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## RaysWeather.Com 2019-2020 Winter Fearless Forecast

### Summary of the Fearless Forecast for Winter 2019-2020

You may want to read the rationale that follows, but we'll give you the "answer" first.

- Snow totals 10% less than long-term.
- Temperatures near average.
- The bulk of winter between mid-November and late-January.

Below are forecast totals for many locations in the Southern Appalachians. (Note: The forecast snowfall total includes snow/ice falling between October 2019 and May 2020.)

**Table 1: Specific 2019-20 Snowfall Forecasts for Selected Locations**

Location	Expected Total Snow/Ice for Winter 2019-2020
Asheville, NC	12"
Banner Elk, NC	39"
Beech Mountain, NC	78"
Boone, NC	33"
Galax, VA	18"
Hendersonville, NC	9"
Hickory, NC	5"
Independence, VA	18"
Jefferson and West Jefferson	19"
Lenoir, NC	6"
Morganton, NC	6"
Mt. Airy, NC	9"
Old Fort, NC	6"
Sparta, NC	18"
Spruce Pine, NC	19"
Sugar Mountain, NC	78"
Waynesville, NC	14"
Wilkesboro and N. Wilkesboro	7"
Wytheville, VA	20"

Happy Skiing and Snowboarding! We'll keep you informed with the most reliable day-to-day forecasts for the Southern Appalachians and Foothills all winter.

Producing a winter forecast in October always a risky endeavor. This year's is even more uncertain than usual due to weak signals in the Pacific and Atlantic. Continue reading if you want the scientific rationale.

## Background and Assessment of Last Year's Forecast

Like the year before, Fall 2019 has been unseasonably warm. Temperatures finally settled to more seasonable levels in mid-October with the first frost occurring around October 15. As a result, leaves are again "behind schedule" as we enter the third weekend of the month.

RaysWeather.Com has produced a long-range winter forecast for 17 years. Last year, the region had one huge snow in early December; otherwise, snowfall was light and intermittent. Assessing last year's forecast:

1. Higher elevations received significantly less than average snowfall, the Foothills received much more than average snow, and lower mountain elevations were exactly as forecast (see Table 1 for details). We forecast slightly more than average snow. One could make the case that "on average across the region" last year's forecast was pretty good; however, many individual stations were very different from forecast totals.
2. We forecast temperatures slightly colder than average, but temperatures were slightly warmer than average overall.

**Table 2: Last Year's RWC Fearless Winter Snowfall Forecast**

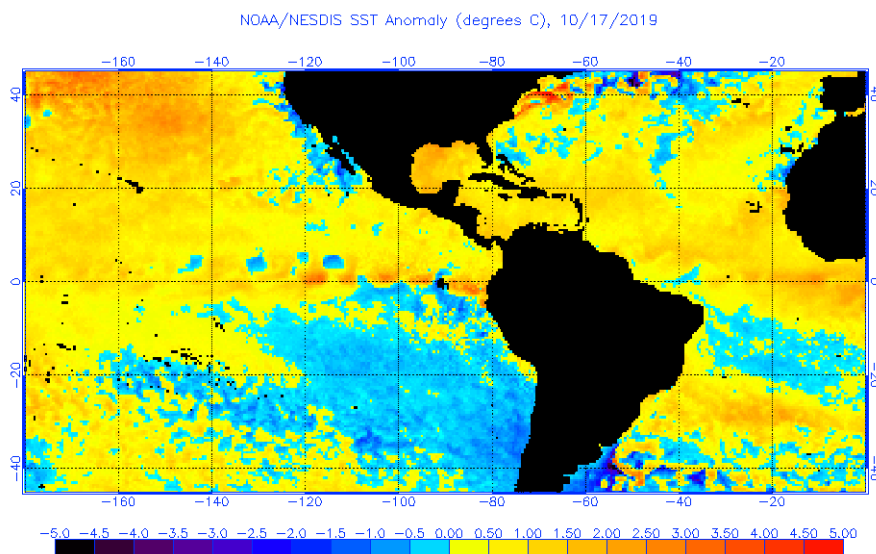
Location	Forecast	Actual	Actual - Forecast
Asheville, NC	16"	8"	-8"
Banner Elk, NC	50"	27"	-23"
Beech Mountain, NC	100"	52"	-48"
Boone, NC	42"	32"	-10"
Galax, VA	24"	24"	0"
Hendersonville, NC	11"	11"	0"
Hickory, NC	6"	13"	7"
Independence, VA	23"	25"	2"
Jefferson and West Jefferson	24"	22"	-2"
Lenoir, NC	7"	16"	9"
Morganton, NC	7"	14"	7"
Mt. Airy, NC	12"	14"	2"
Old Fort, NC	8"	16"	8"
Sparta, NC	23"	19"	4"
Spruce Pine, NC	24"	19"	-5"
Sugar Mountain, NC	100"	67"	-33"
Waynesville, NC	17"	11"	-6"
Wilkesboro and N. Wilkesboro	9"	18"	9"
Wytheville, VA	25"	23"	-2"

