increased conduction of heat into the atmosphere from the sea surface, and

b. increased evaporation from the ocean surface (which converts heat in the ocean into latent heat in water vapor, cooling the ocean surface), followed by condensation of the increased water vapor to form clouds (which converts latent heat back into heat, warming the atmosphere where the clouds form); and
c. increased emission of longwave infrared (LWIR) radiation from the surface, and hence increased absorption of LWIR radiation (especially in the lower troposphere, where most of the water vapor is).

During La Niña events, the colder than normal sea surface temperatures (SSTs) in the central and eastern tropical Pacific should produce cooler than normal temperatures in the lower atmosphere there through:

a. reduced or even reversed conduction of heat between the atmosphere and the sea surface; and
b. reduced evaporation from the sea surface, and hence reduced cloud formation, and hence reduced latent heat release in the atmosphere; and
c. reduced emission of LWIR radiation from the surface, and hence reduced absorption of LWIR radiation in the lower troposphere.

2. Recall that the *polar front* is a narrow zone of relatively large temperature contrast (large temperature gradient) in the lower troposphere between the tropics and the poles, normally found at midlatitudes. Warming of the lower troposphere in eastern tropical Pacific during El Niño events should create a temperature gradient between the tropics in that region and the midlatitudes, a region where the temperature gradient is normally very weak or absent. This should shift the latitude of the polar front farther south, or perhaps create a second, more southern branch of of the polar front.

   Cooling the lower troposphere in the eastern tropical Pacific during La Niña events should weaken the (already weak) temperature gradient between the tropics and midlatitudes, which might leave the polar front farther north than usual.

3. The pattern of pressure aloft between the tropics and midlatitudes should shift along with the polar front, because temperatures in the lower troposphere largely determine the pressure aloft. In particular, the narrow zone of large pressure gradient aloft that occurs directly above the polar front, might shift southward or form a southern branch during El Niño events and shift northward during La Niña events, following the polar front.

4. As the pattern of pressure aloft shifts, the pattern of winds aloft (in particular, the location of the *jet stream*, which forms in the zone of large pressure gradient directly above the polar front), should shift as well. During El Niño events, we might see the jet stream shift southward or form a southern branch in the eastern Pacific.

5. Since midlatitude cyclonic storms track along the jet stream, and midlatitude cyclones bring most of the rainfall received on the West Coast, any alteration in the jet stream position might affect rainfall patterns on the West Coast.

One relatively simple test of this possible physical connection is to analyze upper tropospheric wind speed data to see if the average jet stream position during the rainy season during El Niño and during La Nina events differs from the jet stream's overall average position during the rainy season. If it does differ, and in particular differs in ways consistent with changes in observed patterns of rainfall during El Niño and/or La Nina events, then we will have confirmed (but of course not proven) the hypothesis that ENSO events affect the latitude of the jet stream, and hence midlatitude cyclone tracks, and hence rainy season precipitation totals. That's as far as this project will go, but confirming the possible explanation would help justify searching for more evidence, which is how it works in science!

Instructions for Part III

The National Atmospheric and Oceanic Administration's Earth Systems Research Laboratory (ESRL), in Boulder, Colorado, provides Web access to many years of atmospheric observations analyzed originally for use with computer forecasting models. Among other things, the Web site allows you to construct "composites" (by which ESRL means averages over time of spatial patterns) of a variety of atmospheric quantities, including wind speed at various levels in the atmosphere.

We will take advantage of ESRL's Web site to test the hypothesis that ENSO events influence the jet stream along the West Coast in winter in ways consistent with statistical connections between rainfall and ENSO events at some West Coast weather stations.

To do this:

1. Access ESRL's Monthly/Seasonal Climate Composites Web site at http://www.esrl.noaa.gov/psd/cgi-bin/data/composites/printpage.pl.

(Alternatively, to get to this page step by step:

a. start with ESRL's Physical Science Division at http://www.esrl.noaa.gov/psd/;
b. from the menu of links across the top of the page, pull down the "Products" menu and select "Plotting and Analysis", which gives you access to a wide range of different sorts of data and ways of analyzing them;
c. click on the link to "Monthly/Seasonal Mean Composites".)

2. Specify the quantity that you want to analyze and plot:

   - Pull down the "Which variable?" menu and select "Scalar Wind Speed".

3. Specify the level in the atmosphere where you want to analyze the wind speed:

   - Pull down the "Level?" menu and select "300 mb". [The altitude where the pressure is 300 mb is around 9 or 10 kilometers, or around 30,000 feet, which is in the upper troposphere near where the jet stream has its maximum wind speeds.]

4. Specify the period of particular months of the year (the "season") during which you want to analyze the wind speed at 300 mb:
   - Pull down the "Beginning month of the season" menu and select the first month of the five-month rainy season that you identified in Part I of the Final Project (probably November ["Nov"]).

   - Pull down the "Ending month" menu and select the last month in your five-month rainy season (probably March ["Mar"]).

5. Specify the range of years for which you want to compute a composite average of 300 mb wind speed during your five-month rainy season:

   - In the "Enter range of years" text box, enter "1951" to the last year for which you had data for a full "rainfall season" in Part I of the final project.

6. You are going to create a "color-filled" contour plot, which is a contour plot (of lines of constant wind speed, or isotachs)

in which the area between each pair of adjacent contour lines is filled in with a different color. Specify a plot color:

- Pull down the "Color" menu and select "Black and White".

7. The wind speed data available from ERSL's Web site is in meters per second. One meter per second is almost 2 knots (or 2.24 miles per hour). By convention, the jet stream is defined to be a relatively narrow "tube" of air aloft moving with a speed of at least 60 knots, which is about 30 meters/second. However, the jet stream position can vary somewhat from one day, week, month, and year to the next, so averaging the wind speeds for many months will tend to smear out the position of the jet stream and the winds will be weaker at any particular spot (because sometimes the jet stream will be there and sometimes not). To account for this "smearing out" of the averaged jet stream position and better highlight the average location of the jet stream, you'll want to construct a plot of wind speed that doesn't show winds slower than about 25 meters/second (rather than the conventional cut-off of 30 m/s). To this end, and to help optimize the jet stream plot more generally, change the default wind speed contour interval and the range of values to plot:

   - Under "Override default contour interval?", in the "Interval" text box, enter "2.5" (which means 2.5 meters per second).

   - In the "Range: low" text box, enter "25" (that is, 25 meters/second).

   - In the "Range: high" text box, enter "50" (that is, 50 meters/second).

     (Note that wind speeds in some places in the jet stream at any particular moment routinely exceed 50 meters/sec, which is almost 100 knots, but because the jet stream position wobbles back and forth as troughs and ridges migrate eastward, and the jet stream shifts north and south and back again to some degree over a period of weeks and months, the maximum wind speeds at any particular place and time are averaged with lower wind speeds at that place at other times, so the maximum *averaged* wind speeds are never as fast as the maximum wind speeds at any particular moment. As a result, plotting wind speeds only between 25 and 50 meters/second will still capture all or nearly all of the interesting behavior while optimizing the contrast in colors between lower and highest average wind speeds, which makes the plot easier to read.)

8. Rather than viewing a plot for the entire world, create one for North America (which focuses more closely on the area of

interest to us, the West Coast of the U.S.):

- Pull down the "Map projection" menu and select "North America".

9. Click on the "Create plot" button. This should create the specified plot and display it in your Web browser.

10. Capture the plot for use in your summary report for the Final Project:

    - Open a new document in Microsoft Word (or other word processing software) and drag the plot from your Web browser window and drop it into your Word document. (If this doesn't work, right-click on the plot in your Web browser window, pull down the "File" menu and select "Save image as", assign a name to the file you're about to save, and save it somewhere where you can find it on your computer. Then try importing it into a page in your word processing software, by dragging and dropping or by other means.)

    - Enter a caption for the plot, either above beneath it (something like "Mean Jet Stream, NDJFM 1951-2013") should be enough.

    - Failing this, print a hard copy of your plot and title it by hand.

11. Now you're ready to create another plot, this time a composite of average rainy-season wind speeds during years in which strong El Niño events occurred.

    Click on your browser's "Back" button to get back to the "Monthly/Seasonal Climate Composites" page. Repeat Steps 1 through 10 *except* for Step 5. Erase the existing entry (if any) for the "Enter range of years" item. This time, instead of a requesting a full range of years from 1951 to the more recent "rainfall season", refer to the option immediately *above* that, called "Enter years for composites (from 1 to 16)". In the text boxes beneath it, enter the years in which strong El Niño events occurred, which you determined in Part II of the Final Project. In Step 10, be sure to give your new plot an appropriate title.

12. Repeat for years in which strong La Niña events occurred. By the time you're done, you should have three plots altogether.

13. If you're not working on the computer on which you plan to write your summary of results for the Final Project, then email yourself a copy of the file containing your three captioned plots, or save a copy on a thumb drive, or ask the

instructors for advice about how to save the document in a place and form where you can access it later.

You're now in a position to see if the hypothesis is confirmed, that ENSO events affect the position of the jet stream in a way that can help account for any statistical connections that you saw in Part II of the Final Project.

At this point, you should be ready to write your summary report for the Final Project (see "The Summary Report" for guidance).

METR 104: Our Dynamic Weather (Lecture w/Lab)	**FINAL PROJECT (An Investigation): Why Does West Coast Precipitation Vary from Year to Year?**	Dr. Dave Dempsey, Dept. of Earth & Climate Sciences, SFSU, **Fall 2013**

The Summary Report

(Due Friday, Dec. 20; 15% of course grade)

In Part I, Part II, and Part III of the Final Project (An Investigation): "Why Does West Coast Precipitation Vary from Year to Year?", you investigated the variability in precipitation recorded at several West Coast weather stations since the 1950-1951 rainy season, testing the idea that some of the variability might be due to El Niño and La Niña events and their potential influence on the position and strength of the jet stream. Now you need to summarize your investigation and its results.

Summary Report Template. I provide a template (a Microsoft Word document) for this purpose. (You can download it at http://funnel.sfsu.edu/courses/metr104/F13/labs/FinalProject/M104_FinalProject_SumRpt_Template.F13.doc.) To simplify preparation of your summary report you can edit the template directly, simply inserting your numerical results and your plots, and replacing the italicized questions posed in the template with a corresponding narrative. (If your computer can't read the template, you can create your own summary report, but it should follow the outline in the template. A PDF version of the template is available. A hand-written summary report, with plots, is acceptable if it is neat and legible.)

The summary report template includes the following

- Five sections:

    I. Introduction
    II. Analysis of Precipitation Records *[corresponding to Part I of the Final Project]*
    III. Statistical Connections to El Niño and La Niña Events *[corresponding to Part II of the Final Project]*
    IV. Jet Stream Patterns during El Niño and La Niña Events *[corresponding to Part III of the Final Project]*
    V. Conclusions

In each of the template's five sections, one or more bulleted questions or instructions are posed to you, in italics. Replace the italicized questions and instructions with your brief responses to each one, written to create a coherent narrative for your summary report. (The original questions in italics should no longer appear—your narrative should provide the structure provided initially by those questions.)

There is no minimum length for the narrative, but by addressing the questions and instructions posed to you (even though the questions and instructions posed in the template won't appear explicitly in your final report), your narrative should communicate the steps you took in your investigation, why you took them, the results of your efforts, and your conclusions from them. If you are concise and to the point, this need not be excessively long.

- (Mostly) blank tables for data:
    - Table 1: Station Summary (in Section II)
    - Table 2: El Niño and La Niña Events: 1950-1951 to 2012–2013 (in section III)
    - Table 3A: Probabilities that at Least the Number of El Niño Events Observed to Occur in Wet or Dry Years at Individual Weather Stations, Would Have Occurred by Random Chance (in Section III)
    - Table 3B: Probabilities that at Least the Number of La Niña Events Observed to Occur in Wet or Dry Years at Individual Weather Stations, Would Have Occurred by Random Chance (in Section III)

  You should enter your own data in these tables.

You will add the following items to the template:

- *In Section II of the report, include a histogram chart of monthly average precipitation for each of your four stations. You can find these charts in a Microsoft Excel spreadsheet containing precipitation data that the instructor analyzed for you. (Click on the tabs along the bottom of the main spreadsheet window to access the analyses for the various cities.) You can drag and drop (or copy and paste) these charts from the Excel spreadsheet into your Word document (instructions below), or print them and include them with a hard copy of your summary report. You can access the Excel spreadsheet containing the precipitation data at the following Web address:*
    - http://funnel.sfsu.edu/courses/metr104/F13/labs/FinalProject/PrecipData/M104_FinalProject_PrecipData_WCoast_PartlyAnalyzed.F13.xlsx

    or if you have a version of Microsoft Excel older than 2007:

- http://funnel.sfsu.edu/courses/metr104/F13/labs/FinalProject/PrecipData/M104_FinalProject_PrecipData_WCoast_PartlyAnalyzed.F13.xls

(To copy a histogram chart from Excel into Word, open both at the same time and simply drag the chart from Excel and drop it into Word, or:

1. click on the chart to select it;
2. copy it (press the <command-c> keys on a Mac or <control-c> keys on a Windows PC), or pull down the "Edit" menu and select "Copy");
3. click on the spot in the Word document where you want to copy the chart;
4. pull down Word's "Edit" menu and select "Paste Special";
5. in the "Paste Special" dialogue window, select "Microsoft Excel Chart Object" and click on the "OK" button.)

- *In Section IV of the summary report, include the three composite rainy-season 300 mb jet stream plots (with captions) created in Part III of the Final Project.*

Turning in the Summary Report. The summary report is due on Friday, Dec. 20. You may turn it in as a Microsoft Word document attached to an email message (send to dempsey@sfsu.edu), or you may turn in a hard copy (typed or neatly handwritten) at Dr. Dempsey's office (Room 610 Thornton Hall). (You can slide it under the door if he's not in.)

Evaluation. Your Summary Report for the Final Project is worth 15% of your course grade. Scoring of the report will be based on the following:

- Completeness and accuracy of the data analysis and the presentation (plots, tables) (50%):
    - Histogram charts of monthly average precipitation for each station.
    - El Niño/La Niña event data in Table 2.
    - Probability analysis of the statistical relation (if any) between El Niño/La Niña events and wet/dry years at each station (Tables 3A and 3B).
    - Rainy season composite 300 mb jet stream plots.
- Completeness and coherence of the narrative (50%):

- Addresses all bulleted questions and instructions in the template.
- Narrative flows logically and is understandable.
- Writing is grammatically correct and avoids both excessive informality and excessive jargon.

An Investigation:
Why Does West Coast Precipitation Vary from Year to Year?

The Possible Influence of El Niño and La Niña Events

Your Name
mm/dd/yy

I. Introduction

- *What motivates this investigation? What question(s) will it try to address?*
- *Briefly outline or summarize the strategy that you used in this investigation to address the question(s).*

II. Analysis of Precipitation Records

- *Which weather stations did you use in your investigation, and in which of the four geographic regions was each located?*
- *What was the source of the precipitation data (including the Web address) that the instructor analyzed for you? (That is, where did the instructor originally get the data that he analyzed and made available to you at http://funnel.sfsu.edu/CoursesFolder/M104/FinalProject/PrecipData?)*
- *What analyses of each precipitation record did the instructor perform? (How is the "rainy season defined? [Refer explicitly to the histograms to be included below.] How are "wet" and "dry" years defined?)*
- *Fill in Table 1 below.*
- *Following Table 1, include histograms of monthly average precipitation data. You can get them in the Microsoft Excel file containing the precipitation analyses, and can drag and drop them into this document. (You will need a recent version of Microsoft Excel [2010 or 2011] to do this).*

Table 1: Station Summary
(Stations listed from south to north)

	Station #1	**Station #2**	**Station #3**	**Station #4**
Geographic Area	Southern California	Central California	California/ Oregon Border Area	Washington State
Station Name				
Annual Average Precipitation (1950-2012)				

III. Statistical Connections to El Niño and La Niña Events

• *Briefly describe what El Niño and La Niña events are and why they are of interest in this investigation. What general hypothesis are you testing statistically in this section?*

• *What criterion are you using to define El Niño and La Niña events and the year in which each occurs? How are you distinguishing among strong, moderate, and weak events? What is your source of data for this analysis (including the Web address)? (That is, where did the instructor get the data that he made available to you?) What are your results? (Be sure to refer explicitly to Table 2, which you need to fill in.)*

Table 2: El Niño and La Niña Events: 1950-1951 to 2012-2013

Type of Event	**El Niño**			**La Niña**		
Strength of Event	**Weak**	**Moderate**	**Strong**	**Weak**	**Moderate**	**Strong**
Years When Events Occurred						
Number of Events						
Number of Moderate + Strong Events						
Total Number of Events						

• *Briefly describe the strategy that you used to test for a statistically significant connection at any particular station between rainy season precipitation and the occurrence of El Niño or La Niña events.*

• *What stations show a statistical connection between rainy season precipitation and El Nino and/or La Nina events? In each such case, what sort of connection is there (that is, do "wet" years or "dry" years tend to occur during a particular type of event)? (Be sure to refer explicitly to Tables 3A and/or 3B. In those tables, replace the "Stn #1", "Stn #2", etc. column headers in those tables with the names of your particular stations.)*

• *Does there seem to be any geographic pattern to the statistical connections?*

Table 3A *(for El Niño Events)*: Probabilities that at Least the Number of El Niño Events Observed to Occur in Wet or Dry Years at Individual Weather Stations, Would Have Occurred by Random Chance

El Niño Events		Weather Stations (See Table 1)			
		Stn #1	*Stn #2*	*Stn #3*	*Stn #4*
Weak	**Total #**				
	# in Wet Years				
	Probability				
	# in Dry Years				
	Probability				
Mod-erate	**Total #**				
	# in Wet Years				
	Probability				
	# in Dry Years				
	Probability				
Strong	**Total #**				
	# in Wet Years				
	Probability				
	# in Dry Years				
	Probability				
Strong + Mod-erate	**Total #**				
	# in Wet Years				
	Probability				
	# in Dry Years				
	Probability				

(Note: Probabilities less than or equal to 15% should be highlighted in red)

Table 3B *(for La Niña Events)*:
Probabilities that at Least the Number of La Niña Events Observed to Occur in Wet or Dry Years at Individual Weather Stations, Would Have Occurred by Random Chance

La Niña Events		Weather Stations (See Table 1)			
		Stn #1	***Stn #2***	***Stn #3***	***Stn #4***
Weak	**Total #**				
	# in Wet Years				
	Probability				
	# in Dry Years				
	Probability				
Mod-erate	**Total #**				
	# in Wet Years				
	Probability				
	# in Dry Years				
	Probability				
Strong	**Total #**				
	# in Wet Years				
	Probability				
	# in Dry Years				
	Probability				
Strong + Mod-erate	**Total #**				
	# in Wet Years				
	Probability				
	# in Dry Years				
	Probability				

(Note: Probabilities less than or equal to 15% should be highlighted in red)

IV. Jet Stream Patterns during El Niño and La Niña Events

- *Why in principle aren't the statistical connections that you discovered in the previous section (if any!) enough to demonstrate a direct (that is, cause and effect) link between El Niño or La Niña Events and wet or dry years at some stations? (The answer here should apply to statistically significant connections between any two events, regardless of the phenomena involved.)*
- *Why should we look at jet stream patterns during El Niño and La Niña Events? What hypothesis are we testing in this section (although not statistically)?*
- *Outline/summarize the strategy for testing the hypothesis.*
- *Referring to the three "composite" 300 mb jet stream plots that you created in Part III of the Final Project assignment (for your five-month rainy season in three different sets of years), summarize the key features of these plots (in particular the location of the jet stream and perhaps its strength along the West Coast during El Niño and La Niña Events, compared to the 1950-1951 to 2012-2013 rainy season average) that confirm, disconfirm, or don't seem to address the hypothesis. That is, do these plots offer insight into any of the statistical connections that you report in the previous section?*
- *Include the three rainy season composite jet stream plots, each with a descriptive caption.*

V. Conclusions

- *Summarize briefly the main points emerging from your investigation. (Don't worry if this at least partly repeats points made in earlier sections.)*

METR 104 Final Project, Fall 2013

El Niño/La Niña Event Classification and Probability Table

STATION:						
	El Niño Events			La Niña Events		
Type of Event	Year	Wet ("W"), Dry ("D"), or Neither (leave blank)		Year	Wet ("W"), Dry ("D"), or Neither (leave blank)	
Weak						
Total # of Weak:		#Wet:	#Dry:		#Wet:	#Dry:
		Probability:	Probability:		Probability:	Probability:
Moderate						
Total # of Moderate:		#Wet:	#Dry:		#Wet:	#Dry:
		Probability:	Probability:		Probability:	Probability:
Strong						
Total # of Strong:		#Wet:	#Dry:		#Wet:	#Dry:
		Probability:	Probability:		Probability:	Probability:
Total # of Moderate + Strong:		#Wet:	#Dry:		#Wet:	#Dry:
		Probability:	Probability:		Probability:	Probability:

