Report on 90-day Weather Projection for the Northern Half of New Mexico

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Introduction:

This is the latest 90-day weather forecast for the northern half of New Mexico. The forecast area covers a region bounded by the state borders on the north, west, and east, and Interstate 40 on the south.

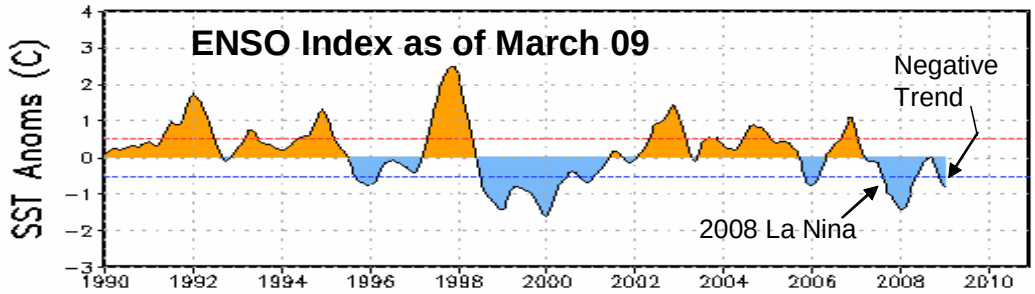
The report contains a summary weather outlook for May through July (directly below), a review of the current El Nino Southern Oscillation (ENSO) condition, and an overview of current weather trends along with outlook maps for the next 90 days. Also included is a discussion about the annoying climatic phenomenon people know as springtime winds.

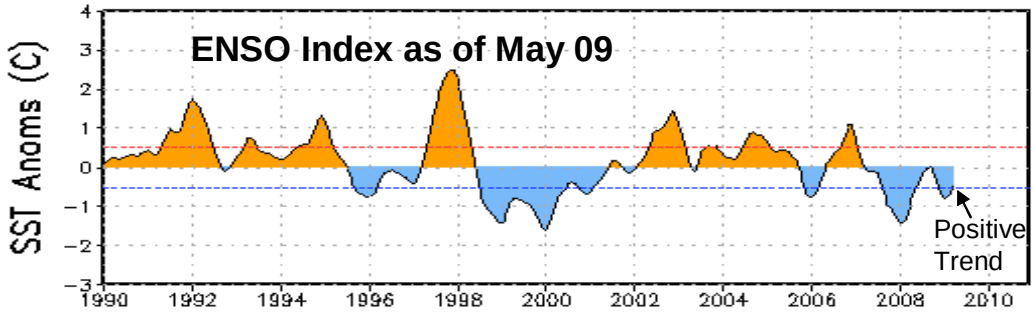
Summary, Ninety-day weather outlook for forecast area:

- *Atmospheric measures now indicate that the moderate La Nina-like condition that has existed over the past 120 days is waning and should allow normal precipitation conditions to prevail over the forecast area in late spring and early summer.*
- Long-range computer models are in reasonable agreement that an official La Nina will not develop and that ENSO neutral conditions will prevail for the next half year. But higher than average temperatures are expected to continue.
- Precipitation throughout the forecast area during the past 5 weeks was well below average. Temperatures have been significantly above normal in the same period.

Review of Current El Nino Southern Oscillation Situation and Discussion:

The Historic Oceanic Nino Index, which is the official metric from which a La Nina or El





Nino is declared, is at -0.5C, about 35% more positive than in late March, an indication that this latest ENSO event will soon end. Most of the climatic models are now predicting that ENSO neutral conditions (neither El Nino nor La Nina) should prevail through the next six months.

The graphics above (from National Climatic Prediction Center) show the historical ENSO Index. The top one shows the index to the end of March; the bottom one shows it to early May, 2008. The growing positive trend in sea surface temperature is clear.

This negative ENSO index event, which began early last winter, never qualified as an official La Nina. For one to be declared, the 3-month moving average index must be greater than -0.5C for five consecutive averaging periods. In this latest cooling episode we have just two consecutive averaging months that meet that condition.

However, this recent La Nina-like event was sufficient to be at least partially responsible for the drier than normal conditions in the forecast area late latest winter and this spring.

Computer models are generally in agreement that the ENSO index will be neutral over the next six months. This portends normal levels of precipitation over the monsoon season and into the fall.

Last 30 days.