# Fearless Forecast Rationale

## ENSO Analysis

The consideration in a Winter forecast is the current state and forecast for the El Niño/Southern Oscillation (ENSO). ENSO is a measure of large-scale weather conditions in the Equatorial Pacific. It fluctuates between El Niño (associated with warmer than average sea surface temperatures in the Equatorial Pacific) and La Niña (associated with colder than average sea surface temperatures in the Equatorial Pacific).

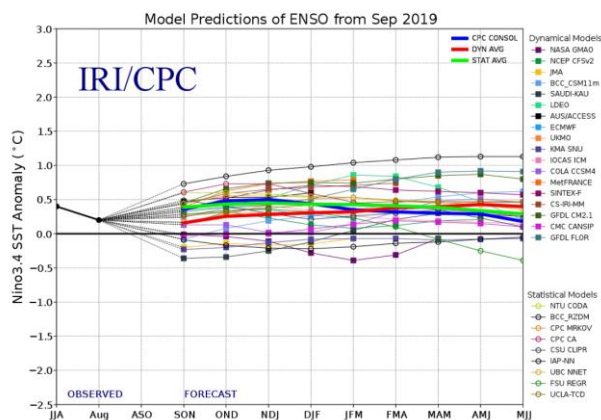
Currently, the ENSO is classified as Neutral; however, the October 17 Sea Surface Temperature Anomaly graphic (Figure 1) shows cooler than average water in eastern areas of the Equatorial Pacific and warmer than average water just to the north and in the western half of the Equatorial Pacific.



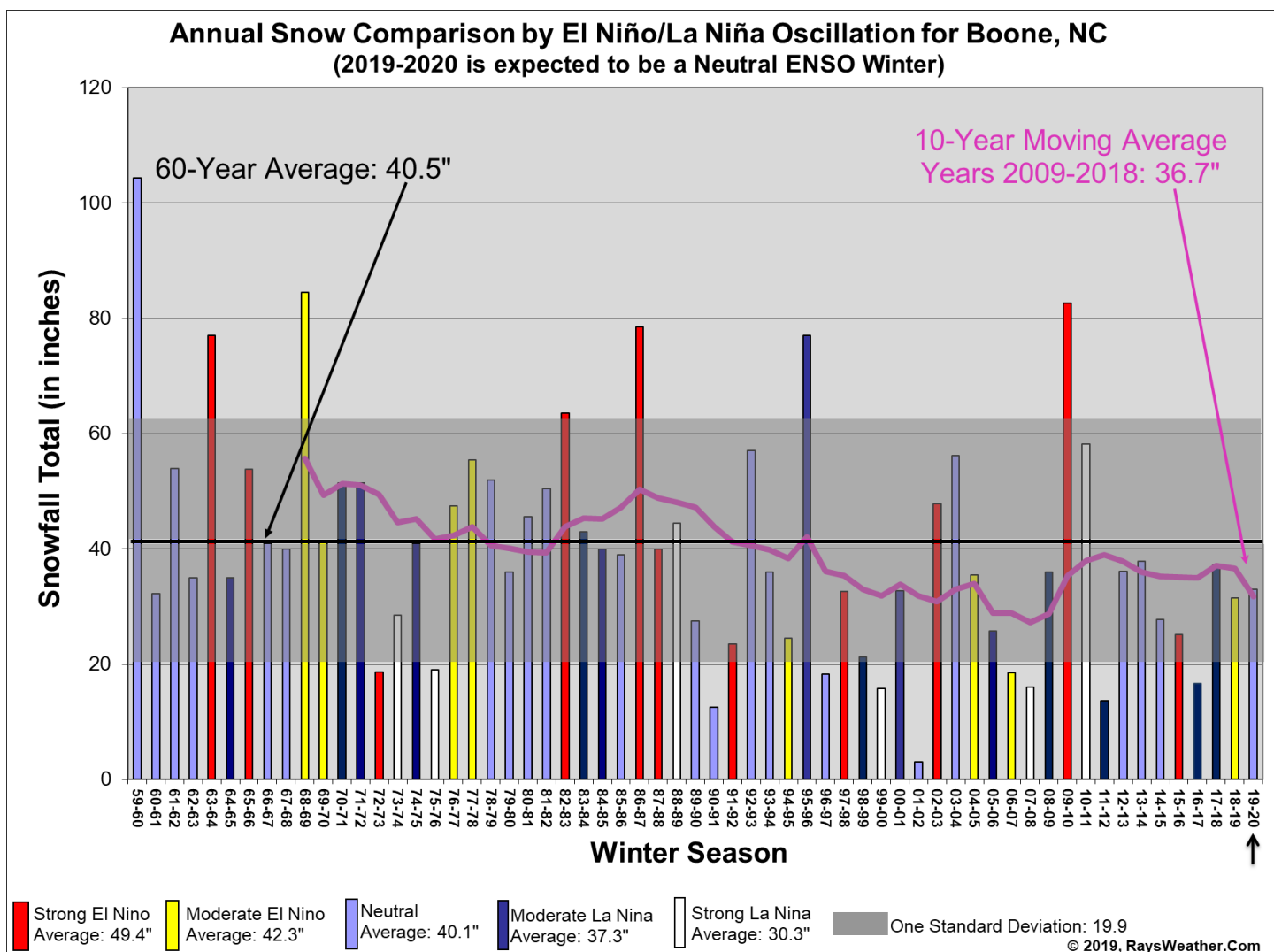
**Figure 1: Sea Surface Temperature Anomaly 10/11/2018**  
([www.ospo.noaa.gov/Products/ocean/sst/anomaly/](http://www.ospo.noaa.gov/Products/ocean/sst/anomaly/))