METR 104 Final Project:
Tables of Probabilities that the Observed Number (or More) of El Nino or La Nina Events Occurring in Wet or Dry Years Could Have Occurred by Chance Alone

Columns:
(A) Total number of El Nino or La Nina events
(B) Of the total number of events in column (A), the number occurring in wet or in dry years
(C) Probability that *at least* the observed number of events occurring in wet or dry years could have occurred by chance alone

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
1	0	100.000
	1	33.871

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
2	0	100.000
	1	56.270
	2	11.472

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
3	0	100.000
	1	71.081
	2	26.646
	3	3.886

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
4	0	100.000
	1	80.876
	2	41.697
	3	11.595
	4	1.316

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
5	0	100.000
	1	87.354
	2	54.967
	3	21.791
	4	4.798
	5	0.446

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
6	0	100.000
	1	91.637
	2	65.937
	3	33.028
	4	10.553
	5	1.920
	6	0.151

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
7	0	100.000
	1	94.470
	2	74.642
	3	44.174
	4	18.166
	5	4.844
	6	0.750
	7	0.051

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
8	0	100.000
	1	96.343
	2	81.358
	3	54.494
	4	26.975
	5	9.356
	6	2.137
	7	0.288
	8	0.017

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
9	0	100.000
	1	97.582
	2	86.433
	3	63.593
	4	36.296
	5	15.324
	6	4.582
	7	0.914
	8	0.109
	9	0.006

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
10	0	100.000
	1	98.401
	2	90.209
	3	71.329
	4	45.542
	5	22.427
	6	8.220
	7	2.156
	8	0.382
	9	0.041
	10	0.002

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
11	0	100.000
	1	98.942
	2	92.984
	3	77.724
	4	54.276
	5	30.256
	6	13.032
	7	4.210
	8	0.983
	9	0.156
	10	0.015
	11	0.001

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
12	0	100.000
	1	99.301
	2	95.002
	3	82.893
	4	62.218
	5	38.392
	6	18.866
	7	7.199
	8	2.076
	9	0.436
	10	0.063
	11	0.006
	12	0.000

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
13	0	100.000
	1	99.538
	2	96.458
	3	86.994
	4	69.221
	5	46.462
	6	25.480
	7	11.151
	8	3.811
	9	0.992
	10	0.189
	11	0.025
	12	0.002
	13	0.000

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
14	0	100.000
	1	99.694
	2	97.501
	3	90.200
	4	75.241
	5	54.171
	6	32.587
	7	16.004
	8	6.297
	9	1.947
	10	0.461
	11	0.081
	12	0.010
	13	0.001
	14	0.000

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
15	0	100.000
	1	99.798
	2	98.244
	3	92.673
	4	80.308
	5	61.308
	6	39.898
	7	21.621
	8	9.585
	9	3.420
	10	0.964
	11	0.210
	12	0.034
	13	0.004
	14	0.000
	15	0.000

Columns:
(A) Total number of El Nino or La Nina events
(B) Of the total number of events in column (A), the number occurring in wet or in dry years
(C) Probability that *at least* the observed number of events occurring in wet or dry years could have occurred by chance alone

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
16	0	100.000
	1	99.866
	2	98.770
	3	94.560
	4	84.496
	5	67.743
	6	47.149
	7	27.811
	8	13.662
	9	5.508
	10	1.796
	11	0.465
	12	0.093
	13	0.014
	14	0.001
	15	0.0001
	16	0.00000

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
17	0	100.000
	1	99.912
	2	99.141
	3	95.986
	4	87.905
	5	73.417
	6	54.125
	7	34.361
	8	18.454
	9	8.270
	10	3.053
	11	0.916
	12	0.219
	13	0.041
	14	0.006
	15	0.0006
	16	0.00003
	17	0.00000

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
18	0	100.000
	1	99.942
	2	99.402
	3	97.055
	4	90.642
	5	78.324
	6	60.659
	7	41.055
	8	23.842
	9	11.719
	10	4.820
	11	1.640
	12	0.455
	13	0.101
	14	0.018
	15	0.0023
	16	0.0002
	17	0.00001
	18	0.00000

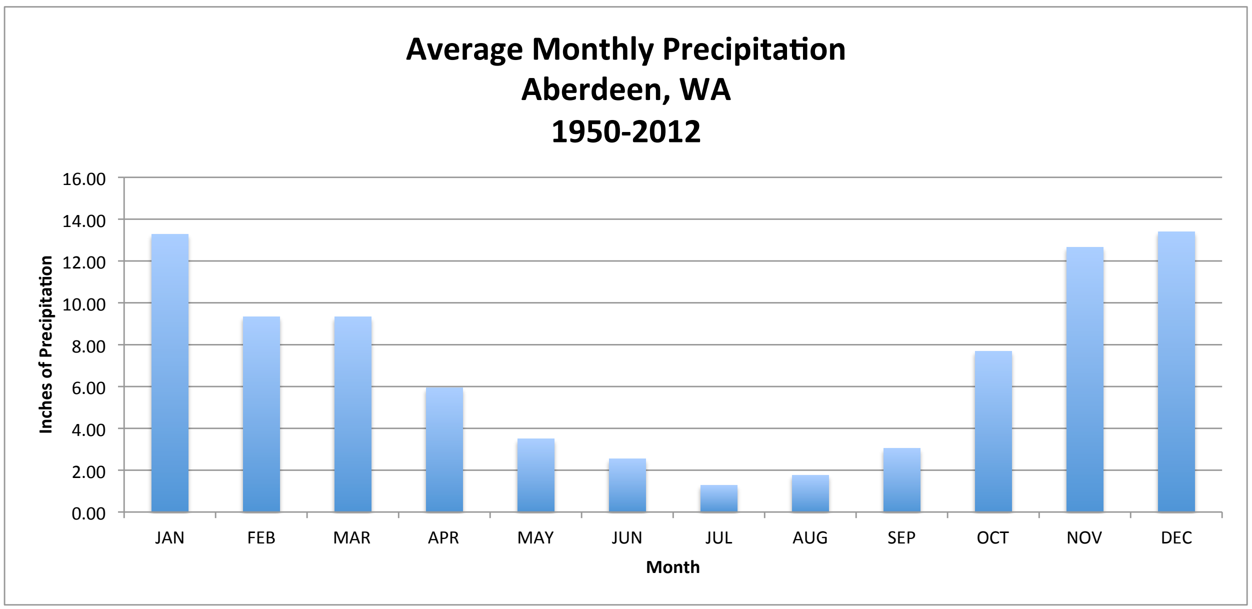
(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
19	0	100.000
	1	99.961
	2	99.585
	3	97.850
	4	92.814
	5	82.496
	6	66.643
	7	47.695
	8	29.672
	9	15.826
	10	7.157
	11	2.717
	12	0.857
	13	0.221
	14	0.046
	15	0.0075
	16	0.0009
	17	0.0001
	18	0.00000
	19	0.00000

(A) # of Events	(B) # Events in Wet or Dry Years	(C) Prob-ability (%)
20	0	100.000
	1	99.974
	2	99.712
	3	98.438
	4	94.520
	5	85.991
	6	72.012
	7	54.113
	8	35.777
	9	20.516
	10	10.093
	11	4.221
	12	1.487
	13	0.436
	14	0.105
	15	0.0205
	16	0.0031
	17	0.0004
	18	0.00003
	19	0.00000
	20	0.00000

ABERDEEN, WASHINGTON

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	10.98	15.28	14.29	6.91	2.45	1.18	1.38	2.50	3.61	12.44	12.13	16.18	99.33		
1951	14.61	13.79	7.98	1.93	1.89	0.26	0.51	0.11	4.32	10.99	9.74	11.05	77.18	64.69	W
1952	12.24	6.82	7.36	3.54	2.34	3.01	0.34	2.50	0.68	1.78	3.01	15.26	58.88	47.21	D
1953	30.46	7.23	7.77	5.03	4.24	2.82	0.46	2.83	3.31	6.53	11.53	17.08	99.29	63.73	
1954	20.22	0.00	5.73	5.69	0.97	3.39	2.30	4.41	2.84	5.91	14.01	10.37	75.84	54.56	
1955	7.11	7.22	9.41	9.29	2.17	2.04	4.69	0.28	2.07	13.36	16.37	18.07	92.08	48.12	D
1956	16.75	8.15	17.17	1.41	1.38	4.99	0.99	1.78	5.39	13.72	5.19	13.10	90.02	76.51	W
1957	6.41	9.78	12.60	5.04	2.01	2.58	2.31	2.71	0.95	5.55	7.15	15.30	72.39	47.08	D
1958	13.76	11.88	4.89	8.44	1.92	3.43	0.04	1.13	3.91	8.24	16.59	12.48	86.13	52.98	
1959	12.86	7.00	9.20	8.96	4.45	3.43	1.65	1.53	8.58	7.28	12.55	11.43	88.92	58.13	
1960	12.50	10.24	8.52	6.10	8.32	1.32	0.04	2.37	1.06	7.52	14.29	7.00	79.28	55.24	
1961	13.89	20.60	12.81	5.39	3.48	0.94	0.89	1.26	1.78	6.93	10.87	12.63	91.47	68.59	W
1962	7.16	4.56	8.20	6.74	3.71	2.37	0.52	3.04	4.34	8.06	16.99	9.79	75.48	43.42	D
1963	4.48	9.98	7.16	6.75	3.63	2.43	2.02	2.42	3.00	9.02	18.78	9.71	79.38	48.40	D
1964	19.99	5.31	10.50	5.37	3.32	3.50	3.60	3.98	3.58	4.17	14.32	12.49	86.53	64.29	
1965	19.05	11.35	1.60	4.93	3.91	0.77	0.48	3.08	0.95	6.47	11.43	11.20	75.22	58.81	
1966	13.07	8.79	11.38	3.21	2.31	2.51	0.50	1.14	2.08	7.85	9.61	20.77	83.22	55.87	
1967	19.25	8.81	10.42	5.46	1.19	1.07	0.30	0.20	2.58	16.40	7.87	13.12	86.67	68.86	W
1968	13.06	9.73	12.33	5.12	3.97	5.94	0.85	3.98	4.54	8.35	10.80	16.51	95.18	56.11	
1969	12.50	7.45	4.86	6.80	3.79	2.82	0.33	0.66	6.42	5.02	6.80	13.28	70.73	52.12	
1970	13.84	7.93	6.82	8.46	3.73	0.88	1.03	0.58	5.51	7.79	9.44	19.16	85.17	48.67	D
1971	19.39	7.90	14.80	5.41	2.91	2.79	0.94	1.26	6.65	5.70	10.92	15.41	94.08	70.69	W
1972	13.04	13.58	11.98	10.28	1.03	1.42	4.16	0.56	5.97	1.98	8.05	13.96	86.01	64.93	W
1973	10.99	3.81	6.67	2.80	4.84	4.82	0.20	0.42	4.44	6.52	14.91	16.80	77.22	43.48	D
1974	18.11	11.82	15.19	7.35	5.27	2.61	3.04	0.78	0.69	2.51	9.34	15.38	92.09	76.83	W
1975	12.67	9.12	7.62	3.35	4.49	2.51	0.18	5.15	0.10	17.84	14.17	20.32	97.52	54.13	
1976	15.32	10.25	10.37	3.56	2.94	2.07	2.44	3.72	1.40	3.13	3.33	5.72	64.25	70.43	W
1977	3.48	6.38	11.04	2.49	6.80	1.62	1.02	5.36	5.40	6.13	14.64	17.97	82.33	29.95	D
1978	6.99	5.90	6.01	4.82	5.15	3.64	0.56	3.17	10.23	1.25	6.21	5.51	59.44	51.51	D
1979	3.68	18.25	5.01	5.06	2.66	1.32	2.25	1.79	3.29	10.10	4.83	18.88	77.12	38.66	D
1980	6.19	13.38	6.44	6.38	1.97	2.01	0.93	1.44	3.67	2.59	14.91	13.23	73.14	49.72	D
1981	3.74	12.99	6.11	12.23	3.75	5.04	1.17	0.66	7.36	11.10	10.45	15.82	90.42	50.98	D
1982	17.69	16.40	8.92	9.92	0.55	2.26	1.27	0.94	2.82	8.71	11.05	16.23	96.76	69.28	W
1983	17.30	14.66	12.71	3.76	2.81	3.28	5.07	1.11	3.62	2.85	23.78	9.84	100.79	71.95	W
1984	14.69	10.98	8.19	5.56	7.77	4.20	0.12	0.78	3.77	8.93	17.95	8.76	91.70	67.48	W
1985	0.58	5.74	8.79	6.35	2.39	3.05	0.22	1.29	3.91	14.56	7.93	3.21	58.02	41.82	D
1986	16.56	12.02	6.22	5.48	5.35	1.61	2.70	0.07	3.53	5.82	14.72	10.15	84.23	45.94	D
1987	13.59	7.86	11.40	4.68	5.45	0.64	1.41	0.38	0.51	0.52	5.92	13.29	65.14	57.72	
1988	8.76	4.32	11.52	6.54	5.79	2.19	1.46	0.80	2.96	5.12	14.26	9.92	73.64	43.81	D
1989	10.38	6.91	10.19	4.37	3.27	1.71	2.64	1.33	0.68	7.15	13.71	8.31	70.65	51.66	
1990	19.60	16.30	7.55	5.46	3.50	3.79	0.42	1.73	0.01	11.96	24.02	10.69	105.03	65.47	W
1991	10.80	14.20	6.56	10.16	3.27	1.64	0.74	7.10	0.04	2.91	14.46	8.58	80.46	66.27	W
1992	16.63	6.25	1.36	8.70	0.41	1.27	0.81	1.34	2.87	5.81	11.48	8.53	65.46	47.28	D
1993	9.09	0.62	8.83	9.56	5.20	4.08	1.85	0.44	0.02	3.48	4.18	13.99	61.34	38.55	D
1994	10.59	12.11	7.90	4.80	3.07	3.80	0.78	1.02	2.33	9.13	15.74	25.58	71.27	48.77	D

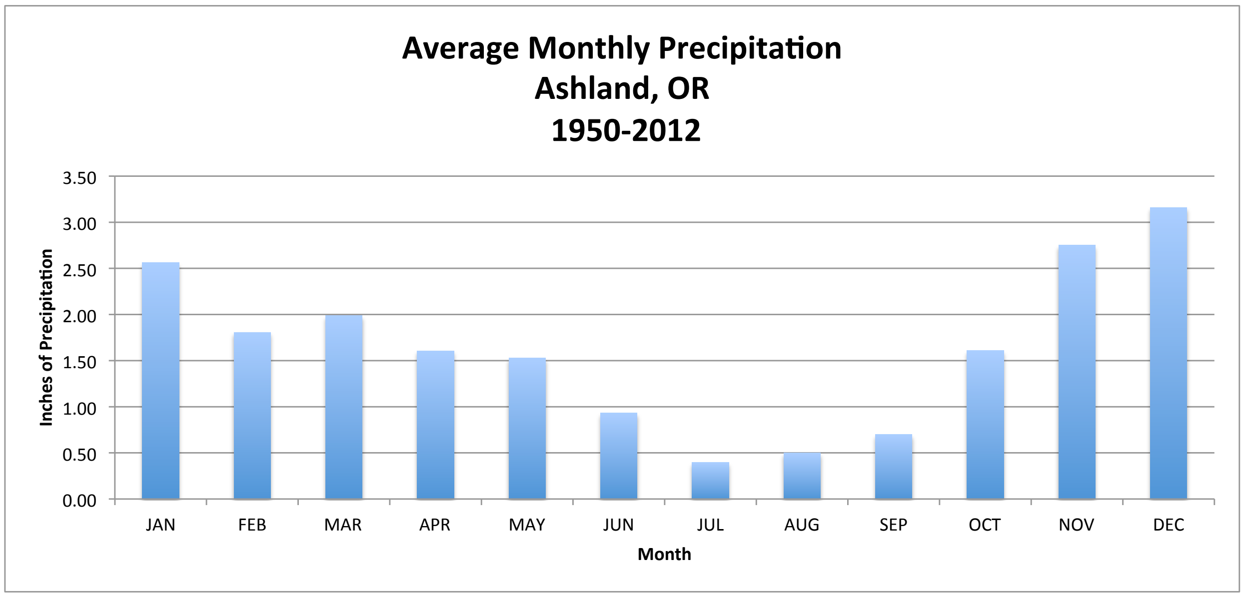
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1995	15.27	11.18	9.71	5.89	1.27	2.17	1.10	2.43	3.13	10.84	22.74	13.20	98.93	77.48	W
1996	12.85	13.18	2.78	11.64	3.70	1.06	0.99	1.02	3.82	12.39	10.12	23.12	96.67	64.75	W
1997	16.49	6.94	21.85	7.65	5.66	4.45	2.48	2.48	6.85	13.50	8.34	10.04	106.73	78.52	W
1998	19.98	9.39	8.64	2.42	3.53	1.52	1.42	0.00	0.69	4.16	22.48	24.19	94.89	56.39	
1999	17.07	26.57	11.32	3.00	3.43	2.71	1.28	1.47	0.37	6.72	18.89	18.30	111.13	101.63	W
2000	12.76	6.32	6.15	4.23	5.51	4.92	0.13	1.22	2.70	5.89	4.28	6.45	54.24	62.42	
2001	7.12	4.55	6.68	5.51	4.39	3.84	0.91	4.52	1.13	7.22	17.56	20.11	83.54	29.08	D
2002	18.02	7.80	8.36	6.49	2.35	2.55	0.31	0.03	1.72	0.99	9.54	15.59	73.75	71.85	W
2003	15.98	4.89	16.85	7.64	1.67	0.72	0.25	0.10	2.39	17.29	15.72	9.44	92.94	62.85	
2004	12.74	7.93	6.18	2.32	4.03	1.56	0.21	4.33	4.34	7.30	7.31	10.15	68.40	52.01	
2005	10.55	1.57	10.56	7.88	5.42	1.85	2.03	0.36	2.84	7.82	10.86	14.83	76.57	40.14	D
2006	26.81	5.97	7.64	3.68	3.64	2.62	0.47	0.31	1.42	3.02	30.48	14.46	100.52	66.11	W
2007	10.67	11.27	12.43	3.68	2.18	3.05	2.98	0.98	1.52	8.42	7.40	16.86	81.44	79.31	W
2008	10.78	6.85	8.76	4.00	1.81	2.41	0.48	4.02	0.69	4.38	16.96	9.56	70.70	50.65	D
2009	14.35	4.21	7.59	4.76	0.00	0.39	0.59	1.45	2.01	12.07	23.87	5.73	77.02	52.67	
2010	15.03	8.89	6.91	7.08	5.93	3.66	0.44	0.61	5.12	10.60	12.00	16.43	92.70	60.43	
2011	14.12	7.99	17.28	8.52	4.72	1.48	1.89	0.29	3.03	7.55	12.32	5.14	84.33	67.82	W
2012	12.39	9.45	15.51	7.58	4.94	4.00	1.34	0.10	0.13	15.27	16.44	18.60	105.75	54.81	
2013	9.00	6.18	8.29	8.81	4.39	2.90	0.00	1.60	8.85	2.43				58.51	
Avg (inche	**13.29**	**9.34**	**9.33**	**5.93**	**3.49**	**2.54**	**1.28**	**1.76**	**3.04**	**7.69**	**12.66**	**13.40**	**83.12**		