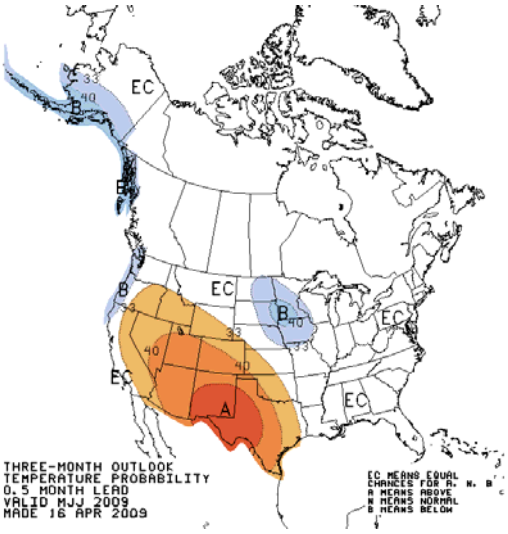
Generally, with a few geographic areas excepted, precipitation in the forecast area has been about 20% below normal. Simultaneously, temperatures have been several degrees (F) above normal. As a result, river runoff has been underway for some time and is essentially complete for many lower elevation mountain areas. But there is still much snow to melt in higher elevation areas.

Next 90 days.

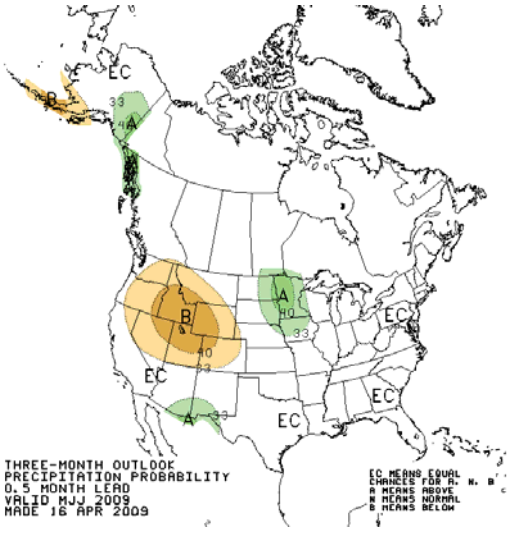
The projection for the next 90 days is not much different from the one in late March. The maps below show the predictions (from the National Climate Prediction Center).

Outlook for May Through Jul 09

Temperature



Precipitation



Above normal temperatures are expected, probably due to the overall global warming. But precipitation is expected to be around normal, which is consistent with the expected neutrality of the ENSO index.

Recent Weather Trends

The recent weather continues to show a preponderance of high pressure ridges over the forecast area that weaken or block moisture laden storms. These storms originate in the Aleutian Island area and mid-latitude Pacific regions and are the sources of most of the winter and spring moisture in the forecast area.

But as we progress into summer, these storms will weaken and give way to the monsoon pattern that defines the summer climatic patterns in the forecast area.

Spring Winds:

Many people are perplexed by the phenomenon of springtime winds in NM. I have been asked many times why the winds blow so hard in the spring and not in the fall, when climatic conditions are about the same. Others question the strength of the spring winds and the direction; the strongest ones tend to be from the west. And there is confusion about why these spring winds are so gusty and tend to diminish during the nighttime and then reappear during the day. Finally, there are questions as to why the winds seem to occur even when there are no storms involved and why they disappear suddenly as summer commences.

I will try to provide some answers, but the explanations will be greatly simplified. The actual situation is complex.

To begin, one has to understand that what happens on the earth's surface is not always reflective of what is happening in the upper atmosphere. Winds aloft can be blowing hard while the surface winds are calm.

The atmosphere is like a body of water and its motions are very similar to one. In fact, most of the physics of the atmosphere are the same ones that describe liquids. So just like a body of water, the surface can be disturbed, but the lower levels can be essentially calm. Imagine children splashing and swimming on the surface of a pool while the water at the bottom is barely disturbed.

The earth's atmosphere is in constant motion because it is trying to equalize the perpetual temperature differences between the poles and the equator. Wind is the mechanism that transports heat from hot regions to cool ones. (The ocean currents do a similar thing, but I will ignore them for this discussion because of the complexity.) Thus, winds are always blowing somewhere on earth.

The shape of the earth, its relationship to the sun (tilt and distance), and the varying types of surface (solid ground and water), all tend to create certain wind patterns. In the upper atmosphere, where there are few objects to disturb the flow, the patterns are more predictable, and they change regularly with the seasons and significant weather events.