ENSO computer models generally predict ENSO Neutral conditions to persist through the winter; however, sea surface temperatures may lean slightly toward the warm side of average. Figure 2 shows current ENSO model forecasts. To be classified as an El Niño, the SST index needs to be above 0.5 for 3 consecutive months—that's unlikely this winter.

Figure 3 (next page) shows snow data from Boone, NC. You see seasonal snow data for 60 years classified by ENSO type (Strong El Niño through Strong La Niña). The graph also shows the long-term average and a 10-year moving average. Note that Neutral ENSO winters tend to have near-average snowfall.



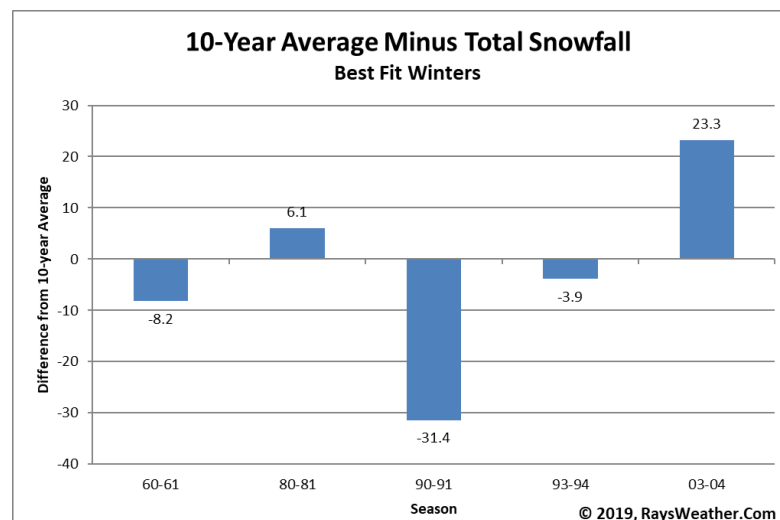
**Figure 2: Forecast for ENSO (from**  
[www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/ens0\\_advisory/ensodisc.shtml](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ens0_advisory/ensodisc.shtml))



**Figure 3: Total Winter Snowfall in Boone, NC, Classified by ENSO (ENSO classifications derived from [www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/ensostuff/ensoyears.shtml](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml))**

Based on predicted ENSO conditions for this winter, we chose 5 Best Fit Winters. We chose Best Fit Winters with the following characteristics: 1) ENSO Neutral, but 2) slightly warmer than average Sea Surface Temperatures in the Equatorial Pacific (but not warm enough to be classified as El Niño). Five such winters were identified, 1960-61, 1980-81, 1990-91, 1993-94, 2003-04.