ASHLAND, OREGON

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	4.25	0.81	2.48	1.18	0.41	1.16	0	0.15	0.3	5.68	2.87	2.79	22.08		
1951	3.34	1.87	0.83	0.33	0.87	0	0	0.07	0.03	3.53	2.73	5.07	18.67	11.7	
1952	2.08	2.44	1.55	0.37	0.86	1.75	0.06	0.72	0.63	0.84	0.89	4.35	16.54	13.87	
1953	4.37	2.65	1.96	0.95	3.78	1.8	0	0.44	0.9	1.36	5.15	2.59	25.95	14.22	W
1954	5.04	1.37	1.01	0.93	0.19	2.05	0	1.19	1.62	0.56	0.89	1.5	16.35	15.16	W
1955	1.31	0.62	1.08	1.03	0.57	0	0.03	0	0.77	2.41	3.43	6.48	17.73	5.4	D
1956	4	3	0.57	0.43	4.61	1	1.52	0.32	0.05	4.57	1.02	2.87	23.96	17.48	W
1957	1.52	2.52	5.35	0.62	1.68	0.09	0.02	0.02	1.06	1.75	2.89	3.45	20.97	13.28	
1958	4.54	3.82	1.58	0.55	0.87	3.41	2.52	0.55	0.45	0.33	1.8	2.13	22.55	16.28	W
1959	1.39	1.68	1.35	0.67	1.74	0.22	0	0.6	0.9	0.46	0	1.21	10.22	8.35	D
1960	1.46	2.99	3.76	0.8	1.68	0.08	0.61	0.14	0.04	0.89	3.81	1.21	17.47	9.42	D
1961	0.5	2.33	2.25	1.27	1.69	0.14	0	0.34	1.41	2.13	2.66	1.82	16.54	10.1	
1962	1.21	0.83	1.76	0.79	1.96	0.54	0	0.71	0.47	7.43	3.44	3.07	22.21	8.28	D
1963	1.37	1.93	1.16	2.02	2.21	0.96	0.11	0.25	0.57	1.5	3.48	1.18	16.74	10.97	
1964	4.29	0.25	2.3	0.92	1.05	1.72	1.15	0.1	0.2	0.63	2.78	11.28	26.67	11.5	
1965	3.57	1.15	0.13	3.09	0.56	0.6	0	1.55	0	0.52	1.68	2.79	15.64	18.91	W
1966	2.33	0.91	1.42	0.42	0.2	0.6	0.68	0.04	1.29	0.58	4.11	2.88	15.46	9.13	D
1967	3.21	0.88	2.55	2.57	1.05	0.7	0	0.04	0.29	1.95	0.54	2.15	15.93	13.63	
1968	1.86	1.79	0.87	1.45	1.39	0.26	0	1.6	0.52	0.88	2.86	3.38	16.86	7.21	D
1969	5.54	2.24	0.36	1.51	1.9	3.68	0.05	0	0.45	2.36	0.65	5.6	24.34	14.38	W
1970	5.13	1.53	1.34	1.89	0.54	1.79	0	0	0.22	1.62	5.66	3.43	23.15	14.25	W
1971	3.36	1.8	2.65	2.02	1.5	1.05	0	0.43	1.67	1.5	3.13	2.99	22.1	16.9	W
1972	3.28	1.64	2.96	1.66	1.26	1.54	0.02	0.23	1.13	1.23	1.07	2.36	18.38	14	W
1973	1.77	0.45	1.88	1.37	0.53	0.15	0.02	0.35	0.6	3.12	5.06	2.37	17.67	7.53	D
1974	4.17	2.46	3.31	2	0.3	0	0.21	0	0	0.63	1.27	3.15	17.5	17.37	W
1975	2.61	1.93	3.06	1.37	0.27	1.02	0.28	0.41	0.67	2.63	2.18	2.05	18.48	12.02	
1976	1.64	2.02	1.2	1.14	0.34	0.29	0.47	3.08	1.07	0.36	0.45	0.68	12.74	9.09	D
1977	1.21	1.01	0.96	0.55	3.68	0.32	0.3	0.41	3.25	0.92	3.91	4.61	21.13	4.31	D
1978	1.28	1.6	2.08	2.02	0.66	1.99	0.6	1.16	2.45	0.23	1.6	0.9	16.57	13.48	
1979	2.51	1.32	1.33	3.27	1.42	1.04	0.02	0.45	0.42	3.91	2.93	2.07	20.69	7.66	D
1980	2.97	2.03	1.93	2.31	1.07	1.56	0	0	0.46	1.32	1.99	2.17	17.81	11.93	
1981	1.34	1.8	1.89	1.33	1.41	0.23	0.18	0	0.64	1.66	6.39	7.06	23.93	9.19	D
1982	1.22	2.88	2.69	1	0.07	1.19	0.1	0.12	1.38	1.48	2.61	5.39	20.13	20.24	W
1983	2.09	4.02	3.19	1.97	1.18	1.08	0.62	2.32	1.27	1.23	4.64	6.52	30.13	17.3	W
1984	0.18	2.14	2.48	1.78	0.75	1.26	0.41	1	0.77	2.36	5.73	3.74	22.6	15.96	W
1985	0.16	1.28	1.59	0.61	0.97	0.75	0.45	0.42	1.8	1.83	2.28	0.65	12.79	12.5	
1986	1.79	5.02	1.32	1.14	1.79	0.31	0.1	0.03	2.57	1.27	3.03	0.9	19.27	11.06	
1987	2.31	1.9	1.58	0.62	1.73	0.36	3.15	0	0	0	1.63	3.38	16.66	9.72	D
1988	1.84	0.29	1.39	1.97	2.31	1.69	0	0.1	0.45	0.1	4.49	1.11	15.74	8.53	D
1989	3.49	0.94	4.26	2.53	2.73	0.22	0	1.23	1.92	1.43	0.58	0.88	20.21	14.29	W
1990	3.7	1.1	2.56	1.74	2.31	0.23	0.73	1.2	0.66	1.32	1.75	1.36	18.66	8.82	D
1991	0.99	1.69	3.35	1.71	3.88	1.54	1.1	0.99	0	0.76	3.18	1.45	20.64	9.14	D
1992	0.77	0.54	0.79	1.31	1	1.23	1.44	0	0.05	2.02	1.4	3.08	13.63	6.73	D
1993	3.74	1.76	1.37	1.71	2.63	2.08	0.83	0.66	0	0.76	0.88	1.77	18.19	11.35	
1994	0.98	1.66	1.4	0.98	1.7	0.37	0	0	0.72	0.56	5.24	1.42	15.03	6.69	D

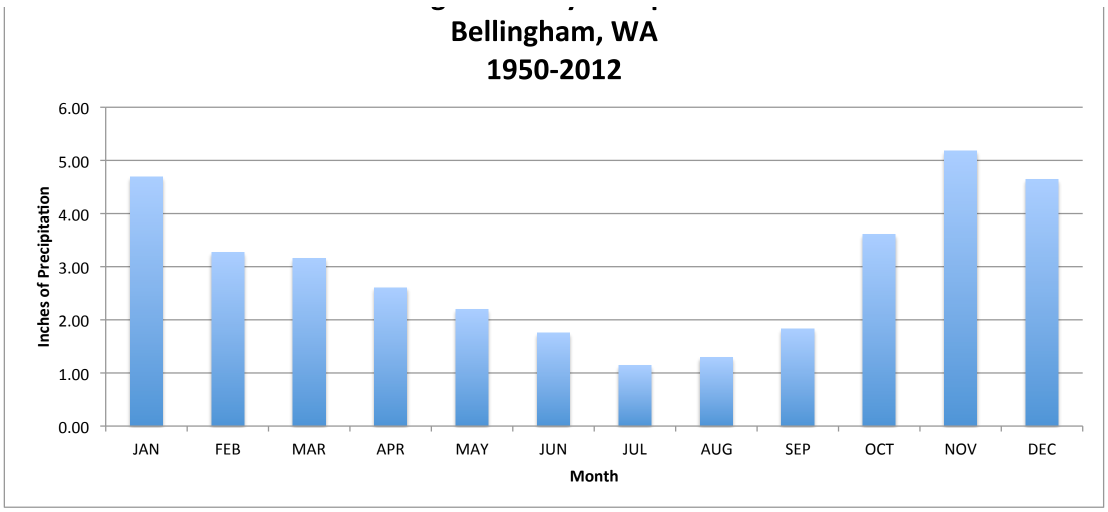
1995	4.02	0.17	3.03	3.36	2.03	2.74	1.36	0.32	0.3	0.41	1.38	8.37	27.49	13.88	W
1996	5.52	2.92	1.36	1.47	1.68	0.38	0.55	0.43	0.76	2.95	3.15	8.29	29.46	19.55	W
1997	4.99	2.16	1.16	1.8	0.96	1.42	0.74	1.05	0.71	2.4	1.73	1.25	20.37	19.75	W
1998	3.55	2.42	2.53	3.22	4.86	1.46	0.13	0	0.34	1.42	8.03	2.03	29.99	11.48	
1999	3.06	4.67	1.21	0.9	0.71	0.02	0.06	1.79	0	2.07	1.96	1.11	17.56	19	W
2000	3.8	1.98	2.26	3.59	0.69	0.63	1.39	0.07	0.23	2.03	1.69	0.85	19.21	11.11	
2001	0.8	0.77	1.9	1.55	0.53	0.28	0.31	0	1.5	0.13	3.5	3.41	14.68	6.01	D
2002	1.29	1.29	1.29	2.92	0.98	0.08	0.28	0	0.2	0.21	2.09	6.76	17.39	10.78	
2003	2.19	1.58	2.6	1.75	1.22	0	0	0.51	1.04	0.97	2.46	3.83	18.15	15.22	W
2004	2.42	2.82	1.43	1.33	2.17	0.22	0.32	1.5	0.13	3.17	1.92	3.32	20.75	12.96	
2005	0.76	0.26	1.39	2.08	3.85	0.52	0.05	0	0.56	1.03	5.68	5.7	21.88	7.65	D
2006	4.65	1.92	1.76	1.76	1.25	1.07	0	0.15	0.21	0.41	4.37	4.22	21.77	19.71	W
2007	1.82	3.42	1.17	1.73	0.39	0.52	1.22	0.74	0.54	4	2.33	2.46	20.34	15	W
2008	3.86	1.15	2.42	1.38	2.17	0.45	0	0.71	0	0.36	1.97	2.9	17.37	12.22	
2009	1.84	1.09	2.06	1.01	1.37	1.21	0	0.51	0.48	1.53	2.03	1.08	14.21	9.86	D
2010	1.68	0.7	3.01	3.33	1.68	0.65	0	0.23	0.93	1.88	2.15	4.03	20.27	8.5	D
2011	1.52	1.19	4.55	3.75	3.03	1.9	0.34	0	0.05	0.57	1.38	1.02	19.3	13.44	
2012	1.89	2.38	3.32	2.4	1.45	1.06	0.46	0	0	1.18	4.74	5.18	24.06	9.99	
2013	1.25	0.81	0.29	1.04										12.27	
Avg (inche	**2.56**	**1.81**	**1.99**	**1.61**	**1.53**	**0.93**	**0.40**	**0.50**	**0.70**	**1.61**	**2.75**	**3.16**	**19.54**		
YEAR(S)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**	**NDJFM Total**	**Wet/Dry Yrs**



BELLINGHAM 3 SSW, WASHINGTON

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	3.14	4.8	7.02	3.01	1.95	0.35	1.27	2.28	0.7	5.11	4.98	6.23	40.84		
1951	5.59	6.13	5.07	0.95	2.42	0.26	0.05	0.34	2.25	4.82	3.1	4.23	35.21	28	W
1952	2.42	2.21	2.81	2.32	1.68	2.09	0.6	0.44	1.45	2.16	1.37	2.82	22.37	14.77	D
1953	9.23	2.83	2.58	2.43	1.29	2.58	0.94	0.68	2.06	3.68	7.24	7.18	42.72	18.83	
1954	5.42	3.2	1.78	1.95	1.52	2.56	1.41	1.99	1.41	1.36	8.63	3.52	34.75	24.82	W
1955	3.1	4.12	2.09	2.58	2.61	1.94	1.96	0.17	1.03	4.43	6.68	5.66	36.37	21.46	
1956	4.53	2.15	2.77	0.37	0.7	4.48	0.13	1.24	3.6	6.2	2.49	6.22	34.88	21.79	
1957	2.12	2.57	4.35	2.6	0.69	1.02	1.56	0.41	0.8	2.55	2	3.44	24.11	17.75	
1958	3.92	4.08	1.2	2.4	1.29	0.86	0	0.85	1.59	7.25	7.32	4.07	34.83	14.64	D
1959	5.66	3.31	2.82	3.86	2.34	1.34	0.73	1.45	4.51	3.68	5.08	4.38	39.16	23.18	
1960	5.27	2.62	3.07	2.52	4.81	1.3	0	2.62	1.64	3.02	4.99	2.89	34.75	20.42	
1961	4.25	7.43	4.32	2.48	2.27	1	1.54	1.21	1.12	4.43	3.31	4.92	38.28	23.88	W
1962	2.92	1.48	2.76	2.38	2.07	0.97	0.33	4.77	2.26	2.92	5.36	4.02	32.24	15.39	D
1963	1.22	2.92	1.7	3.01	1.14	1.1	2.07	0.3	1.14	4.4	7.06	7.39	33.45	15.22	D
1964	5.15	2.39	4.56	3.01	2.71	1.96	2.75	1.77	4.08	2.3	4.71	3.81	39.2	26.55	W
1965	7.71	7.59	0.76	2.93	1.97	0.56	0.21	3.63	1.39	4.08	4.77	4.51	40.11	24.58	W
1966	3.08	1.78	3.53	2.44	3.03	0.98	2.43	0.85	2.28	4.33	3.51	6.43	34.67	17.67	D
1967	7.86	4.04	3.69	1.76	1.41	1.28	0.69	0.46	2.1	7.93	2.23	6.15	39.6	25.53	W
1968	3.59	3.57	4.29	1.54	2.02	2.35	1.17	3.35	2.55	3.88	4.76	5.46	38.53	19.83	
1969	4.35	1.14	2.66	4.56	1.62	1.48	0.59	0.56	4.71	2.39	2.34	3.17	29.57	18.37	
1970	5.79	2.34	1.19	3.65	1.36	1.4	1.46	0.15	2.56	2.3	4.47	3.32	29.99	14.83	D
1971	10.58	3.68	3.19	1.26	1.32	4.78	1.34	0.31	3.66	3.44	6.23	7.39	47.18	25.24	W
1972	4.06	6.61	5.37	3.92	1.49	2.68	2.73	1.07	1.73	1.31	2.66	7.56	41.19	29.66	W
1973	2.45	1.74	1.8	1.55	2.08	1.52	0.38	0.56	0.9	4.44	6.89	4.61	28.92	16.21	D
1974	6.83	3.98	3.39	2.13	2.97	1.29	1.92	0.03	0.34	1.5	4.16	4.92	33.46	25.7	W
1975	5.21	4.1	1.69	1.41	1.88	0.73	1.55	4.02	0.43	4.49	6.03	8.29	39.83	20.08	
1976	10.24	4.86	2.23	2.92	2.87	1.87	0.67	1.96	1.01	2.74	1.76	3.63	36.76	31.65	W
1977	3.45	1.78	4.64	2.21	3.69	0.25	1.24	2.38	1.82	2.65	5.08	5.04	34.23	15.26	D
1978	3.48	2.99	3.48	2.55	1.44	1.25	0.57	2.88	3.79	1.84	4.96	2.2	31.43	20.07	
1979	1.92	3.31	2.03	2.53	1.56	1.96	0.87	1.25	0.89	2.8	1.38	9.99	30.49	14.42	D
1980	2.11	4.23	3.21	2.82	1.93	3.46	1.35	0.66	2.38	1.22	8.73	7.07	39.17	20.92	
1981	1.72	5.05	2.84	4.3	2.16	4.11	2.3	0.72	2.07	6	3.07	5.1	39.44	25.41	W
1982	9.31	8.71	2.33	1.78	0.4	1.1	2.86	1.02	1.16	2.52	4.01	4.12	39.32	28.52	W
1983	4.38	2.61	2.49	2.6	1.85	1.59	2.59	0.66	4.2	1.91	6.14	2.8	33.82	17.61	D
1984	9.01	3.24	4.09	2.32	5.93	2.2	0.12	1.43	2.97	4.13	5.37	3.97	44.78	25.28	W
1985	0.77	2.07	2.01	2.9	2.01	1.9	0.07	0.4	0.87	6.82	5.01	1	25.83	14.19	D
1986	3.98	4.47	3.28	3.35	4.1	1.39	1.91	0	2.19	2.07	6.38	2.18	35.3	17.74	D
1987	3.61	2.12	2.57	3	1.72	1.38	1.93	0.4	0.66	0.29	2.35	5.4	25.43	16.86	D
1988	2.16	1.77	3.98	3.31	4.31	1.92	1.22	0.74	2.09	5.14	5.52	5.41	37.57	15.66	D
1989	5.56	1.83	4.91	2.63	3.05	0.84	1.04	2.57	0.25	2.87	10.09	4.02	39.66	23.23	W
1990	4.36	5.44	2.1	3.02	1.62	4.2	0.19	1.97	0.55	4.99	11.6	5.5	45.54	26.01	W
1991	4.98	3.36	2.65	3	1.47	0.6	0.15	3.34	0.05	1.27	6.93	2.88	30.68	28.09	W
1992	6.35	3.11	1.03	6.09	0.52	2.18	2.36	1.8	2.49	2.5	6.02	2.76	37.21	20.3	
1993	3.53	0.49	3.09	3.1	3.96	2.48	2.07	0.61	0.32	1.86	2.4	3.94	27.85	15.89	D
1994	1.75	3.99	1.9	2.17	0.75	2.39	0.69	0.18	1.99	3.58	5	4.69	29.08	13.98	D
1995	3.93	3.71	2.38	1.75	0.57	0.77	2.13	2.51	0.96	5.12	9.01	5.46	38.3	19.71	
1996	4.88	3.16	1.69	4.51	3.25	0.52	0.98	0.85	3.87	5.65	7.14	6.46	42.96	24.2	W
1997	6.21	3.4	5.65	2.8	3.61	2.55	1.69	0.59	2.69	5	2.88	3.88	40.95	28.86	W
1998	5.8	1.35	3.65	0.95	2.7	1.62	1.8	0.08	0.17	2.63	8.79	7.1	36.64	17.56	D
1999	4.86	3.68	4.14	1.88	2.87	2.04	0.87	1.63	0.34	3.41	5.89	5.26	36.87	28.57	W
2000	3.1	1.93	2.83	2.61	4.34	2.32	1.46	0.97	2.45	2.6	2.08	2.97	29.66	19.01	
2001	3.3	1.45	4.19	2.12	1.3	3.11	0.98	3.03	1.53	4.96	4.8	5.28	36.05	13.99	D
2002	5.47	3.78	2.16	2.28	1.94	1.16	0.59	0.05	1.33	1.05	3.28	4.25	27.34	21.49	
2003	4.51	1.96	3.46	2.61	1.89	1.14	0.69	0.21	1.48	8.29	4.72	1.75	32.71	17.46	D
2004	4.65	1.73	3.32	0.35	3.23	1.06	0.41	3.08	3.91	3.86	7.77	5.36	38.73	16.17	D
2005	4.62	2.05	3.01	3.8	1.7	1.55	0.77	1.73	0.91	5.09	5.17	3.86	34.26	22.81	
2006	8.12	3.23	1.42	2.81	1.76	1.75	0.62	0.59	1.68	1.58	12.06	4.35	39.97	21.8	
2007	5.86	3.06	5.56	2.13	1.33	1.68	1.08	0.73	1.5	3.8	2.45	4.98	34.16	30.89	W
2008	2.25	2.27	3.96	1.45	2.28	2.37	0.26	2.77	0.78	2.38	5.77	2.49	29.03	15.91	D
2009	5.47	2.12	2.69	1.99	0	0.4	0.52	1	2.15	6.95	6.97	1.74	32	18.54	
2010	4.07	2.08	3.27	2.09	4.1	2.69	0.09	0.68	4.22	2.21	4.64	5.82	35.96	18.13	
2011	6.57	2.21	4.28	4.49	3.89	0.77	1.12	0.32	0.98	0.22	4.5	2.23	31.36	23.52	W
2012	3.74	4.71	6.04	4.07	1.88	3.36	2.26	0.13	0.13	6.8	4.25	5.03	42.4	21.22	
2013	4.00	2.12	2.67	4.21										18.07	
Avg (inche	**4.69**	**3.27**	**3.16**	**2.61**	**2.20**	**1.76**	**1.15**	**1.29**	**1.83**	**3.61**	**5.18**	**4.64**	**35.38**		
YEAR(S)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**	**NDJFM Total**	**Wet/Dry Yrs**