It is a complicated situation, but for this discussion it is only important to know that during the cool season, which I will define as November through April, the *upper*

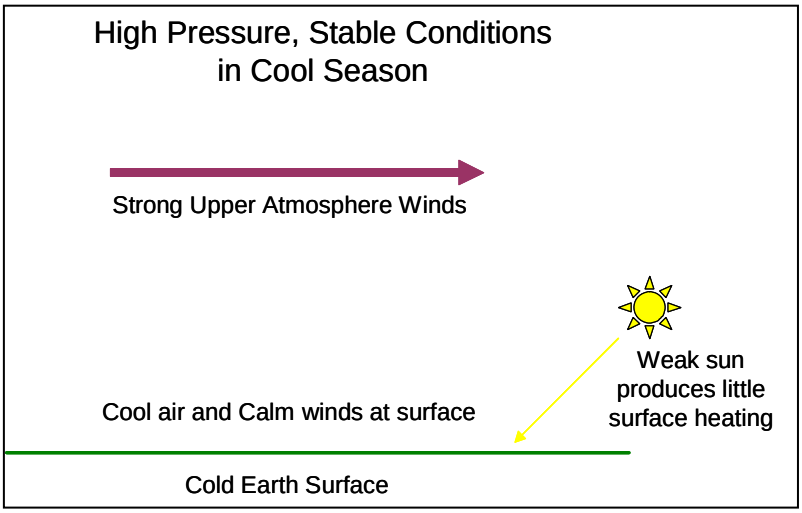
atmosphere winds over most of the US blow strongly from west to east. The main flow is roughly across the middle of the country. These winds are strong because during this season there is the greatest temperature difference between the equator and artic polar regions. In the warmer season the temperature difference is minimized and main flow moves farther north. In fact, there develops a small east to west flow in the upper air in the lower latitudes during this warm time of year. The two maps below show the trend (simplified). The size and thickness of the arrows represent the relative strength of the air flow.

Simplified Flow of Mid-latitude Upper Level Winds in Cold Season (Nov-Apr)

Simplified Flow of Mid-latitude Upper Level Winds in Warm Season (May – Oct)

Spring is a transition time where the conditions go from cold to hot. Another is in the fall, when conditions go from hot to cold.

In the winter, when the sun is low in the sky and the earth is cool, winds rage above the earth. Occasional cold fronts pass from north to south, bringing down cold artic air that is warmed in the lower latitudes. The warmed air returns north in the form of warm fronts. Storms also pass from west to east over the US, following the upper level flow.

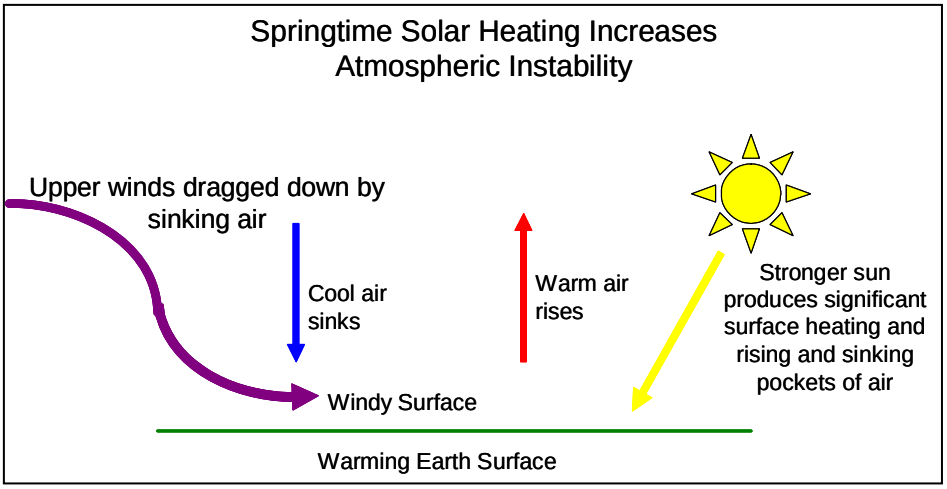


When there are no storms or cold fronts, the weather is calm because the entire system is cool and the sun cannot generate enough heating to disrupt it. Thus, even though winds are raging in the upper atmosphere, the surface is largely unaffected. See the figure above. Analogously, it is like a big pot of cold water sitting on a stove with a tiny flame underneath—essentially nothing happens.

The cold to hot transition (i.e., springtime) is one that causes the causes turbulence in the atmosphere, and which creates the windy conditions. It all starts with the sun, which in Feb begins to rise rapidly in the sky—each day the sun's position at noon is higher than

the previous day. Thus, its ability to heat the earth increases and with this heating comes atmospheric turbulence.

