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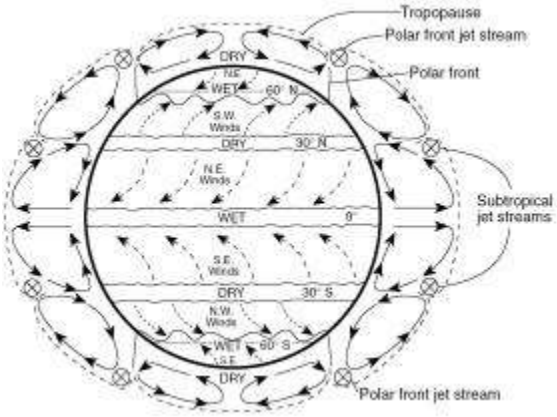
Global Influences on Weather and El Nino/La Nina Episodes

As noted in the overview guide, "Weather is felt locally, caused globally, and understood regionally." You know that the weather in your area is one small piece of the global atmospheric circulation system, also known as the planetary wind and moisture belts. One version is provided on p. 14 of the *ESRT:*



NYS lies in the Mid-Latitudes between approximately $40^{o} – 45^{o}$ N. So in this diagram we are in the "S.W. Winds." Usually this is referred to as the "Prevailing Westerlies" or just "Westerlies." This means that weather systems usually approach us from the west, and looking at what is happening there can give some indication of what will happen here in a day or two.

Another part of this diagram that influence NYS weather is the "Polar Front." This is shown as a wavy line between the N.E. winds in the polar convection cell and the S.W. Winds. The location of the Polar Front at any time is influenced by the Polar front jet stream, a narrow zone of high-speed winds flowing from west-to-east. Sometimes the Polar Front is south of us and weather is carried from the southwest; when this happens, temperatures are relatively warm. At other times, the Polar Front dips south over us and weather comes from the northwest; when this happens, temperatures are relatively cold.

Study the *ESRT* diagram carefully so you and your students known when and how to use it to answer Regents exam questions. Notes:

El Nino and La Nina Episodes

Meteorologists and the general public have paid much attention in the past few decades to weather patterns that previously were thought to be confined to the west coast of South America. Instruments aboard weather satellites such as TOPEX and Jason provided data from detailed monitoring of sea surface temperatures. Researchers used these to expand our understanding of changes in weather extending across the Pacific Ocean, and further investigations identified links to weather in other parts of the globe, including NYS. So although El Nino and La Nina are usually studied as Climate phenomena, we will consider them here as weather-shapers.

NOAA's National Ocean Service describes El Niño and La Niña as opposite phases of what is known as the *El Niño-Southern Oscillation* (**ENSO**) cycle. The ENSO cycle is a scientific term that describes the fluctuations in temperature between the ocean and atmosphere in the east-central Equatorial Pacific (approximately between the International Date Line and 120 degrees West). La Niña is sometimes referred to as the *cold phase* of ENSO and El Niño as the *warm phase* of ENSO. These deviations from normal surface temperatures can have large-scale impacts not only on ocean processes, but also on global weather and climate. El Niño and La Niña episodes typically last nine to 12 months, but some prolonged events may last for years. While their frequency can be quite irregular, El Niño and La Niña events occur on average every two to seven years. Typically, El Niño occurs more frequently than La Niña. (Source: http://oceanservice.noaa.gov/facts/ninonina.html).

During an El Nino, sea surface temperatures in the central and east-central Equatorial Pacific are warmer than normal; that is, they have a **positive temperature anomaly.** That is, the measured value is above the expected or average value for that location and time of year. It is important to teach your students the technique of using anomalies, rather than just actual values. This is because merely to say the temperature in a location is 25^{o} C probably means little, but to say that this represents a + 1.5^{o} C anomaly shouts that something is happening.

El Nino episodes typically develop in the fall and have an impact over North America during the following winter. These include warmer-than-average temperatures over western and central Canada, and over the western and northern United States. Wetter-than-average conditions are likely over portions of the U.S. Gulf Coast and Florida, while drier-than-average conditions can be expected in the Ohio Valley and the Pacific Northwest. You and you students may recall how mild the winter of 2015-2016 was, and perhaps the devastative flooding in Tennessee and other parts of the Southeast.

La Niña episodes are periods of below-average sea surface temperatures across the east-central Equatorial Pacific. Global climate and tropical ocean conditions during a La Niña tend to be opposite those of El Niño impacts. During a La Niña year, winter temperatures are cooler than normal in the Northwest and warmer than normal in the Southeast.

The American Meteorological Society created a learning module centered around their "El Nino-La Nina-lyzer." You will receive one and work through their activity.

(If desired, additional AMS Educational materials are available through https://www.ametsoc.org/ams/index.cfm/education-careers/education-program/k-12-teachers/education-materials/.)

NOAA provides El Nino-La Nina updates and information through https://www.climate.gov/enso.

Examine the information here—What is the current ENSO status?

Describe the expected effects for your area during a typical El Nino winter.

Examine some of the Teaching Climate resources at https://www.climate.gov/teaching.

What might be some strategies you would use with your students to teach about the weather impacts of El Nino-Lan Nina episodes?