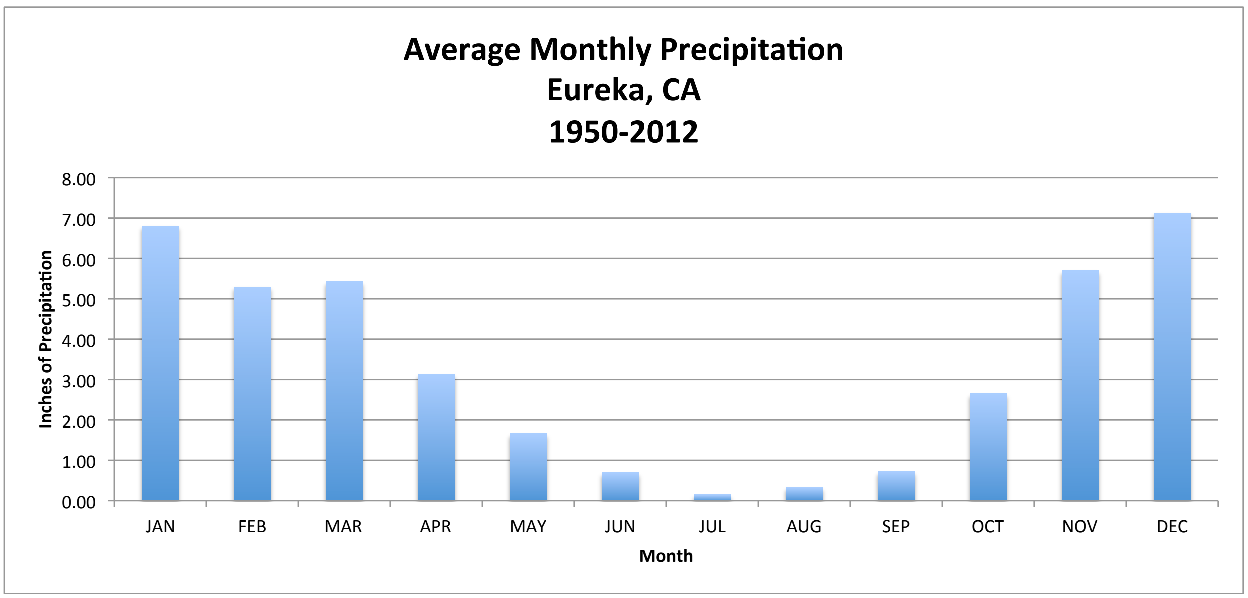
Average Monthly Precipitation


Bellingham, WA
1950-2012
Inches of Precipitation
6.00
5.00
4.00
3.00
2.00
1.00
0.00
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Month

EUREKA WSO CITY, CALIFORNIA

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	13.79	4.61	7.71	1.93	1.3	1.03	0.05	0.07	0.35	13.04	3.43	5.99	53.3		
1951	8.47	7.56	3.94	2.05	1.38	0	0.05	0.02	0.79	3.88	7.8	9.1	45.04	29.39	
1952	10.67	6.22	3.78	1.34	1.77	1.98	0	0.01	0.73	0.62	2.13	11.87	41.12	37.57	W
1953	12.63	3.44	5.95	3.18	5.83	1.24	0	0.41	0.61	3.84	9.57	3.62	50.32	36.02	W
1954	11.78	3.29	3.76	2.78	0.16	2.57	0.04	1.24	0.87	1.47	5.09	9.65	42.7	32.02	
1955	5.73	1.83	1.82	5.56	0.03	0.11	0.21	0	1.18	2.64	5.77	11.63	36.51	24.12	D
1956	11.51	7.47	2.36	0.31	1.58	1.71	0.06	0	0.33	5.47	0.49	7.18	38.47	38.74	W
1957	4.22	4.36	8.77	1.96	3.42	0.3	0.34	0.02	1.37	6	4.44	5.69	40.89	25.02	
1958	8.57	10.8	6.09	3.67	1.26	0.71	0.05	0	0.78	1.17	3.71	4.06	40.87	35.59	W
1959	7.23	10.65	3.37	0.52	0.91	0.25	0	0.01	1.54	0.74	0.28	3.64	29.14	29.02	
1960	3.87	7.48	8.13	2.92	6.05	0	0.02	0.04	0.01	1.31	9.87	5.08	44.78	23.4	D
1961	4.54	7.53	7.9	3.49	3.97	0.5	0.03	0.3	0.53	2.28	5.65	3.44	40.16	34.92	W
1962	3.26	6.08	4.04	2.62	0.6	0.11	0	1.92	0.71	6.49	6.77	2.58	35.18	22.47	D
1963	1.7	4.74	6.28	10.68	1.74	0.33	0.11	0.07	0.68	5.41	6.91	3.2	41.85	22.07	D
1964	11.13	1.2	5.91	0.67	1.59	0.72	0.83	0.03	0.07	1.82	12.11	10.96	47.04	28.35	
1965	5.82	1.36	1.23	5.6	0.44	0.35	0	0.36	0	0.7	5.2	5.22	26.28	31.48	
1966	9.44	3.12	6.57	1.34	0.06	0.3	0.25	0.5	1.33	1.02	9.86	6.52	40.31	29.55	
1967	8.87	1.47	7.44	5.29	1.52	0.32	0	0	1.32	2.15	4.4	4.34	37.12	34.16	W
1968	7.59	2.93	3.85	0.4	1.04	0.2	0.04	1.98	0.6	2.81	5.88	8.32	35.64	23.11	D
1969	13.92	7.82	1.56	3.22	1.01	0.34	0.05	0	0.36	3.2	3.49	9.6	44.57	37.5	W
1970	12.46	3.15	2.7	1.54	1.38	0.29	0	0	0.32	2.11	13.2	10.24	47.39	31.4	
1971	5.41	3.28	7.91	2.92	1.28	1.51	0.16	0.55	2.08	0.92	6.36	6.38	38.76	40.04	W
1972	7.96	5.93	5.08	2.27	1.11	0.88	0.01	0.07	1.06	1.97	5.41	7.42	39.17	31.71	
1973	6.47	3.85	7.1	0.35	0.85	0.23	0	0.08	2.35	4.14	16.58	7.02	49.02	30.25	
1974	6.02	5.98	6.98	3.15	0.42	0.33	0.11	0.32	0	1.76	2.75	6.4	34.22	42.58	W
1975	5.2	7.68	10.73	3.29	1.05	0.58	0.1	0.58	0.01	6.77	4.72	5.38	46.09	32.76	
1976	1.88	7.51	3.12	2.8	0.54	0.14	0.2	1.7	0.04	0.28	2.98	0.52	21.71	22.61	D
1977	1.9	2.24	4.33	1.2	2.1	0.07	0	0.2	3.35	2.79	4.51	6.6	29.29	11.97	D
1978	4.52	6.06	2.88	4.1	0.82	0.34	0.03	0.59	2.72	0.04	2.39	1.16	25.65	24.57	D
1979	3.82	6.26	1.7	3.94	2.25	0.05	0.31	0.13	1.15	6.14	6.19	3.75	35.69	15.33	D
1980	3.19	4.67	6.14	4.18	1.7	0.42	0	0.07	0.14	1.38	2.49	6.1	30.48	23.94	D
1981	7.67	3.72	4.64	0.71	2.02	0.57	0	0.01	0.97	3.71	9.39	9.88	43.29	24.62	D
1982	4.75	5.76	7.06	5.97	0.07	0.78	0.08	0.03	0.62	4.89	7.83	10.3	48.14	36.84	W
1983	8.48	9.18	10.73	5.47	1.12	0.65	0.89	3.42	0.87	1.87	10.4	14.13	67.21	46.52	W
1984	0.76	5.18	4.7	2.76	2.51	1.07	0.03	0.05	0.55	3.67	15.15	4.27	40.7	35.17	W
1985	0.66	3.69	4.68	0.45	1.14	0.89	0.15	0.52	1.06	4.07	2.98	2.78	23.07	28.45	
1986	7.19	10.08	6.12	1.46	2.34	0.21	0.02	0	2.7	1.75	1.85	3.83	37.55	29.15	
1987	6.48	3.38	6.1	1.15	0.41	0.26	0.2	0.06	0.02	1.05	4.23	10.92	34.26	21.64	D
1988	7.13	0.54	1.18	2.06	2.7	2.22	0.05	0	0.12	0.41	8.93	6.26	31.6	24	D
1989	4.71	2.88	7.63	2.01	1.67	0.21	0.08	0.13	0.85	2.9	1.6	0.8	25.47	30.41	
1990	7.2	4.5	3.3	1.41	3.74	0.32	0.22	0.71	0.19	1.73	3.07	2.91	29.3	17.4	D
1991	1.65	2.75	6.94	2.52	2.16	0.26	1.13	0.37	0	1.06	1.95	2.36	23.15	17.32	D
1992	3.99	3.8	3.51	2.42	0.06	1.27	0.25	0.01	0.33	2.08	2.21	9.33	29.26	15.61	D
1993	7.15	5.93	4.72	5.94	4.44	1.23	0.37	0.54	0.03	0.56	1.35	7.12	39.38	29.34	
1994	5.09	7.12	2.06	3.3	1.1	0.71	0.08	0	0.06	0.54	8.21	7	35.27	22.74	D

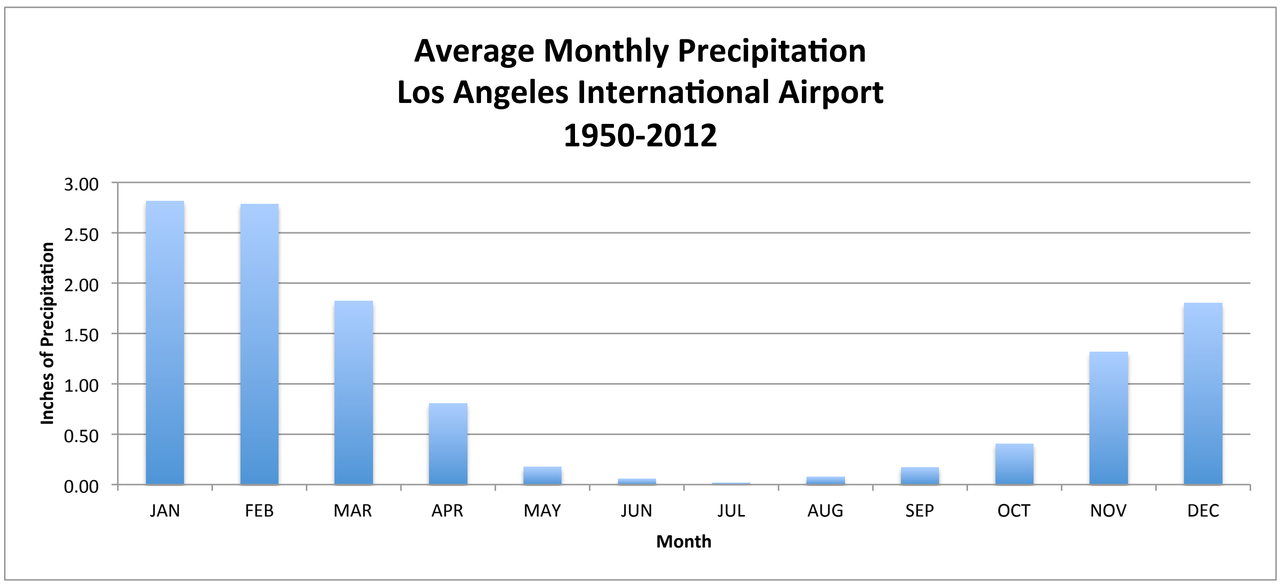
1995	12.74	1.4	11.18	7.47	1.21	1.85	0.08	0.22	0.69	0.53	2.26	11.56	51.19	40.53	W
1996	10.74	8.11	3.51	4.64	2.4	0.05	0.03	0	1.21	3.5	5.16	21.26	60.61	36.18	W
1997	8.81	2.55	2.73	3.06	0.9	1.25	0	0.84	2.05	2.73	7.39	4.73	37.04	40.51	W
1998	13.42	13.95	7.83	2.23	3.12	0.33	0.16	0.01	0.08	3.06	14.09	5.4	63.68	47.32	W
1999	4.37	10.32	8.94	1.79	1.62	0.15	0.04	0.3	0.05	1.6	7.36	3.02	39.56	43.12	W
2000	9.71	7	2.81	2.15	1.86	0.54	0.04	0	0.55	2.99	3.51	1.97	33.13	29.9	
2001	3.79	3.6	2.45	2.54	0.71	0.69	0.2	0.21	0.28	1	7.71	11.56	34.74	15.32	D
2002	6.37	5.76	4.32	2.42	0.55	0.28	0.03	0.01	0.06	0.06	2.66	23.31	45.83	35.72	W
2003	5.51	3.84	4.91	11.25	1.74	0.04	0.02	0.49	0.35	0.55	5.78	11.35	45.83	40.23	W
2004	6.29	8.12	2.38	1.68	1.37	0.06	0.06	0.43	0.68	5.71	1.87	9.43	38.08	33.92	W
2005	5.91	2.41	6.24	4.7	3.9	3.08	0.05	0.07	0.08	2.4	8.52	12.72	50.08	25.86	
2006	12.09	6.34	11.11	4.08	1.03	0.35	0.04	0	0.09	0.58	7.41	7.09	50.21	50.78	W
2007	1.86	11.86	2.51	2.72	0.86	0.46	0.97	0.08	0.6	4.92	2.33	7.3	36.47	30.73	
2008	9.7	2.51	3.16	2.12	0.04	0.24	0.02	0.47	0.05	0.93	4.05	6.66	29.95	25	D
2009	1.58	6.2	5.45	1.23	2.93	0.18	0.06	0.02	1.03	1.95	4.15	4.17	28.95	23.94	D
2010	9.29	4.2	6.06	7.76	3.51	2.31	0.04	0.15	1.39	4.26	4.69	10.08	53.74	27.87	
2011	2.23	3.62	11.88	4.07	1.43	1.29	0.17	0.04	0.37	4.21	3.86	2.22	35.39	32.5	
2012	7.76	2.63	12.02	4.76	0.77	2	0.67	0.07	0.04	1.35	6.37	10.76	49.2	28.49	
2013	2.19	1.75	2.89	2.24										23.96	D
Avg (inche	**6.80**	**5.29**	**5.43**	**3.14**	**1.66**	**0.69**	**0.15**	**0.33**	**0.72**	**2.65**	**5.69**	**7.13**	**39.68**		
YEAR(S)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**	**NDJFM Total**	**Wet/Dry Yrs**



LOS ANGELES WSO ARPT, CALIFORNIA

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	2.53	2.04	0.47	0.41	0	0.02	0.03	0	0.11	0.12	0.94	0.01	6.68		
1951	2.82	0.54	0.38	1.37	0.02	0	0	0.06	0	0.23	0.71	4.63	10.76	4.69	D
1952	7.23	0.72	4.33	1.21	0	0	0	0	0.06	0	2.76	2.28	18.59	17.62	W
1953	1.13	0.1	0.44	1.78	0	0	0.02	0	0	0	1.23	0.06	4.76	6.71	D
1954	4.78	3.36	2.6	0.11	0.02	0.01	0.01	0.04	0	0	1.24	0.74	12.91	12.03	W
1955	4.12	0.88	0.15	2.2	0.42	0.07	0.01	0	0	0	1.35	0.94	10.14	7.13	
1956	8.07	0.51	0	2.07	0	0	0	0	0	0.01	0	0.49	11.15	10.87	
1957	3.88	1.94	0.95	1.33	0.27	0.06	0.03	0	0	1.27	0.46	2.1	12.29	7.26	
1958	1.49	6.26	5.25	2.04	0.01	0	0	0.02	0.03	0.32	0	0.01	15.43	15.56	W
1959	1.11	3.72	0	0.39	0	0	0	0	0.04	0.01	0.06	1.11	6.44	4.84	D
1960	2.83	2.9	0.21	2	0	0	0	0	0	0	2.67	0.06	10.67	7.11	D
1961	1.27	0	0.46	0.02	0	0	0.01	0.3	0.04	0	1.88	1.07	5.05	4.46	D
1962	2.68	11.07	1.11	0	0.06	0	0	0	0	0.07	0.02	0.01	15.02	17.81	W
1963	0.62	4.48	2.42	1.41	0.02	0.24	0	0.01	1.13	0.42	2.76	0	13.51	7.55	
1964	1.49	0	1.2	0.2	0.01	0.29	0	0	0	0.3	1.07	1.95	6.51	5.45	D
1965	0.43	0.34	1.63	4.52	0	0.03	0	0.12	0.11	0	6.38	3.25	16.81	5.42	D
1966	0.84	1.4	0.49	0.01	0.02	0	0.01	0	0.19	0.04	2.69	3.67	9.36	12.36	W
1967	2.71	0.05	1.47	2.68	0.03	0	0	0	0.44	0	7.47	1.05	15.9	10.59	
1968	0.84	0.44	3.77	0.49	0	0	0.04	0	0	0.32	0.24	1.42	7.56	13.57	W
1969	9.6	3.76	0.42	0.38	0	0	0.15	0	0.01	0	1.37	0.01	15.7	15.44	W
1970	1.44	1.39	1.29	0	0	0.01	0	0	0	0.02	3.68	4.12	11.95	5.5	D
1971	0.66	0.36	0.23	0.68	0.17	0	0	0	0	0.28	0.22	5.7	8.3	9.05	
1972	0	0.16	0	0	0.01	0.06	0	0.06	0.03	1.79	3.13	1.88	7.12	6.08	D
1973	3.16	4.87	2.42	0	0.01	0	0	0.02	0	0.08	1.92	0.45	12.93	15.46	W
1974	5.68	0.13	2.49	0.14	0.02	0	0	0	0	0.54	0	3.76	12.76	10.67	
1975	0.01	3.21	2.98	0.74	0.04	0	0	0	0	0.24	0	0.1	7.32	9.96	
1976	0	2.15	0.83	0.77	0	0.28	0.02	0.03	1.85	1.5	0.87	0.95	9.25	3.08	D
1977	3.21	0.26	1.23	0	2.55	0	0	2.47	0	0	0.04	3.92	13.68	6.52	D
1978	7.48	7.66	5.75	1.23	0	0	0	0	0.39	0.04	1.2	0.83	24.58	24.85	W
1979	5.26	2.53	4.74	0	0	0	0	0	0.04	0.31	0.22	0.42	13.52	14.56	W
1980	6.97	9.13	3.69	0.17	0.07	0	0	0	0	0	0	1.57	21.6	20.43	W
1981	1.51	1.58	3.24	0.46	0	0	0	0	0.05	0.4	2.63	1.52	11.39	7.9	
1982	2.78	0.66	3.41	1.61	0.11	0.01	0	0	0.78	0.18	3.48	0.66	13.68	11	
1983	5.25	5.64	6.37	3.18	0.04	0.03	0	1.25	1.91	0.94	2.74	2.11	29.46	21.4	W
1984	0.39	0.01	0.14	1.16	0	0	0	0.29	0.09	0.28	1.24	4.21	7.81	5.39	D
1985	0.7	1.91	0.72	0	0.16	0	0	0	0.28	0.36	4.75	0.44	9.32	8.78	
1986	2.31	5.36	4.89	0.3	0	0	0.09	0	1.44	0.1	1.14	0.3	15.93	17.75	W
1987	1.27	0.64	0.92	0.02	0	0.09	0.08	0	0.08	1.74	0.6	1.79	7.23	4.27	D
1988	1.61	1.79	0.08	1.14	0	0	0	0.02	0.07	0	0.73	2.52	7.96	5.87	D
1989	0.59	1.72	0.86	0	0.04	0	0	0	0.26	0.34	0.38	0	4.19	6.42	D
1990	1.18	2.6	0.14	0.34	0.83	0	0	0.02	0	0	0.1	0.03	5.24	4.3	D
1991	1.38	2.53	3.96	0	0	0	0.17	0	0.09	0.06	0	2.86	11.05	8	
1992	1.61	4.7	5.08	0.18	0.04	0	0.32	0	0	0.5	0	4.16	16.59	14.25	W
1993	10.63	5.48	1.83	0	0	0.74	0	0	0	0.09	0.93	0.97	20.67	22.1	W