In spring the air is still cold from the winter season. The sun's radiation passes through the cold air without much heating, but when this radiation strikes the earth's solid surface, heating does occur. As the earth is heated during the day, the air in contact with the surface warms and it rises. The cool air above, which has not been heated much, sinks in place of the rising pockets of hot air. As a result, there is a continual action of rising and sinking air, all driven directly by the sun.



At this time of year, the upper level winds are still relatively strong and when the turbulence is sufficient, some of the sinking air will drag some of the upper level flow down to the surface.

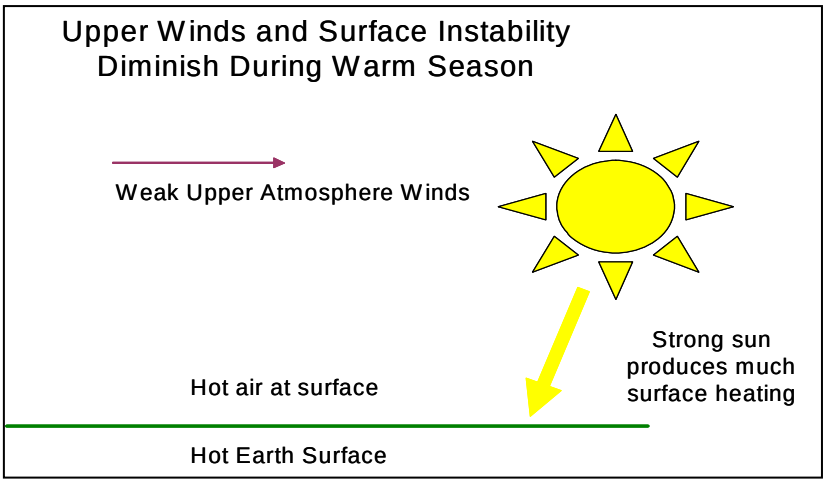
The turbulence is sporadic. After a pocket of hot air has risen and is replaced by cooler air, it takes some time for this cooler air to warm and then rise. As a result, the process is choppy. Correspondingly, the process of dragging down the upper winds is also choppy; and the result is gusty wind conditions.

These spring winds can be triggered by storms that move through the area and create instability in addition to that created by the sun, but most of the time they begin spontaneously due to the heating of the earth's surface by solar radiation. Once the sun sets in the evening, the winds will reduce to calm because the generation mechanism has been removed. Mornings tend to be calm because the earth's surface has been cooling all the previous night and it takes time for the sun to begin heating. The winds are at peak intensity during the hottest part of the day. See the figure above.

Analogously, it is similar to what happens to a pot of cold water sitting on a stove and the fire is turned continuously higher. The pan begins to heat and water at the bottom rises up. Boiling is eventually the result, and that is essentially what happens in most of the forecast area on clear April afternoons—the atmosphere is essentially boiling. A very cold pot with an intense flame under it tends to create the most turbulence as it transitions quickly from cold to hot conditions.

In the warm season, the atmosphere continues to "boil" every day. In fact, this "boiling" is what creates the billowing clouds and drives the thunderstorm activity. However, at this time of year the upper level winds have greatly diminished and the main flow has moved northward. Therefore, even when these upper winds are dragged down, they are mild. See the figure below.

During the autumn, the conditions at the surface in terms of temperature and solar radiation may appear to be similar to those in spring. However, the conditions are quite different because the sun's intensity is diminishing daily and thus it is providing less heating each day. In other words, the system is cooling and turbulence in the lower atmosphere is minimal (excepting interruptions from storms and cold fronts as winter approaches). In addition, during the fall period the upper level winds remain relatively weak as they are just beginning to regain strength and commence their migration back to their winter location.



Analogously, autumn is like when a hot pot of water is put on a flame that is continuously reduced. Even though the water is hot, it sits quietly and begins to cool as the flame gets smaller and smaller.

Again, this explanation is simplified for brevity and clarity. In actual fact, the atmospheric system is extremely complex and continues to be the subject of intense study. Very intricate computer models that operate on super computers are used to simulate its behavior, with varied results. Thousands of PhD and Master's degree theses are conducted each year regarding atmospheric questions. Some people, including me, believe that the atmosphere is but an attribute of the earth that characterizes it as a living entity. From this perspective, the earth is alive and very difficult to predict.

Next Report: Mid to late June, 2009.