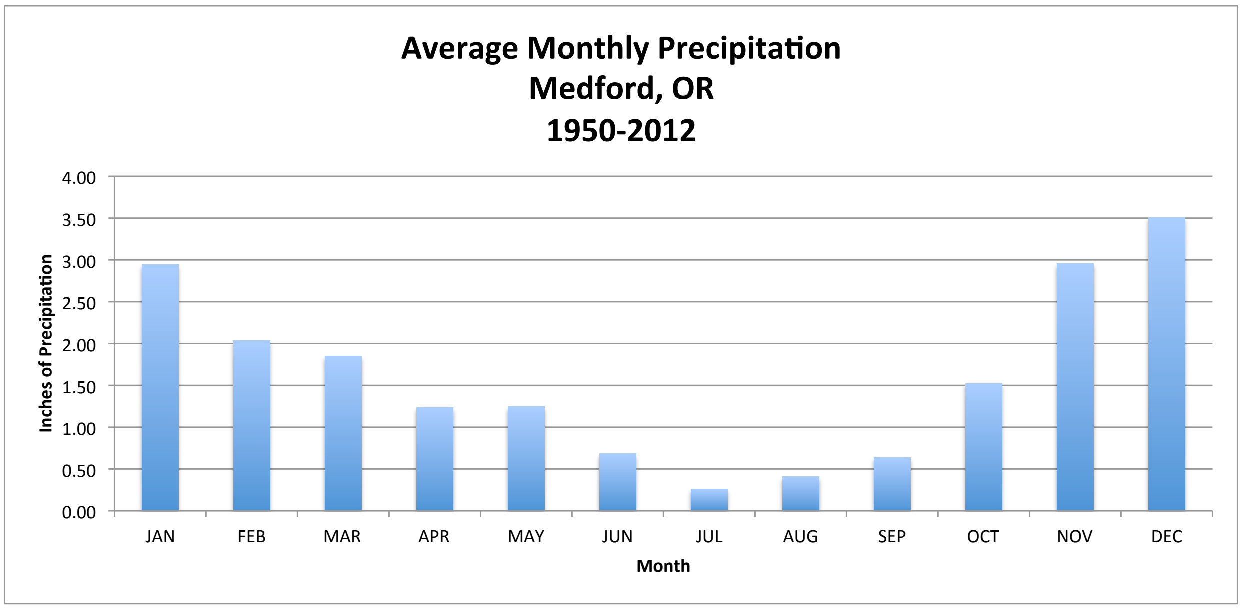
1994	0.33	4.36	1.01	0.44	0.08	0	0	0	0	0.14	0.66	1.05	8.07	7.6	
1995	12.71	0.62	5.67	0.74	0.61	0.6	0.06	0	0	0.01	0.1	2.16	23.28	20.71	W
1996	1.94	4.19	1.36	0.42	0.05	0	0	0	0	1.46	1.93	4.74	16.09	9.75	
1997	5.12	0.05	0	0	0	0	0	0	0.27	0	2.66	3.93	12.03	11.84	W
1998	3.71	13.79	3.37	1	2.46	0.09	0	0	0.01	0	1.89	0.74	27.06	27.46	W
1999	1.19	0.5	2.12	2.23	0	0.59	0	0	0	0	0.28	0	6.91	6.44	D
2000	0.85	4.71	2.39	1.88	0	0	0	0.03	0.03	1.12	0	0	11.01	8.23	
2001	4.68	7.3	1.29	1.1	0.01	0	0	0	0	0.04	1.34	1.25	17.01	13.27	W
2002	0.73	0.35	0.27	0.02	0.11	0.05	0	0	0.08	0.05	1.6	1.77	5.03	3.94	D
2003	0	3.78	1.66	0.49	0.95	0	0.02	0	0	0.71	0.8	1.14	9.55	8.81	
2004	0.49	4.61	0.77	0.03	0.04	0	0	0	0	3.78	0.11	6.49	16.32	7.81	
2005	6.87	6.95	1.08	0.9	0.33	0	0	0	0.25	1.01	0.47	0.95	18.81	21.5	W
2006	1.42	2.03	2.52	1.63	0.6	0.01	0.1	0.01	0	0	0.25	0.61	9.18	7.39	
2007	0.39	0.82	0.09	0.36	0	0	0.01	0	0.49	0.64	0.5	1.59	4.89	2.16	D
2008	4.67	2.17	0.03	0.03	0.11	0	0	0	0	0	1.5	2.51	11.02	8.96	
2009	0.51	3.41	0.05	0	0	0.15	0	0	0	1.3	0	2.05	7.47	7.98	
2010	4.3	3.23	0.21	1.25	0.08	0	0	0	0	1.56	0.59	8.83	20.05	9.79	
2011	0.81	1.47	4.04	0	0.53	0.02	0	0	0.01	0.63	1.69	0.67	9.87	15.74	W
2012	1.19	0.12	1.78	1.51	0.01	0	0	0	0	0.15	1.31	2.85	8.92	5.45	D
2013	1.30	0.20	0.64	0.06										6.30	D
Avg (inche	**2.82**	**2.78**	**1.82**	**0.81**	**0.17**	**0.05**	**0.02**	**0.08**	**0.17**	**0.40**	**1.32**	**1.80**	**12.24**		
YEAR(S)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**	**NDJFM Total**	**Wet/Dry Yrs**



MEDFORD WSO AP, OREGON

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	5.96	1.18	2.03	0.58	0.43	1.27	0	0	0.67	9.16	2.16	5.13	28.57		
1951	4.05	2.72	0.82	0.73	0.51	0	0	0.27	0.22	3.48	2.43	4.77	20	14.88	W
1952	3.2	2.88	1.2	0.25	1.27	1.73	0.04	0.47	0.64	0.14	1.3	5.58	18.7	14.48	
1953	5.49	2.04	1.5	0.55	3.6	1.16	0	0.52	1.57	1.42	5.09	2.62	25.56	15.91	W
1954	6.18	1.69	0.84	0.94	0.33	1.25	0	0.4	1.18	0.51	0.68	2.25	16.25	16.42	W
1955	1.31	0.63	1.03	1.04	0.18	0.07	0.01	0	0.83	2.19	3.85	8.77	19.91	5.9	D
1956	5.88	4.95	1.31	0.64	4.18	0.8	0.94	0.32	0.64	5.89	0.91	2.32	28.78	24.76	W
1957	1.7	2.99	5.54	0.36	1.1	0.03	0.16	0	0.8	1.64	2.28	3.92	20.52	13.46	
1958	5.63	5.37	1.83	0.4	1.01	2.72	1.35	0.14	0.28	0.42	1.63	2.51	23.29	19.03	W
1959	1.99	2.78	0.88	0.59	1.4	0.27	0	0.28	0.29	0.61	0.16	1.17	10.42	9.79	D
1960	2.35	4.12	4.4	0.67	1.97	0	0.09	0.03	0.18	0.38	4.7	1.71	20.6	12.2	
1961	1.12	2.74	3.05	0.96	1.86	0.34	0.1	0.15	0.93	2.38	3.42	2.6	19.65	13.32	
1962	1.69	1.05	1.55	0.81	0.8	0.15	0	1	0.76	6.27	4.37	4.68	23.13	10.31	D
1963	1.75	2.47	0.88	2.25	2.23	0.92	0.15	0.26	0.26	1.4	5.25	1.05	18.87	14.15	
1964	5.6	0.21	2.7	0.37	0.82	0.79	0.97	0.1	0.15	0.9	3.75	12.72	29.08	14.81	W
1965	4.3	0.7	0.41	3.07	0.31	1.05	0.03	1.52	0	0.46	2.56	3.71	18.12	21.88	W
1966	4.8	0.37	1.7	0.45	0.2	0.37	1.63	0.19	1.88	0.76	5.89	2.8	21.04	13.14	
1967	5.44	1.14	2.08	1.72	0.96	0.27	0	0	0.28	2.34	1.04	3.4	18.67	17.35	W
1968	1.86	2.95	0.9	0.38	1.05	0.06	0	1.33	0.32	0.62	3.04	2.78	15.29	10.15	D
1969	6.16	1.46	0.29	0.6	1.62	1.31	0.02	0	0.62	2.46	0.49	5.44	20.47	13.73	
1970	6.19	1.7	1.13	1.44	0.34	0.59	0	0.34	0.22	1.39	6.57	3.36	23.27	14.95	W
1971	3.68	1.43	2.72	1.34	1.13	0.97	0.07	0.28	1.24	0.61	3.43	2.45	19.35	17.76	W
1972	3.55	2.49	3.62	0.94	1.61	1.59	0	0.36	0.52	1.21	1.5	3.23	20.62	15.54	W
1973	1.98	0.54	1.58	0.76	0.45	0.06	0.04	0.03	0.64	2.79	7.01	3.02	18.9	8.83	D
1974	4.32	2.78	3.26	1.7	0.22	0	0.1	0	0	1.17	1.13	3.91	18.59	20.39	W
1975	2.64	2.64	3.97	1.27	0.24	0.38	0.22	0.54	0.65	2.21	1.85	2.74	19.35	14.29	
1976	1.62	2.21	1.13	1.67	0.11	0.04	0.84	2.83	0.9	0.18	0.43	0.36	12.32	9.55	D
1977	1.17	0.67	1.12	0.81	2.37	0.53	0.23	0.36	4.22	0.96	4.91	4.81	22.16	3.75	D
1978	1.53	2.45	2.03	1.26	1.59	1.02	0.54	1.46	1.68	0.01	1.5	0.66	15.73	15.73	W
1979	2.81	1.54	0.83	2.24	1.42	0.55	0.02	0.63	0.32	3.98	3.17	2.73	20.24	7.34	D
1980	2.59	1.78	1.27	1.75	0.69	1.22	0.02	0	0.18	1.52	2.28	2.59	15.89	11.54	
1981	0.54	1.72	1.23	0.55	1.17	0.47	0.41	0	0.52	1.23	6.05	8.02	21.91	8.36	D
1982	1.43	3.64	2.3	0.87	0	0.85	0.07	0.03	0.97	1.6	2.17	5.31	19.24	21.44	W
1983	0.92	5.67	3.21	1.12	0.81	0.66	0.59	2.21	2.05	1.21	4.97	6.73	30.15	17.28	W
1984	0.19	2.5	2.05	1.11	0.39	0.79	0.16	0.4	0.51	1.93	6.56	1.96	18.55	16.44	W
1985	0.23	1.58	1.22	0.39	1	0.37	0	0.02	1.53	1.5	2.02	0.83	10.69	11.55	
1986	1.99	5.22	1.02	0.23	1.19	0.45	0	0	2.31	1.49	2.45	0.72	17.07	11.08	D
1987	2.89	2.24	1.34	0.45	0.95	0.12	1.34	0	0	0	1.68	3.77	14.78	9.64	D
1988	2.53	0.2	0.57	1.07	1.51	1.04	0	0.02	0.22	0.12	5.14	1.28	13.7	8.75	D
1989	2.33	0.78	3.94	2.42	1.01	0.16	0	0.41	1.94	0.71	0.71	0.68	15.09	13.47	
1990	2.94	1.06	1.49	0.82	1.86	0.17	0.11	0.99	0.13	1.29	1.52	1.12	13.5	6.88	D
1991	1.55	1.73	2.42	1.07	1.84	0.68	1.1	0.22	0	0.39	2.42	1.08	14.5	8.34	D
1992	0.84	0.63	0.42	1.1	1.3	2.62	0.58	0	0.06	2.37	1.54	3.52	14.98	5.39	D
1993	2.65	1.37	1.25	1.83	2.63	1.23	0.66	1.21	0	0.66	0.68	2.43	16.6	10.33	D
1994	1.06	1.21	1.35	0.58	0.57	0.12	0.21	0	0.83	0.46	4.64	1.07	12.1	6.73	D

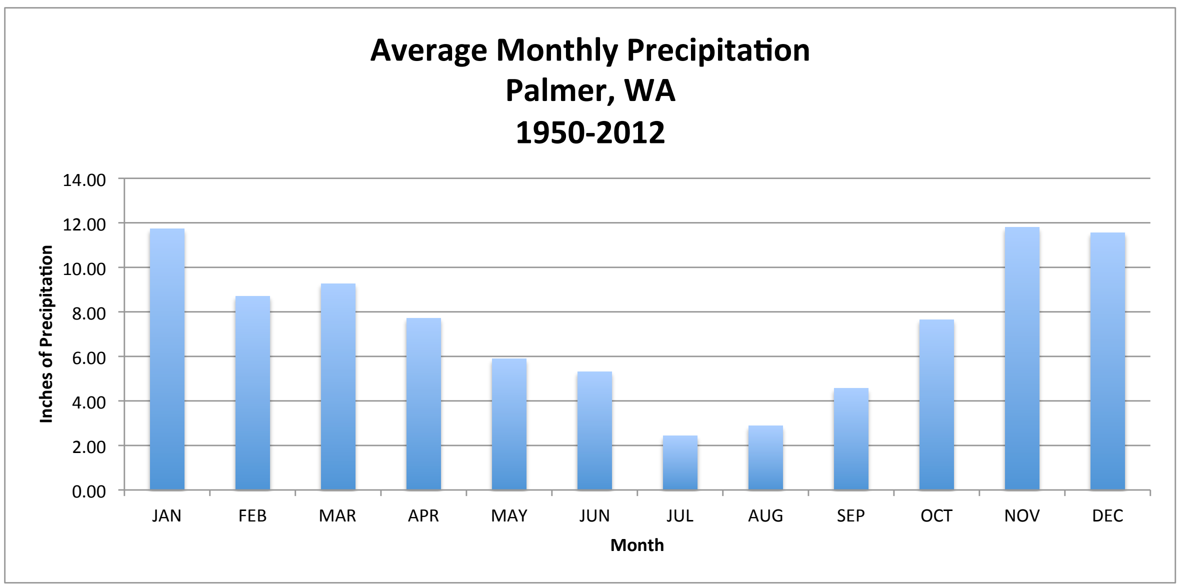
1995	3.76	0.4	2.63	2.49	0.54	1.54	1.17	0	0.12	0.2	1.26	7.66	21.77	12.5	
1996	5.44	2.96	1.55	1.3	2.89	0.22	0.3	0.08	0.49	2.2	4.04	9.94	31.41	18.87	W
1997	3.44	1.11	1	1.98	1.09	1.42	0.02	1.39	0.83	2.19	2.1	1.36	17.93	19.53	W
1998	4.78	3.27	2.73	2.25	4.26	0.67	0	0	0.05	1.81	7.67	1.23	28.72	14.24	
1999	3.65	4.32	0.81	0.44	0.66	0	0.04	2.03	0	1.72	1.94	0.89	16.5	17.68	W
2000	5	2.76	1.52	3.59	0.75	0.43	0.58	0.07	0.38	1.51	1.24	0.98	18.81	12.11	
2001	1	0.82	1.55	1.15	0.4	0.38	0.19	0.03	0.79	0.19	4.16	4.35	15.01	5.59	D
2002	1.59	1.65	1.33	1.49	0.53	0.03	0.08	0	0.53	0.16	3.42	7.19	18	13.08	
2003	2.48	1.74	2.52	3.53	0.86	0	0	0.76	0.86	0.05	2.38	4.66	19.84	17.35	W
2004	2.98	3.35	1.27	0.75	1.27	0.18	0	0.52	0.04	2.9	1.7	4.13	19.09	14.64	
2005	1.6	0.3	1.77	2.16	2.97	0.68	0.07	0	0.48	0.39	5.93	7.07	23.42	9.5	D
2006	5.12	1.94	2.19	1.26	1.51	0.81	0	0	0.06	0.38	3.78	4.75	21.8	22.25	W
2007	1.66	3.57	0.97	1.34	0.27	0.2	0.62	0.23	0.59	2.06	2.81	2.78	17.1	14.73	
2008	3.77	0.54	1.85	0.69	1.2	0.09	0	0.04	0.01	0.4	2.29	2.93	13.81	11.75	
2009	1.52	0.91	1.57	0.35	2.18	1.14	0	0.38	0.08	0.65	1.22	1.81	11.81	9.22	D
2010	2.77	1.03	2.1	2.92	1.53	1	0	0.86	0.79	2.06	1.94	4.31	21.31	8.93	D
2011	1.73	1.23	4.26	2.12	2.2	0.69	0.6	0	0.01	0.65	1.99	0.94	16.42	13.47	
2012	2.76	2.19	3.72	1.92	1.1	2.36	0.09	0	0	1.96	5.1	5.71	26.89	11.6	
2013	0.91	0.42	0.42	0.75										12.56	
Avg (inche	**2.95**	**2.04**	**1.85**	**1.24**	**1.25**	**0.68**	**0.26**	**0.41**	**0.64**	**1.52**	**2.96**	**3.51**	**19.30**		
YEAR(S)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**	**NDJFM Total**	**Wet/Dry Yrs**



PALMER 3 SE, WASHINGTON

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	11.55	14.72	16.72	11.61	5.57	3.99	1.38	4.7	4.43	15.53	14.27	15.75	120.2		
1951	13.83	17.39	8.64	2.24	5.07	1.36	0.15	1.55	5.6	10.48	11.2	12.15	89.66	69.88	W
1952	6.83	7.11	11.18	5.19	5.46	4.75	1.26	1.54	2.09	1.63	2.68	8.25	57.97	48.47	
1953	30.3	10.18	9.51	8.26	8.75	7.51	2.2	3.16	3.72	8.17	14.63	19.2	125.6	60.92	W
1954	16.48	8.7	6.02	9.83	4.53	9.74	3.99	4.66	3.9	4.62	9.42	13.03	94.92	65.03	W
1955	6.32	9.9	11.46	11.09	7.13	4.92	5.39	1.31	3.72	16.12	16.45	16.98	110.8	50.13	
1956	13.8	9.12	16.01	3.03	3.57	7.11	1.15	1.36	4.99	15.2	5.73	17.45	98.52	72.36	W
1957	5.68	8.77	12.97	7.03	3.44	6.15	2.36	1.73	2.11	8.23	7.37	14.44	80.28	50.6	
1958	15.52	10.49	3.51	11.46	1.37	4.76	0.03	2	5.12	7.7	20.77	16.74	99.47	51.33	
1959	16.76	7	12	11.61	7.6	6.85	1.97	2.49	19.56	9.75	16.63	14.02	126.2	73.27	W
1960	7.32	9.45	10.43	9.57	11.92	4.09	0.02	6.52	3.14	9.64	18.05	7.54	97.69	57.85	
1961	12.41	20.88	9.35	10.33	8.03	2.18	1.65	1.3	4.95	10.31	7.65	13.9	102.9	68.23	W
1962	6.62	4.99	9.83	7.7	6.41	3.55	2.11	7.05	4.37	5.34	16.73	13.36	88.06	42.99	D
1963	4.32	10.08	9.26	8.66	3.69	7.13	5.33	2.73	1.93	9.34	16.87	10.38	89.72	53.75	
1964	20.82	6.88	10.8	9.44	7.87	8.62	2.93	5.6	7.06	6.48	12.97	14.25	113.7	65.75	W
1965	17.41	12.05	2.84	7.85	4.59	0.69	1.49	4.47	2.55	7.75	9.19	10.24	81.12	59.52	W
1966	10.6	7.12	7.78	5.99	4.15	6.58	3.86	2.04	3.79	10	9.69	13.54	85.14	44.93	D
1967	17.66	7.71	10.39	6.11	2.42	2.97	0.31	0.33	3.46	10.41	6	11.96	79.73	58.99	
1968	11.78	10.64	9.48	6.93	4.6	9.09	2.19	9.52	6.21	8.27	10.43	12.41	101.6	49.86	
1969	11.77	3.81	5.53	7.63	6.68	6.36	2.02	1.69	10.02	4.73	5.69	13.09	79.02	43.95	D
1970	12.39	5.3	7.29	10.6	4.17	2.97	3.04	0.55	6.54	7.53	9.18	11.37	80.93	43.76	D
1971	18.05	8.96	12.28	5.68	7.5	7.01	2.54	1.36	7.82	6.88	12.23	11.83	102.1	59.84	W
1972	10.03	16.25	11.9	10.83	3.69	7.74	5.78	1.75	9.9	3.26	7.65	16.3	105.1	62.24	W
1973	7.71	3.51	5.76	5.04	5.42	7.83	0.79	0.67	4.3	6.9	15.44	14.37	77.74	40.93	D
1974	17.07	10.79	10.9	9	7.36	5.94	4.95	0.68	0.9	2.64	12.98	15.67	98.88	68.57	W
1975	15.88	10.85	9.19	6.33	5	4.65	1.26	8.48	0.42	14.5	11.18	21.2	108.9	64.57	W
1976	14.12	9.54	7.34	6.32	4.36	5.03	2.78	6.45	3.8	4.1	0	7.12	70.96	63.38	W
1977	4.54	3.95	9.59	4.86	9.12	2.73	1.61	7.03	6.49	5.04	12.02	12.98	79.96	25.2	D
1978	6.76	5.98	4.76	8.96	5.47	3.3	2.01	3.98	9.8	2.84	10.87	8.8	73.53	42.5	D
1979	5.41	15.6	4.38	7.18	3.25	2.07	3.99	1.88	4.45	7.74	4.06	17.52	77.53	45.06	D
1980	9.06	9.32	9.87	6.5	4.54	3.66	2.19	4.41	6.22	2.04	13.74	14.05	85.6	49.83	
1981	4.11	10	4.83	11.2	8.44	10.23	2.48	1.12	6.21	8.22	6.19	12.88	85.91	46.73	
1982	17.89	15.78	8.05	4.29	2.61	1.91	3.65	3.43	6.13	6.96	8.44	9.21	88.35	60.79	W
1983	14.62	6.91	9.4	3.76	5.08	6.04	8.67	1.89	5.39	4.14	17.4	8.47	91.77	48.58	
1984	14.43	8.78	9.08	7.57	11.63	6.34	0.08	1.28	2.87	5.76	12.78	9.97	90.57	58.16	
1985	1.13	7.27	6.95	5.85	4.64	4.99	0.08	3.41	5.77	13.37	10.22	2.68	66.36	38.1	D
1986	11.97	10.67	8.54	6.38	7	1.95	3.87	0.86	5.75	4.32	17.09	7.5	85.9	44.08	D
1987	8.33	6.26	9.84	7.24	7.28	1.92	2.07	1.33	2.56	0.59	6.21	10.43	64.06	49.02	
1988	7.46	5.62	12.71	9.48	8.05	4.62	4.33	1.32	6.14	9.36	15.97	8.2	93.26	42.43	D
1989	13.57	4.54	13.17	7.65	4.95	3.29	1.75	2.66	0.78	5.54	12.63	8.32	78.85	55.45	
1990	17.59	12.16	10.87	7.17	7.47	8.78	2.38	7.02	0.71	13.58	22.59	7.87	118.2	61.57	W
1991	12.26	13.54	8	12.21	5.64	5.41	0.6	2.62	1.43	2.48	15.32	7.56	87.07	64.26	W
1992	10.42	6.24	3.91	9.21	2.51	3.46	5.96	1.83	4.81	5.53	13.34	8.99	76.21	43.45	D
1993	7.85	0.41	8.87	11.4	6.53	8.13	6.8	1.22	1.01	5.35	4.19	8.35	70.11	39.46	D
1994	8.52	7.65	8.28	7.65	4.05	5.7	1.7	0.73	3.58	7.74	12.52	12.01	80.13	36.99	D

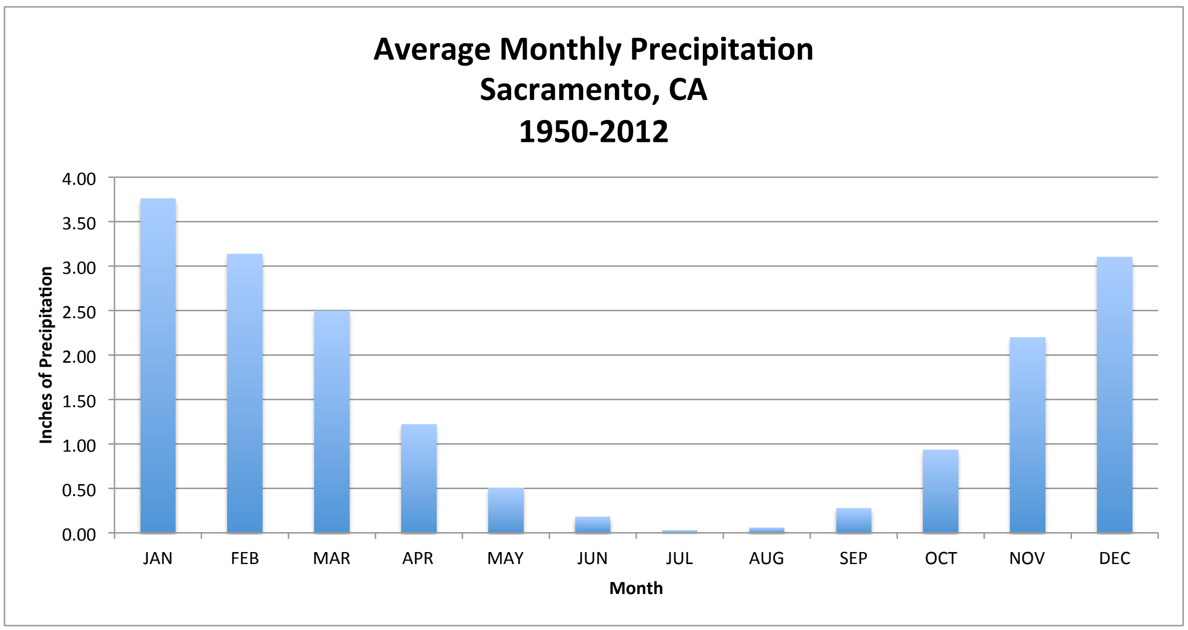
1995	7.47	10.24	7.73	4.88	3.71	3.98	3.23	3.9	3.36	10.98	19.58	11.05	90.11	49.97	
1996	14.85	16.34	4.55	10.76	7.24	1.63	2.17	1.76	6.05	12.55	13.68	15.94	107.5	66.37	W
1997	11.21	9.54	15.36	9.5	5.87	7.39	5.05	1.88	4.99	11.47	6.22	8.2	96.68	65.73	W
1998	13.02	4.15	8.58	2.85	6.34	4.35	1.33	0.58	1.06	5.49	18.4	16.39	82.54	40.17	D
1999	13.38	10.7	7.76	3.81	8.26	7.99	3.41	3.69	0.62	6.9	19.14	10.14	95.8	66.63	W
2000	6.95	8.79	8.19	8.66	7.99	5.55	1.42	1.46	5.19	6.44	5.83	5.78	72.25	53.21	
2001	4.64	3.08	8.89	8.1	5.97	9.19	2.33	4.2	2.59	8	13.73	11.63	82.35	28.22	D
2002	12.54	6.97	10.65	8.37	6.05	6.4	1.23	2.24	1.97	3.43	4.3	9.35	73.5	55.52	
2003	13.13	6.84	13.86	8.17	3	1.93	0.48	0.45	4.95	11.26	11.07	8.75	83.89	47.48	
2004	13.18	5.59	6.05	2.38	9.81	3.2	1.58	9.82	6.16	6.69	8.76	8.55	81.77	44.64	D
2005	8.06	1.12	8.23	6.93	5.78	6.42	3.57	2.16	5.46	7.26	11.44	10.93	77.36	34.72	D
2006	20.48	7.04	4.13	7.08	7.03	4.81	0.88	0.6	5.49	4.6	26.36	10.14	98.64	54.02	
2007	9.42	9.76	16.21	4.95	4.56	6.58	1.94	1.95	4.93	8.85	5	11.13	85.28	71.89	W
2008	8.93	8.97	10.01	8.28	6.51	7.48	2.3	6.42	3.76	3.3	16.82	12.63	95.41	44.04	D
2009	13.17	4.4	10.8	8.28	0	0	0	2.15	3.49	10.27	12.08	4.45	69.09	57.82	
2010	10.54	4.7	8.55	7.57	9.83	7.83	1.23	2.9	7.04	8.03	12.95	12.53	93.7	40.32	D
2011	17.6	7.86	13.14	11.78	7.56	6	1.66	1.39	3.03	9.57	9.56	5.46	94.61	64.08	W
2012	11.57	9.46	11.85	9.86	6.99	9.74	1.89	0.02	0.62	10.9	11.63	12.81	97.34	47.9	
2013	10.76	4.73	3.47	5.89										43.4	D
Avg (in)	**11.73**	**8.71**	**9.27**	**7.72**	**5.89**	**5.31**	**2.43**	**2.88**	**4.56**	**7.65**	**11.80**	**11.56**	**89.50**		
YEAR(S)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**	**NDJFM Total**	**Wet/Dry Yrs**



SACRAMENTO FAA ARPT, CALIFORNIA

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	3.96	2.88	1.78	0.62	0.4	0.02	0.01	0	0.35	2.44	4.8	4.55	21.81		
1951	1.97	1.62	0.66	0.69	0.47	0	0	0	0.14	1.33	2.85	4.71	14.44	13.6	
1952	7.96	1.13	4.13	1.32	0.03	0.25	0.01	0	0	0	2	7.1	23.93	20.78	W
1953	2.56	0.2	1.22	2.13	0.41	0.63	0	0.07	0	0.32	1.48	0.55	9.57	13.08	
1954	2.67	3.58	3.02	1.62	0.2	0	0	0.34	0	0.01	3.01	4.41	18.86	11.3	D
1955	2.87	1.02	0.44	2.31	0.57	0	0	0	0.67	0.47	1.27	12.64	22.26	11.75	
1956	6.1	1.91	0.17	1.44	0.86	0	0	0	0.84	1.23	0.06	0.17	12.78	22.09	W
1957	2.11	4.19	2.07	1.5	1.61	0	0	0	1.08	0.92	0.51	2.99	16.98	8.6	D
1958	4.87	7.72	5.62	4	0.76	0.23	0	0.01	0.08	0.24	0.09	0.76	24.38	21.71	W
1959	4.93	4.11	0.53	0.21	0	0	0	0	1.61	0	0.02	1.36	12.77	10.42	D
1960	3.43	3.34	1.43	1.32	0.55	0	0.01	0	0	0	4.25	0.87	15.2	9.58	D
1961	3.47	1.25	2.02	0.46	0.17	0.01	0	0.03	0.17	0.03	3.13	2.47	13.21	11.86	
1962	1	8.77	1.69	0.15	0.03	0.01	0	0.13	0.06	7.51	0.39	1.84	21.58	17.06	W
1963	4.71	2.09	4.25	3.54	0.69	0	0	0	0.47	1.09	4.35	0.45	21.64	13.28	
1964	3.83	0.15	1.36	0.17	0.23	0.39	0.01	0.11	0	1.72	2.7	6.03	16.7	10.14	D
1965	3.01	0.41	1.47	2.7	0.09	0	0	0.65	0	0.11	2.93	2.44	13.81	13.62	
1966	1.91	1.56	0.14	0.47	0.25	0.02	0.1	0	0.07	0	5.73	3.53	13.78	8.98	D
1967	8.42	0.41	3.91	3.4	0.13	0.6	0	0	0.04	0.24	1.18	1.29	19.62	22	W
1968	3.77	2.13	2.39	0.42	0.16	0.15	0	0.02	0	0.6	2.49	2.77	14.9	10.76	D
1969	8.5	6.98	0.94	1.63	0.04	0.08	0	0	0.02	0.72	0.6	4.41	23.92	21.68	W
1970	7.88	1.58	1.62	0.18	0	0.16	0	0	0	0.84	7.41	3.4	23.07	16.09	
1971	0.9	0.56	2.05	0.44	0.77	0.01	0	0	0	0.13	0.87	4.05	9.78	14.32	
1972	0.81	1.28	0.29	1.39	0.28	0.19	0	0	0.9	1.75	5.14	1.88	13.91	7.3	D
1973	6.87	5.64	2.76	0.05	0.13	0	0	0	0.33	1.64	6.27	2.79	26.48	22.29	W
1974	3.58	1.37	3.27	0.96	0.01	0.5	0.79	0	0	1.16	0.66	2.86	15.16	17.28	W
1975	0.73	4.59	4.28	0.81	0	0	0.04	0.23	0	2.03	0.29	0.18	13.18	13.12	
1976	0.36	1.49	0.44	1.53	0	0.04	0	0.65	0.52	0.02	0.55	0.65	6.25	2.76	D
1977	1.17	1.17	1.27	0.3	0.73	0	0	0	0.76	0.12	1.92	4.27	11.71	4.81	D
1978	9.14	4.46	3.38	2.31	0	0	0	0	0.3	0	3.2	0.95	23.74	23.17	W
1979	5.66	4.55	2.47	0.76	0.14	0	0.25	0	0	1.62	1.48	3.41	20.34	16.83	
1980	5.64	7.12	2.62	1.06	0.49	0.04	0.4	0	0	0.06	0.12	1.79	19.34	20.27	W
1981	4.56	0.87	3.55	0.66	0.5	0	0	0	0.25	2.57	6.09	3.28	22.33	10.89	D
1982	5.5	2.35	7.12	3.07	0	0.15	0	0	1.81	2.61	5.74	3.25	31.6	24.34	W
1983	4.92	5.56	6.75	4.21	0.25	0.4	0	0.11	0.66	0.4	4.92	5.26	33.44	26.22	W
1984	0.16	1.22	1.35	0.34	0.01	0.1	0	0.01	0.07	1.39	3.61	1.23	9.49	12.91	
1985	0.66	1.52	2.01	0	0.01	0.15	0	0.06	0.56	0.53	3.72	2.34	11.56	9.03	D
1986	3.67	8.6	3.2	0.91	0.07	0	0	0	0.6	0.19	0.14	0.76	18.14	21.53	W
1987	2.29	3.23	3.05	0.2	0	0	0	0	0	1.28	2.53	3.25	15.83	9.47	D
1988	2.98	0.99	0.17	1.58	0.89	0.19	0	0	0.64	0.19	1.68	2.73	12.04	9.92	D
1989	0.71	1.25	6.29	0.31	0.06	0.43	0	0.2	2.78	1.76	1.32	0	15.11	12.66	
1990	4.97	2.91	0.93	0.73	2.1	0	0	0	0	0.09	0.43	1.6	13.76	10.13	D
1991	0.36	3.1	6.14	0.29	0.25	0.53	0	0.14	0.04	1.25	0.19	1.6	13.89	11.63	D
1992	1.39	5.47	2.05	0.92	0	0.15	0	0	0	1.31	0.28	4.94	16.51	10.7	D
1993	8.63	4.94	2.39	0.63	1.14	1.26	0	0	0	0.47	2.15	1.75	23.36	21.18	W
1994	2.12	3.15	0.05	0.67	1.68	0	0	0	0	0	0.71	2.68	11.06	9.22	D

1995	8.81	0.2	8.13	1.46	1.06	0.47	0	0	0	0	0	5.49	25.62	20.53	W
1996	4.16	5.49	1.73	1.25	0.79	0	0	0	0	0.67	1.97	6.39	22.45	16.87	W
1997	9.05	0.28	0.34	0.18	0.35	0.59	0	0.32	0.16	0.82	4.56	2.91	19.56	18.03	W
1998	6.4	9.95	2.47	1.05	2.98	0.58	0	0	0.23	0.76	2.84	0.58	27.84	26.29	W
1999	2.63	4.45	1.5	0.89	0.07	0.03	0	0	0	0.18	1.63	0.06	11.44	12	
2000	6.49	8.49	2.03	1.39	1.17	0.04	0	0	0.09	1.62	0.68	0.59	22.59	18.7	W
2001	3.75	4.57	2.04	1.5	0	0.08	0	0	0.5	0.36	2.43	6.27	21.5	11.63	D
2002	2.19	1.13	2.87	0.12	2.07	0	0	0	0	0	2.34	6.26	16.98	14.89	
2003	1.29	1.29	1.87	2.53	1.17	0	0	0.57	0	0.04	1.52	4.23	14.51	13.05	
2004	1.02	5.01	0.48	0.09	0.17	0	0	0	0.16	2.71	2.69	4.14	16.47	12.26	
2005	3.83	2.33	3.3	0.84	1.23	0.66	0	0	0	0.15	0.85	8.98	22.17	16.29	
2006	2.53	2.09	5.29	3.27	0.3	0	0	0	0	0.16	1.12	3.01	17.77	19.74	W
2007	0.05	4.44	0.35	1.34	0.41	0	0.01	0	0.06	1.05	0.85	3.17	11.73	8.97	D
2008	6.67	1.81	0.05	0	0.04	0	0	0	0	0.84	2.38	1.51	13.3	12.55	
2009	1.41	5.07	2.09	1.46	1.01	0.56	0	0	0.14	3.24	0.26	3.64	18.88	12.46	
2010	4.79	2.29	2.98	2.65	0.75	0	0	0	0.01	1.43	2.39	5.55	22.84	13.96	
2011	1.67	3.39	6.95	0.06	1.02	1.5	0	0	0.01	1.33	0.74	0.27	16.94	19.95	W
2012	2.43	0.92	4.06	2.42	0	0.03	0.03	0	0	0.99	4.01	6.26	21.15	8.42	D
2013	0.96	0.36	1.37	0.04										12.96	
Avg (inch	**3.76**	**3.14**	**2.50**	**1.22**	**0.50**	**0.18**	**0.03**	**0.06**	**0.27**	**0.93**	**2.20**	**3.10**	**17.89**		
YEAR(S)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**	**NDJFM Total**	**Wet/Dry Yrs**



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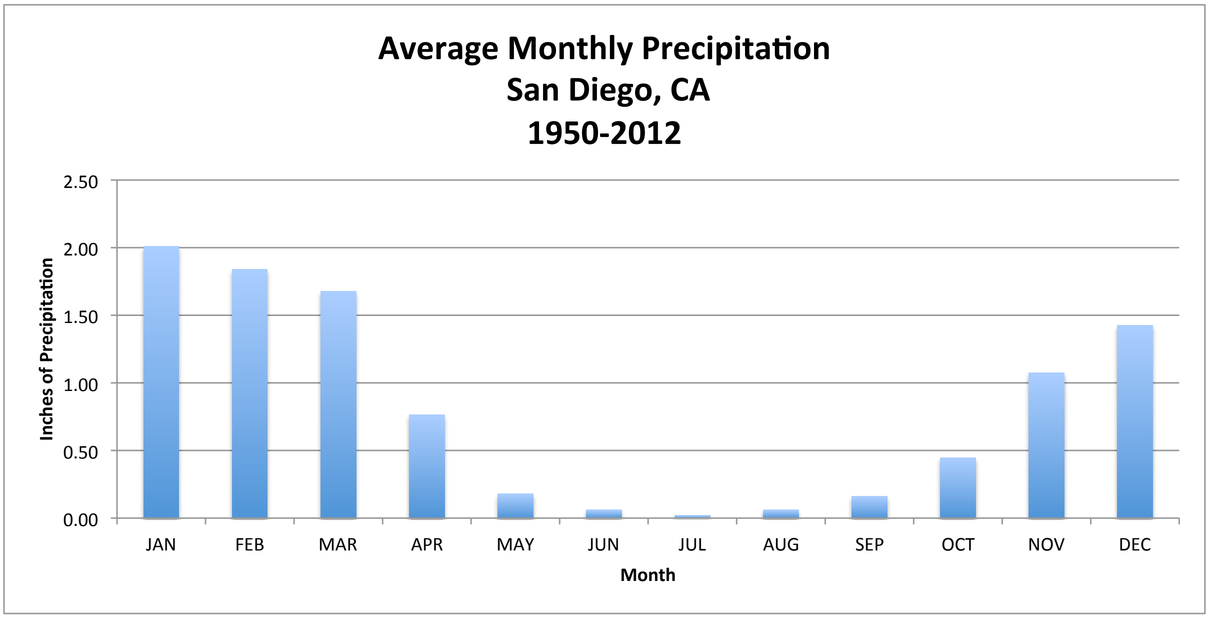
YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	3.31	1.62	1	0.28	0.09	0	0.08	0	0	0.01	1.23	0.05	7.67		
1951	1.6	0.5	0.5	1.95	0	0	0	0.85	0.04	0.68	1.23	3.87	11.22	3.88	D
1952	4.24	0.6	4.97	1.54	0	0.14	0	0	0	0	1.83	2.2	15.52	14.91	W
1953	0.58	0.58	0.79	0.33	0.09	0.14	0	0	0	0.07	0.8	0.03	3.41	5.98	
1954	2.76	1.03	4.31	0.09	0.01	0.03	0	0	0	0	0.74	0.55	9.52	8.93	W
1955	3.59	0.56	0.38	0.9	0.49	0	0	0.11	0	0	0.55	0.33	6.91	5.82	
1956	1.65	0.22	0	1.56	0.1	0	0	0	0	0.68	0	0.18	4.39	2.75	D
1957	4.8	0.5	0.75	0.84	0.88	0.26	0	0	0.37	1.76	0.59	1.38	12.13	6.23	
1958	0.62	3.15	3.98	1.65	0.4	0	0	0	0.62	0.01	0.44	0.06	10.93	9.72	W
1959	0.08	3.76	0	0.31	0	0	0	0	0.04	0.23	0.02	1.44	5.88	4.34	D
1960	2.99	1.45	0.55	0.56	0.17	0	0	0	0.06	0.04	1.01	0.22	7.05	6.45	
1961	1.21	0.06	0.85	0	0.01	0	0	0.04	0	0.2	0.79	1.45	4.61	3.35	D
1962	2.71	3.08	0.64	0.01	0.62	0.09	0	0	0	0.01	0.01	0.22	7.39	8.67	
1963	0.11	1.22	1.33	0.71	0.09	0.28	0	0	1.9	0.13	1.85	0.1	7.72	2.89	D
1964	1.3	0.37	0.97	0.2	0.15	0.08	0	0	0	0.02	1.01	1.17	5.27	4.59	D
1965	0.4	0.52	1.79	3.58	0	0.01	0.02	0	0.29	0	5.82	6.6	19.03	4.89	D
1966	1.29	0.86	0.17	0	0.02	0	0	0	0	0.8	0.82	3.22	7.18	14.74	W
1967	2.2	0	1.14	2.24	0.05	0.16	0.01	0.14	0.08	0	3.53	1.66	11.21	7.38	
1968	0.35	0.22	1.55	0.34	0.08	0	0.13	0	0	0.04	0.36	0.61	3.68	7.31	
1969	4.78	4.34	0.94	0.21	0.17	0.02	0	0.01	0	0.04	0.79	0.46	11.76	11.03	W
1970	0.86	2.58	1.5	0.09	0.01	0	0	0	0	0.07	2.05	2.22	9.38	6.19	
1971	0.3	1.27	0.2	0.93	0.95	0.01	0	0.03	0	1.66	0.06	3.27	8.68	6.04	
1972	0.07	0.1	0	0.02	0.1	0.38	0	0.02	0.44	0.58	3.16	1.61	6.48	3.5	D
1973	1.68	1.63	2.26	0.05	0	0	0	0	0.02	0.01	1.63	0.19	7.47	10.34	W
1974	2.96	0.04	1.7	0.02	0.01	0.02	0.01	0	0	1.03	0.14	2.2	8.13	6.52	
1975	0.49	0.96	3.79	2	0.01	0.02	0	0	0	0.09	0.64	0.37	8.37	7.58	
1976	0	5.4	0.99	1.33	0.27	0.02	0.02	0.01	1	0.38	0.75	1.06	11.23	7.4	
1977	2.36	0.06	0.61	0.01	1.79	0.03	0	2.13	0	0.5	0.05	1.67	9.21	4.84	D
1978	5.95	2.64	5	0.73	0.04	0	0	0	0.72	0.05	2.09	2.19	19.41	15.31	W
1979	5.82	0.85	3.71	0.02	0.09	0.01	0.09	0.01	0	0.73	0.27	0.02	11.62	14.66	W
1980	5.58	4.47	2.71	1.18	0.65	0.01	0	0	0	0.05	0	0.31	14.96	13.05	W
1981	1.48	2.26	3.74	0.22	0.04	0	0	0	0.03	0.14	1.79	0.54	10.24	7.79	
1982	2.71	0.88	4.74	0.62	0.01	0.04	0	0	0.38	0.05	2.1	1.43	12.96	10.66	W
1983	2.1	3.88	6.57	1.74	0.01	0	0.01	0.39	0.21	0.4	1.94	1.53	18.78	16.08	W
1984	0.46	0.09	0.04	0.62	0	0.04	0.19	0.06	0	0.29	2.37	4.55	8.71	4.06	D
1985	0.52	0.77	0.58	0.32	0	0	0	0	0.2	0.29	4.92	1.06	8.66	8.79	W
1986	0.75	2.59	3.12	1.17	0	0	0.01	0	1.04	1.39	1.16	0.95	12.18	12.44	W
1987	1.68	1.53	1.04	0.78	0.03	0	0.03	0.01	0.7	1.74	1.33	2.73	11.6	6.36	
1988	0.89	1.37	0.59	3.71	0.08	0	0	0	0	0	1.39	2.23	10.26	6.91	
1989	0.42	0.7	0.69	0.12	0.04	0.06	0	0	0.23	0.47	0.09	1.01	3.83	5.43	D
1990	2.52	1.13	0.25	0.76	0.51	0.87	0	0.01	0	0	0.65	0.59	7.29	5	D
1991	1.06	2.46	6.96	0.05	0.01	0	0.24	0.01	0.28	0.69	0.05	1.7	13.51	11.72	W
1992	1.81	3.34	4.42	0.28	0.07	0.04	0.03	0.05	0	0.18	0.03	2.56	12.81	11.32	W
1993	9.09	4.73	1.22	0	0.01	0.41	0.03	0	0	0.22	0.77	0.78	17.26	17.63	W
1994	0.7	2.75	3.67	0.93	0.07	0	0.03	0.01	0	0.01	0.46	0.8	9.43	8.67	
1995	8.06	1.93	3.81	0.96	0.59	0.46	0.05	0	0	0	0.3	0.88	17.04	15.06	W
1996	1.52	0.88	1.1	0.36	0.02	0	0.09	0	0.03	0.94	1.7	0.63	7.27	4.68	D
1997	3.02	0.31	0	0.28	0	0	0	0	0.85	0.02	1.17	1.35	7	5.66	D
1998	2.68	7.65	2.21	1.11	0.64	0.1	0.2	0	0.03	0.08	0.69	0.66	16.05	15.06	W
1999	1.54	0.7	1.09	1.62	0.06	0.04	0	0	0.02	0	0.04	0.32	5.43	4.68	D
2000	0.17	3.67	1	0.54	0	0	0	0.01	0	1.24	0.26	0.01	6.9	5.2	D
2001	3.28	2.38	0.63	0.76	0.01	0	0	0	0	0	0.95	0.46	8.47	6.56	
2002	0.32	0.17	0.46	0.63	0	0	0	0	0.31	0.04	0.32	1.98	4.23	2.36	D
2003	0.02	4.88	1.36	1.41	0.3	0	0	0	0	0	0.6	0.61	9.18	8.56	
2004	0.34	2.81	0.22	0.6	0	0	0	0	0	4.98	0.33	4.01	13.29	4.58	D
2005	4.49	5.83	2.12	0.59	0.12	0.02	0.01	0	0.1	0.46	0.12	0.25	14.11	16.78	W
2006	0.36	1.11	1.36	0.88	0.77	0	0.04	0.01	0	0.76	0.15	0.71	6.15	3.2	D
2007	0.51	1.12	0.09	0.46	0	0	0	0	0.05	0.37	0.97	0.8	4.37	2.58	D
2008	3.34	1.21	0.26	0	0.23	0.02	0	0	0	0.18	2.49	3.38	11.11	6.58	
2009	0.08	2.63	0.18	0.14	0.04	0.03	0	0	0	0	0.12	2.28	5.5	8.76	W
2010	3.38	2.28	0.68	1.78	0.01	0.02	0.02	0	0.03	2.18	0.88	5	16.26	8.74	
2011	0.3	2.1	1.46	0.26	0.36	0.03	0	0	0.13	0.46	3.12	0.86	9.08	9.74	W

2012	0.4	1.19	0.97	0.88	0.02	0	0	0	0	0.7	0.19	2.27	6.62	6.54	
2013	1.20	0.63	1.22											5.51	D
Avg (inch	**2.01**	**1.84**	**1.68**	**0.77**	**0.18**	**0.06**	**0.02**	**0.06**	**0.16**	**0.45**	**1.07**	**1.43**	**9.73**		
YEAR(S)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**	**NDJFM Total**	**Wet/Dry Yrs**



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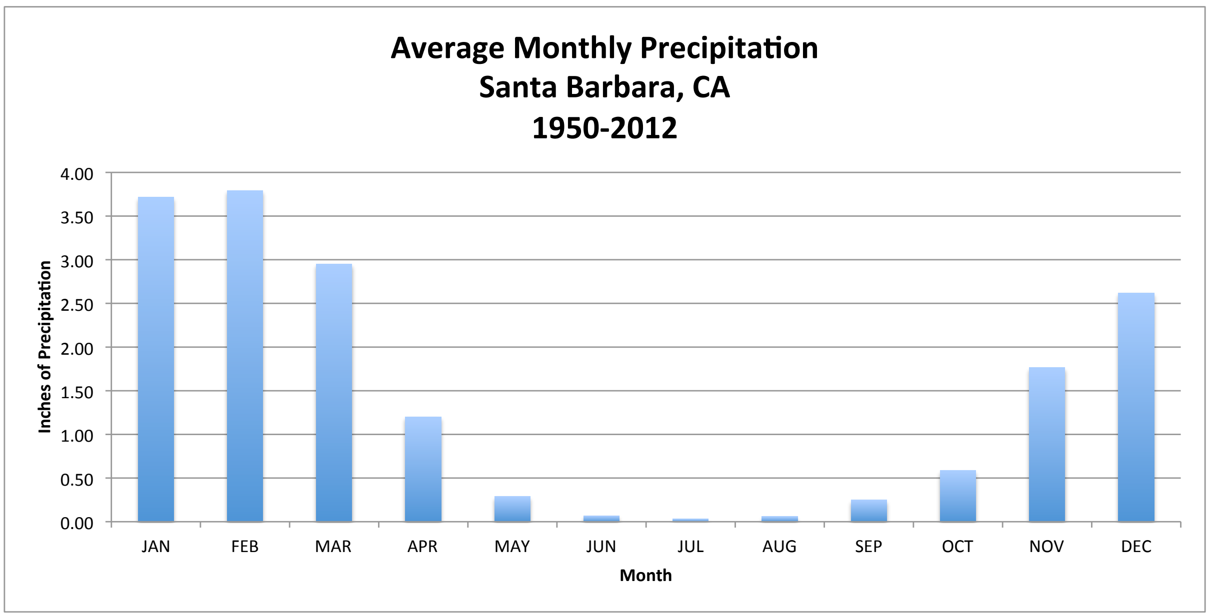
YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	2.38	2.48	1.43	0.49	0.03	0.01	0.94	0	0.35	0.84	1.93	0.47	11.35		
1951	2.39	1.6	0.44	2.26	0.03	0	0	0.06	0.01	0.3	1.16	5.49	13.74	6.83	D
1952	9.41	0.69	6.79	1.51	0	0.02	0	0	0	0.04	4.02	4.8	27.28	23.54	W
1953	1.75	0	0.6	1.15	0.03	0.04	0	0	0	0	2.42	0.03	6.02	11.17	
1954	4.93	2.28	4.06	0.39	0.04	0.01	0	0.01	0	0	1.61	3.05	16.38	13.72	
1955	4.37	2.51	0.79	3.26	0.24	0.01	0	0	0	0	1.36	5.86	18.4	12.33	
1956	6.68	1.05	0	1.91	0.98	0	0	0	0	0.07	0	0.08	10.77	14.95	
1957	5.12	2.91	0.39	2.11	1.08	0.01	0	0	0	0.84	0.25	3.81	16.52	8.5	D
1958	3.21	7.37	6.01	4.2	0.47	0	0	0	0.54	0	0.03	0.09	21.92	20.65	W
1959	1.66	4.37	0	0.76	0	0	0	0	0.02	0	0	1.42	8.23	6.15	D
1960	3.98	3.67	0.43	2.21	0	0	0	0	0	0.33	5.08	0.37	16.07	9.5	D
1961	1.23	0.02	0.87	0.05	0	0	0	0	0.08	0	2.31	1.05	5.61	7.57	D
1962	2.46	13.62	1.37	0	0.04	0	0.03	0	0	0.48	0	0.06	18.06	20.81	W
1963	2.24	5.06	3.66	2.74	0.26	0.31	0	0.18	0.92	1	3.03	0	19.4	11.02	
1964	1.49	0	2.59	0.1	0.06	0.03	0	0.01	0	1	2.23	4.69	12.2	7.11	D
1965	0.81	0.58	2.78	5.75	0	0	0	0	0	0	6.92	3.47	20.31	11.09	
1966	1.98	0.81	0.13	0	0.07	0.11	0	0	0.02	0.04	3.76	5.11	12.03	13.31	
1967	5.51	0.58	1.82	4.3	0.05	0	0	0.05	0.07	0	4.31	1.28	17.97	16.78	
1968	1.13	1.88	4.39	0.65	0	0	0	0	0	1.49	0.77	1.64	11.95	12.99	
1969	12.25	8.41	0.42	1.66	0.01	0.03	0.03	0	0.04	0.11	1.61	0.19	24.76	23.49	W
1970	3.89	4.11	2.2	0	0.01	0	0	0	0	0.1	4.16	4.01	18.48	12	
1971	0.81	0.74	0.91	0.67	1.11	0	0.04	0	0	0.02	0.36	5.77	10.43	10.63	
1972	0.26	0.46	0	0.16	0	0.01	0	0	0	0.49	6.35	0.9	8.63	6.85	D
1973	6.15	8.28	2.11	0	0	0	0	0.01	0	0.35	1.42	1.43	19.75	23.79	W
1974	7.73	0.22	4.6	0.19	0	0	0.01	0	0	0.59	0.06	5.58	18.98	15.4	
1975	0.53	4.96	5.18	1.05	0.09	0	0	0.01	0	0.35	0.15	0.07	12.39	16.31	
1976	0	5	1.17	0.89	0	0.19	0	0	4.13	2.4	1.1	1.07	15.95	6.39	D
1977	3.6	0.19	1.54	0	1.83	0.04	0	0.26	0	0	0.1	4.4	11.96	7.5	D
1978	8.52	10.51	10.08	2	0	0.01	0	0.02	1.27	0	1.59	1.11	35.11	33.61	W
1979	4.74	3.88	5.57	0	0.04	0	0	0	0.41	0.59	0.66	2.1	17.99	16.89	W
1980	5.92	8.14	2	0.5	0.21	0	0.4	0	0	0.01	0	0.9	18.08	18.82	W
1981	3.76	3.49	6.83	0.4	0	0	0	0	0	0.87	1.97	0.74	18.06	14.98	
1982	2.89	0.45	5.19	2.11	0	0	0	0	1.4	0.66	6.34	1.72	20.76	11.24	
1983	8.89	8.07	4.92	4.55	0.12	0	0	1.87	3.2	1.19	2.97	4.96	40.74	29.94	W
1984	0.02	0.01	0.73	0.14	0.02	0	0	0.81	0.29	0.56	2.42	4.43	9.43	8.69	D
1985	0.72	4.09	1.92	0.02	0	0	0.03	0	0.02	0.58	3.76	0.93	12.07	13.58	
1986	1.98	6.98	7.15	0.5	0	0	0	0	1.45	0	0.54	0.85	19.45	20.8	W
1987	1.25	2.36	4.4	0.06	0	0	0	0	0	2.21	0.82	3.56	14.66	9.4	D
1988	2.46	1.52	0.02	3.01	0	0.46	0.02	0	0	0.01	1	4.02	12.52	8.38	D
1989	0.48	2.35	0.54	0.19	0.15	0	0	0	0.06	0.46	0.1	0	4.33	8.39	D
1990	2.56	1.64	0.02	0.2	0.72	0	0	0	0.2	0	0.11	0.01	5.46	4.32	D
1991	1.65	3.1	11.45	0.02	0	0.2	0.16	0.25	0.02	0.23	0.07	5.1	22.25	16.32	
1992	2.19	7.17	3.11	0.01	0.02	0	0.29	0	0	0.82	0	4.34	17.95	17.64	W
1993	9.07	5.42	4.75	0	0.04	0.38	0.01	0	0	0.05	1.33	1.52	22.57	23.58	W
1994	1.23	6.31	1.51	0.53	0.26	0	0	0	0.03	0.07	1.34	1.35	12.63	11.9	
1995	12.99	0.77	9.7	0.21	0.89	0.28	0	0	0	0	0.26	3.27	28.37	26.15	W

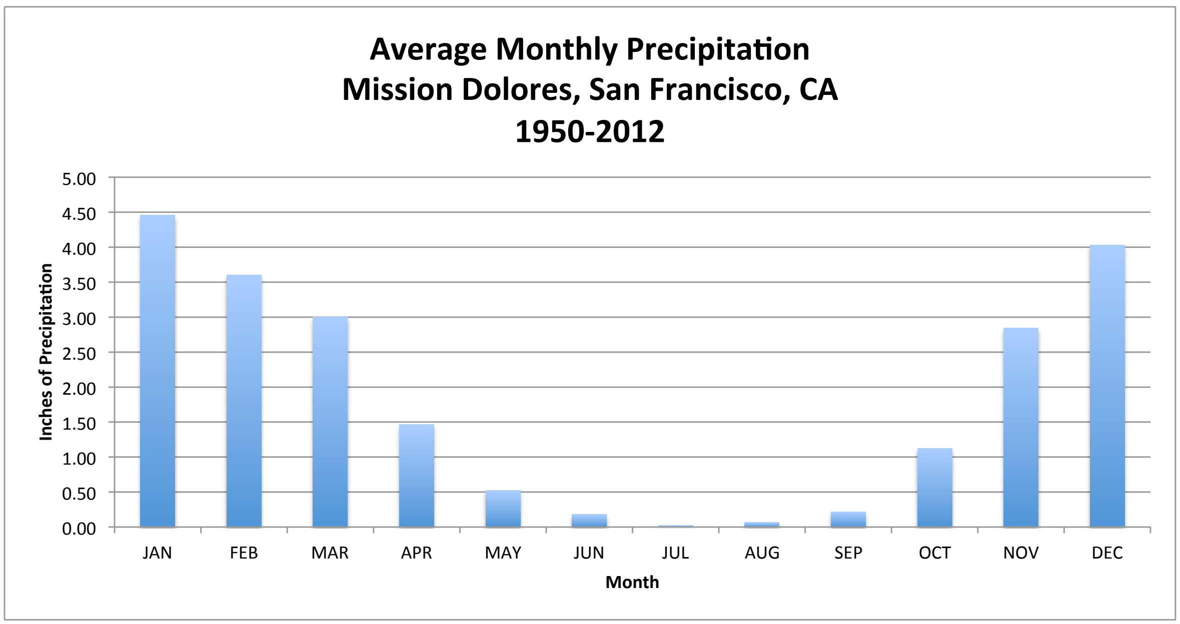
1996	2.99	8.31	2.58	0.84	0.6	0	0	0	0	3.02	2.99	6.56	27.89	17.41	W
1997	7.39	0.07	0	0	0.02	0	0.02	0.08	0.04	0.11	3.72	7.07	18.52	17.01	W
1998	5.62	21.76	4.3	1.42	3.92	0.05	0.02	0	0.35	0.01	1.09	0.91	39.45	42.47	W
1999	2.1	0.81	4.31	2.39	0	0.05	0	0.03	0.1	0.05	1.42	0	11.26	9.22	D
2000	2.13	10.57	6.89	3.72	0.04	0.15	0.05	0.06	0.11	1.44	0	0.31	25.47	21.01	W
2001	8.04	5.66	6.89	1.05	0.07	0	0.04	0	0	0.54	3.91	2.1	28.3	20.9	W
2002	1.43	0.43	0.44	0.09	0.08	0.01	0	0	0.18	0.01	5.72	5.8	14.19	8.31	D
2003	0	2.63	4.86	1.19	1.74	0	0	0	0	0.86	0.83	2.52	14.63	19.01	W
2004	0.48	4.91	0.59	0	0	0	0	0	0	3.43	0.08	6.26	15.75	9.33	D
2005	9.55	6.44	3.6	0.88	0.94	0	0	0	0.04	0.89	1.94	2.38	26.66	25.93	W
2006	2.21	1.09	3.86	4.86	1.13	0	0	0.02	0	0.14	0.27	0.97	14.55	11.48	
2007	2.57	2.02	0.03	1.11	0	0	0	0	0.2	0.29	0	2.16	8.38	5.86	D
2008	10.44	1.99	0.01	0.11	0.1	0	0	0	0	0.04	1.8	2.11	16.6	14.6	
2009	0.63	3.77	0.67	0.54	0	0.51	0	0	0	3.63	0	3.44	13.19	8.98	D
2010	5.99	4.57	0.65	2.34	0.14	0	0	0	0	2.56	1.07	10.15	27.47	14.65	
2011	1.19	3.8	7.5	0.01	0.55	1.43	0	0	0	0.83	3.03	1.09	19.43	23.71	W
2012	2.09	0.08	2.28	2.24	0	0.01	0	0.02	0.08	0.04	1.63	4.22	12.66	8.54	D
2013	2.04	0.05	1.06	0.02										9.00	D
Avg (inche	**3.72**	**3.79**	**2.95**	**1.20**	**0.29**	**0.07**	**0.03**	**0.06**	**0.25**	**0.59**	**1.77**	**2.62**	**17.34**		
YEAR(S)	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**ANN**	**NDJFM Total**	**Wet/Dry Yrs**



SAN FRAN MISSION DOLORES, CALIFORNIA

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	7.4	2.33	1.65	0.87	0.37	0.03	0	0	0	2.72	4.96	6.01	26.34		
1951	4.41	3	1.32	0.89	0.65	0.04	0.01	0.43	0.08	0.81	3.33	7.92	22.89	19.7	
1952	10.69	2.62	4.9	1.08	0.3	0.39	0	0.01	0	0.07	2.42	9.06	31.54	29.46	W
1953	3.26	0.04	1.83	3.42	0.38	0.61	0	0.07	0	0.34	1.88	0.82	12.65	16.61	
1954	3.11	2.42	4.56	0.82	0.11	0.14	0.03	0.2	0	0.24	2.55	5.67	19.85	12.79	D
1955	4.05	1.18	0.29	1.49	0.04	0	0.02	0	0.02	0.03	2.38	11.47	20.97	13.74	D
1956	8.72	2.03	0.12	1.68	0.68	0.02	0	0.01	0.33	1.14	0.04	0.37	15.14	24.72	W
1957	2.84	3.58	2.39	1.09	3.19	0.06	0.01	0	1.46	3.46	1.13	3.6	22.81	9.22	D
1958	4.38	7.78	8.22	5.47	0.88	0.09	0.05	0	0.04	0.12	0.09	1.48	28.6	25.11	W
1959	3.96	4.04	0.3	0.36	0.02	0	0	0.02	2.06	0	0	1.71	12.47	9.87	D
1960	4.04	3.57	2.06	1.16	0.85	0	0	0	0	0.48	3.35	2.31	17.82	11.38	D
1961	2.79	0.96	2.27	0.79	0.88	0.04	0	0.02	0.22	0.09	4.44	2.13	14.63	11.68	D
1962	1.08	6.58	2.76	0.36	0	0	0	0.07	0.22	5.51	0.6	2.81	19.99	16.99	
1963	3.35	1.92	3.87	3.35	0.45	0	0	0	0.06	1.39	3.52	0.87	18.78	12.55	D
1964	3.37	0.19	2.12	0.01	0.22	0.57	0	0.01	0	1.9	3.99	5.35	17.73	10.07	D
1965	3.97	0.94	2.92	3.21	0	0	0.02	0.49	0	0.01	4.79	3.51	19.86	17.17	
1966	3.27	2.72	0.8	0.36	0.19	0.17	0.06	0.1	0.1	0.01	4.8	3.87	16.45	15.09	
1967	9.49	0.22	4.35	4.9	0.09	1.42	0	0	0.04	0.53	1.1	2.12	24.26	22.73	W
1968	4.54	2.28	3.15	0.48	0.22	0	0	0.03	0.06	0.62	2.67	3.91	17.96	13.19	D
1969	7.74	7.26	1.01	1.74	0	0.05	0	0	0.01	2.61	0.45	6.15	27.02	22.59	W
1970	7.81	1.56	1.55	0.06	0.03	0.57	0	0	0	0.84	6.44	5.39	24.25	17.52	
1971	2.04	0.26	2.91	0.72	0.19	0	0.01	0.01	0.22	0.11	1.92	3.93	12.32	17.04	
1972	1.32	2.13	0.23	1.07	0	0.11	0.01	0.04	0.54	5.41	6.4	3.53	20.79	9.53	D
1973	9.38	6.32	2.63	0.02	0.08	0	0	0	0.3	1.62	7.8	3.65	31.8	28.26	W
1974	3.4	1.53	4.49	2.34	0	0.1	0.62	0	0	0.85	0.4	1.53	15.26	20.87	W
1975	2.57	3.72	5.15	1.25	0.02	0.04	0.2	0.02	0	2.44	0.43	0.18	16.02	13.37	D
1976	0.31	1.83	1.01	0.7	0.01	0.03	0	0.78	0.51	0.38	1.04	2.13	8.73	3.76	D
1977	1.65	0.9	2.01	0.05	0.57	0	0	0.03	0.86	0.17	1.96	3.3	11.5	7.73	D
1978	6.2	3.54	5.2	3.82	0	0	0	0	0.2	0	1.67	0.89	21.52	20.2	W
1979	6.74	4.96	1.58	0.87	0.15	0	0.07	0	0.01	1.66	2.98	3.1	22.12	15.84	
1980	3.77	4.84	1.25	0.97	0.23	0.02	0.04	0	0	0	0.14	2.95	14.21	15.94	
1981	4	1.78	3.71	0.17	0.12	0	0	0	0.22	1.74	3.73	4.15	19.62	12.58	D
1982	6.84	3.26	7.65	3.03	0	0.06	0	0	0.72	2.79	5.62	2.22	32.19	25.63	W
1983	5.77	8.06	9.04	3.48	0.47	0	0.01	0.06	0.68	0.26	8.2	7.72	43.75	30.71	W
1984	0.5	2.34	1.32	0.92	0.16	0.3	0	0.24	0.1	2.94	7.45	2.1	18.37	20.08	
1985	0.59	1.98	3.94	0.27	0.09	0.31	0	0	0.38	0.8	4.83	2.47	15.66	16.06	
1986	4.77	8.29	6.25	0.76	0.13	0	0.03	0.01	1.32	0.11	0.2	1.64	23.51	26.61	W
1987	4.26	3.77	2.31	0.14	0.06	0.01	0	0	0	1.07	3.09	5.09	19.8	12.18	D
1988	4.93	0.4	0.07	1.73	0.66	0.7	0	0	0	0.64	3.7	4.23	17.06	13.58	D
1989	1.26	1.49	5.28	0.7	0.06	0.07	0	0.05	0.98	1.18	1.33	0	12.4	15.96	
1990	4.02	2.45	1.34	0.58	2.38	0.01	0	0.04	0.12	0.2	0.52	1.94	13.6	9.14	D
1991	0.6	3.29	5.89	1.07	0.36	0.05	0	0.42	0	2.35	0.5	2.32	16.85	12.24	D
1992	2.09	6.34	4.41	0.38	0	0.39	0	0.02	0	1.16	0.4	6.03	21.22	15.66	
1993	9.82	4.48	2.9	0.71	0.87	0.27	0	0	0	0.33	2.16	2.25	23.79	23.63	W
1994	2.77	4.87	0.35	1.12	1.31	0.06	0	0	0.22	0.33	10.49	2.69	24.21	12.4	D

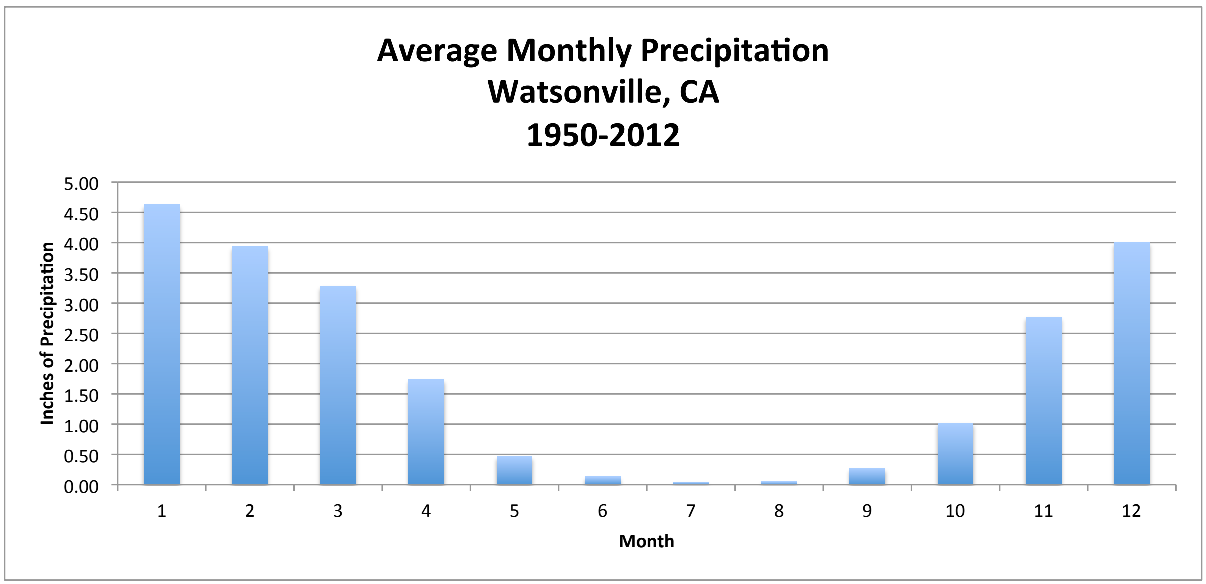
YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1995	8.97	0.24	7.88	1.61	0.97	0.62	0	0	0	0.06	0.08	8.13	28.56	30.27	W
1996	6.71	5.28	1.28	1.56	1.79	0	0	0	0.04	1.05	4.72	7.61	30.04	21.48	W
1997	7.59	0.32	0.58	0.29	0.16	0.3	0	0.73	0.04	1	6.97	2.77	20.75	20.82	W
1998	12.08	14.89	2.54	2.13	3.92	0.15	0.01	0.01	0.09	0.91	4.02	1.42	42.17	39.25	W
1999	4.41	7.35	2.34	2.62	0.23	0.12	0	0.1	0.59	0.65	2.32	0.62	21.35	19.54	
2000	6.41	8.96	2.04	1.66	1.4	0.16	0.02	0.02	0.21	2.38	0.85	0.9	25.01	20.35	W
2001	3.76	7.73	1.58	1.89	0	0.15	0.01	0.05	0.18	0.51	5.18	10.75	31.79	14.82	
2002	2.13	2.59	2.27	0.52	0.84	0.03	0	0.03	0.01	0.01	2	12.03	22.46	22.92	W
2003	1.75	1.8	1.71	3.6	0.93	0	0	0.06	0	0.04	2.22	7.69	19.8	19.29	
2004	3.4	5.67	1.16	0.12	0.12	0	0	0.05	0.04	2.62	2.07	7.98	23.23	20.14	
2005	4.82	5.19	4.67	2.19	1.32	0.94	0.02	0.01	0	0.51	2.21	11.19	33.07	24.73	W
2006	3.52	2.81	8.74	5.02	0.41	0	0	0	0	0.63	3.05	5.31	29.49	28.47	W
2007	0.72	4.79	0.52	1.44	0.43	0	0.02	0	0.09	2.01	0.96	3.16	14.14	14.39	
2008	8.86	1.87	0.33	0.14	0.03	0	0	0.01	0	0.35	2.31	2.82	16.72	15.18	
2009	0.9	7.92	2.76	0.24	0.8	0	0	0	0.28	3.11	0.45	2.77	19.23	16.71	
2010	6.66	3.42	2.79	3.59	0.95	0.07	0	0.01	0.02	1.81	3.1	6.71	29.13	16.09	
2011	1.55	4.94	7.02	0.56	1.13	2.02	0.08	0.03	0	1.38	1.74	0.14	20.59	23.32	W
2012	2.68	1.09	5.71	2.74	0.02	0.14	0.01	0.01	0	0.32	3	5.28	12.72	11.35	D
2013	0.17	0.85	0.83	0.60										10.13	D
Avg (inch	**4.46**	**3.60**	**3.00**	**1.47**	**0.52**	**0.18**	**0.02**	**0.07**	**0.22**	**1.12**	**2.84**	**4.03**	**21.41**		



Watsonville Waterworks, California

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1950	7.41	3.47	1.63	0.98	0.35	0.04	0	0	0.26	1.48	6.78	5.78	28.18		
1951	2.8	2.48	2.23	1.2	0.4	0	0	0.04	0.04	1.05	3.47	8.52	22.23	20.07	
1952	8.96	2.79	3.96	0.96	0.19	0.22	0.01	0	0	0.05	2.82	8.63	28.59	27.7	W
1953	3.76	0.01	2.25	3.22	0.69	0.03	0	0.16	0.01	0.3	2.51	0.56	13.5	17.47	
1954	3.31	2.38	4.53	1.8	0.12	0.21	0	0.01	0	0	3.24	4.15	19.75	13.29	D
1955	6.5	1.91	0.2	2.26	0.58	0	0	0.04	0	0	2.08	14.61	28.18	16	
1956	8.04	1.51	0	1.86	1	0	0.07	0.05	0.31	1.31	0.01	0.98	15.14	26.24	W
1957	4.39	2.83	1.77	0.83	2.54	0.13	0.01	0	0.11	1.71	0	4.03	18.35	9.98	D
1958	5.07	7.63	5.19	4.35	0.57	0.15	0	0.05	0.28	0.02	0.23	0.65	19	21.92	W
1959	7.77	5.45	0.58	0.57	0.02	0	0	0.01	6.09	0	0	0.56	21.05	14.68	
1960	4.97	4.83	1.08	1.71	0.22	0.03	0	0	0	0.1	4.08	1.17	18.19	11.44	D
1961	2	1.57	2.67	0.96	0.49	0.18	0	0.01	0.08	0.07	2.34	1.22	11.59	11.49	D
1962	2.81	10.43	2.05	0.3	0	0.06	0	0.1	0.01	3.81	0.53	2.92	23.02	18.85	
1963	5.9	4.78	4.39	6.2	0.2	0.01	0	0.04	0.3	2.59	4.48	0.26	29.15	18.52	
1964	4.68	0.18	1.89	0	0.39	0	0	0.05	0.11	1.1	3.39	10.49	22.28	11.49	D
1965	1.87	1.08	2.38	2.63	0.02	0.01	0	0.28	0	0.07	5.21	4.6	18.15	19.21	
1966	1.77	2.01	0.23	0.41	0.05	0	0.32	0	0.08	0.04	4.77	5.17	14.85	13.82	D
1967	7.34	0.36	6.42	6.67	0.31	1.29	0	0	0	0.05	1.04	3.27	26.75	24.06	W
1968	3.48	2.58	4.26	0.85	0.06	0	0	0.22	0.01	0.6	3.35	4.74	20.15	14.63	D
1969	10.93	8.53	1.62	2.39	0	0	0	0	0.09	2.27	1.07	5.83	32.73	29.17	W
1970	7.28	1.66	3.24	0.14	0	0.28	0	0	0	0.67	7.31	5.09	25.67	19.08	
1971	1.6	0.49	2.21	1.68	0.13	0	0	0.06	0.18	0.03	1.81	4.74	12.93	16.7	
1972	1.77	1.17	0.05	1.37	0.03	0.04	0.01	0	0.15	2.62	6.92	2.1	16.23	9.54	D
1973	6.38	8.15	3.77	0.05	0	0.01	0	0	0.12	1.64	6.82	5.85	32.79	27.32	W
1974	4.68	1.31	7.76	4.29	0	0.45	1.27	0	0	1.7	0.89	2.76	25.11	26.42	W
1975	1.01	5.58	4.7	1.65	0.03	0.16	0.09	0.31	0.02	2.95	0.37	0.24	17.11	14.94	
1976	0.27	1.04	2.07	1.14	0	0.11	0	1.12	1.08	0.52	1.63	1.68	10.66	3.99	D
1977	1.12	0.87	1.87	0.02	0.98	0.14	0	0	0.86	0.19	1.21	4.93	12.19	7.17	D
1978	7.35	5.25	6.15	3.82	0.01	0.21	0	0	0.61	0	3.7	1.96	29.06	24.89	W
1979	6.3	4.71	2.82	0.51	0.17	0	0.28	0	0	2.03	2.36	6.26	25.44	19.49	
1980	6.98	5.49	2.55	2.03	0.65	0.06	0.62	0	0.01	0.07	0.09	2.53	21.08	23.64	W
1981	7.2	2.16	5.55	0.65	0.07	0	0	0	0.02	1.84	3.26	3.88	24.63	17.53	
1982	8.53	4.42	6.38	5.58	0	0.38	0	0	1.45	2.43	6.16	2.79	38.12	26.47	W
1983	8.47	7.67	11.02	5.93	0.27	0	0	0.02	1.24	0.65	8.01	5.07	48.35	36.11	W
1984	0.23	1.58	1.89	0.84	0.19	0.1	0	0	0	2.3	7.37	1.73	16.23	16.78	
1985	1.04	1.18	4.64	0.48	0.32	0.1	0.04	0	0.22	1.27	4.98	2.63	16.9	15.96	
1986	3.46	8.61	5.82	0.81	0.41	0	0	0	1.2	0.09	0.06	1.27	21.73	25.5	W
1987	3.24	5.17	2.88	0.46	0	0.02	0	0	0	0.57	2.23	5.03	19.6	12.62	D
1988	2.01	0.64	0.02	2.11	0.63	0.12	0	0	0	0.02	2.58	5.7	13.83	9.93	D
1989	1.56	1.22	4.75	0.65	0.1	0	0	0.04	0.86	1.38	1.73	0.03	12.32	15.81	
1990	3.26	3.11	1.92	0.31	2.17	0	0.06	0	0.3	0.27	0.27	1.68	13.35	10.05	D
1991	0.48	3.02	11.74	0.46	0.05	0.01	0.01	0.04	0.01	0.86	0.75	3.17	20.6	17.19	
1992	2.47	7.67	3.85	0.07	0	0.15	0	0	0	0.86	0.01	7.01	22.09	17.91	
1993	10.47	5.71	2.87	0.73	1.21	0.37	0	0	0.01	0.35	2.17	2.61	26.5	26.07	W

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	NDJFM Total	Wet/Dry Yrs
1994	2.54	5.66	0.36	1.83	1.33	0.02	0	0	0.05	1	5.5	2.5	20.79	13.34	D
1995	11.61	0.58	7.71	3.95	0.75	0.64	0	0	0	0	0.11	6.64	31.99	27.9	W
1996	5.1	7.79	2.58	0.8	2.53	0	0	0	0	1.62	6.1	10.95	37.47	22.22	W
1997	7.56	0.14	0.42	0.57	0.02	0.08	0	0.2	0	0.55	6.18	3.71	19.43	25.17	W
1998	10.23	15.99	3.84	3.01	2.46	0	0	0	0.15	0.61	2.95	1.89	41.13	39.95	W
1999	4.98	7.1	2.9	1.68	0	0.1	0	0	0	0.22	3.3	0.29	17.27	19.82	
2000	9.57	10.14	2.59	0.98	0.76	0.11	0	0.16	0.09	3.1	0.53	0.76	28.79	25.89	W
2001	3.44	6.28	1.98	1.12	0	0	0	0.02	0.17	0.34	4.3	0	17.65	12.99	D
2002	1.51	0.7	1.51	0.24	0.29	0	0	0.05	0	0	3.27	8.88	16.45	8.02	D
2003	1.27	1.71	1.22	2.52	1.16	0.02	0	0.02	0.01	0.41	2.31	7.8	18.45	16.35	
2004	2.49	5.74	0.77	0.4	0.11	0	0	0	0.01	3.51	1.75	4.87	19.65	19.11	
2005	4.22	4.63	5.33	1.59	0.83	0.82	0.03	0	0	0.17	0.9	8.77	27.29	20.8	W
2006	5.51	1.76	8.61	5.81	0.83	0	0	0	0	0.1	1.52	4.1	28.24	25.55	W
2007	0.96	4.96	0.33	1.06	0.17	0	0	0	0.41	1.23	0.64	2.73	12.49	11.87	D
2008	7.37	3.27	0.21	0.28	0	0	0	0.03	0	0.35	1.49	3.29	16.29	14.22	D
2009	1.28	6.24	2.21	0.36	0.77	0.02	0.02	0	0	5.31	0.09	3.57	19.87	14.51	D
2010	6.12	5.27	2.33	4.19	0.52	0.02	0.01	0.09	0	1.62	3.23	6.67	30.07	17.38	
2011	2.05	4.65	7.98	0.27	1.39	1.11	0.01	0.03	0	1.87	2.1	0.04	2.14	24.58	W
2012	2.81	0.65	4.13	3.13	0.01	0.2	0.04	0	0	0.35	4.42	6.09	21.83	9.73	D
2013	0.68	0.44	0.48	0.32										12.11	D
Avg (inch	**4.63**	**3.94**	**3.28**	**1.74**	**0.47**	**0.13**	**0.05**	**0.05**	**0.27**	**1.02**	**2.77**	**4.01**	**21.91**		



METR 104 Final Project:
El Nino/La Nina and Precipitation on the West Coast

Weather Station Assignments for Precipitation Analysis

Student Name		Station Assignments for Each of Four Regions			
FIRST NAME	**LAST NAME**	**Southern California**	**Central California**	**Nor. Cal./So. Oregon**	**Washington State**
Lexi	**Adsit**	San Diego	Mission Dolores	Eureka, CA	Palmer, WA
Adoray	**Alonzo**	KLAX	Mission Dolores	Eureka, CA	Palmer, WA
Michael	**Banh**	Santa Barbara	Mission Dolores	Eureka, CA	Palmer, WA
Joshua	**Braze**	San Diego	Watsonville	Eureka, CA	Palmer, WA
Henry	**Brown**	KLAX	Watsonville	Eureka, CA	Palmer, WA
Reid	**Cammack**	Santa Barbara	Watsonville	Eureka, CA	Palmer, WA
Paulina	**Cardenas**	San Diego	Sacramento	Eureka, CA	Palmer, WA
Christine	**Cheung**	KLAX	Sacramento	Eureka, CA	Palmer, WA
Brian	**Conry**	Santa Barbara	Sacramento	Eureka, CA	Palmer, WA
Anagabriela	**Cordero**	San Diego	Mission Dolores	Medford, OR	Aberdeen, WA
Liam	**Doherty**	KLAX	Mission Dolores	Medford, OR	Aberdeen, WA
Hannah	**Erickson**	Santa Barbara	Mission Dolores	Medford, OR	Bellingham, WA
Richelle	**Gernan**	San Diego	Watsonville	Medford, OR	Aberdeen, WA
Emma	**Gonzalez**	KLAX	Watsonville	Medford, OR	Aberdeen, WA
Emily	**Goulart**	Santa Barbara	Watsonville	Medford, OR	Aberdeen, WA
Brandon	**Kirk**	San Diego	Sacramento	Medford, OR	Bellingham, WA
Danielle	**Pinson**	KLAX	Sacramento	Medford, OR	Aberdeen, WA

Gabriel	**Price**	Santa Barbara	Sacramento	Medford, OR	Aberdeen, WA
Aaron	**Quach**	San Diego	Mission Dolores	Ashland, OR	Bellingham, WA
Kalani	**Ruidas**	KLAX	Mission Dolores	Ashland, OR	Bellingham, WA
Cori	**Saffel**	Santa Barbara	Mission Dolores	Ashland, OR	Bellingham, WA
Katie	**Winnen**	San Diego	Watsonville	Ashland, OR	Bellingham, WA
Carl	**Winston**	KLAX	Watsonville	Ashland, OR	Bellingham, WA
Alexandria	**Wong**	Santa Barbara	Watsonville	Ashland, OR	Bellingham, WA
Qi	**Yang**	San Diego	Sacramento	Ashland, OR	Bellingham, WA