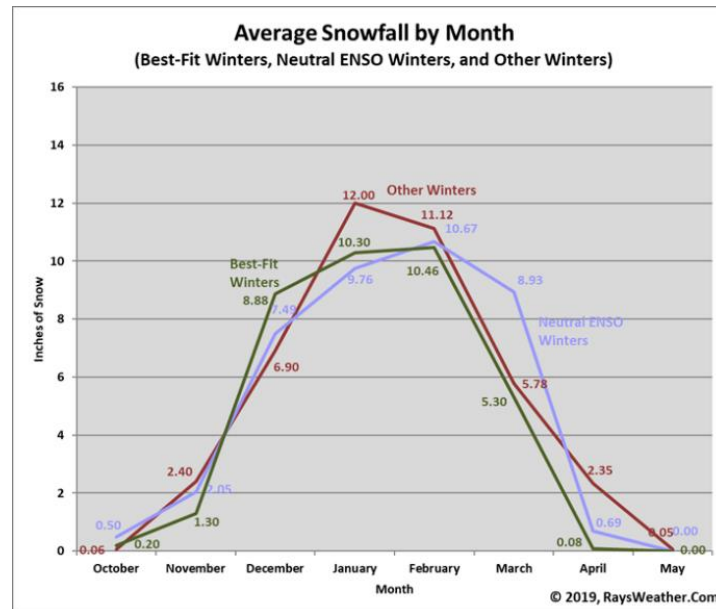
Average total snowfall in the Best Fit Winters in Boone, NC, is 36.5", 10% less than the long-term average (40.5") and almost identical to the 10-year average. Figure 4 shows snowfall in



**Figure 4: Best Fit Winters Total Snowfall Compared to 10-year Average.**

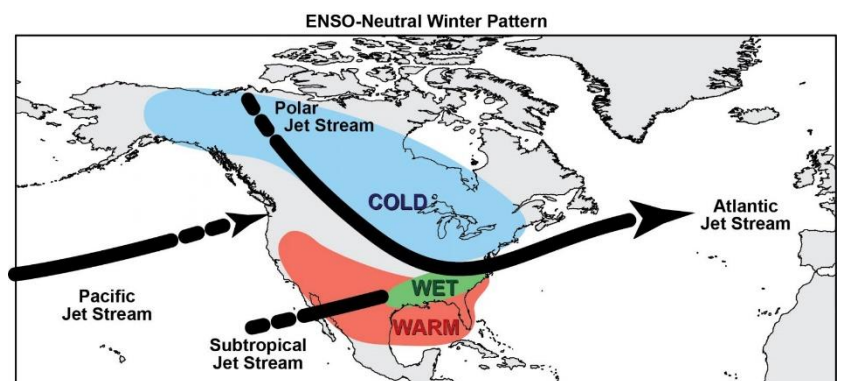
Best Fit Winters relative to their 10-year moving average. Using Olympic diving scoring (throwing out the Russian judge and the Romanian judge ☺, i. e., the two outliers in Figure 4), we have three winters with near or slightly less than average snowfall.

Figure 5 compares Best Fit Winter Snowfall with all Neutral ENSO Winters and all other winters. Our Best Fit Winters have slightly below average snow. This analysis also shows a slight preference for snow between November and February with little snow in March and early Spring.



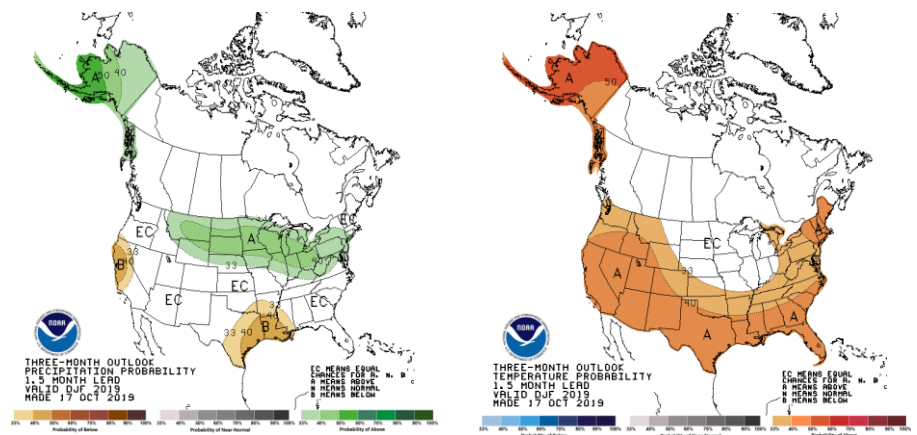
**Figure 5: Snow totals from our Best-Fit Winters (2003-04, 1993-94, 1990-91, 1980-81, 1960-61) compared with all Neutral ENSO Winters and all other winters. Snow totals shown are from Boone, NC.**

The winter pattern associated with ENSO neutral winters have the following tendencies: 1) Colder in the north-central and northeast US with a polar jet stream slightly south of average. 2) Warmer weather in the southern US, and 3) Above average precipitation in the Southeast with the subtropical jet tending to be positioned from the Baja Peninsula into the Southeast. Figure 6 shows the typical pattern.



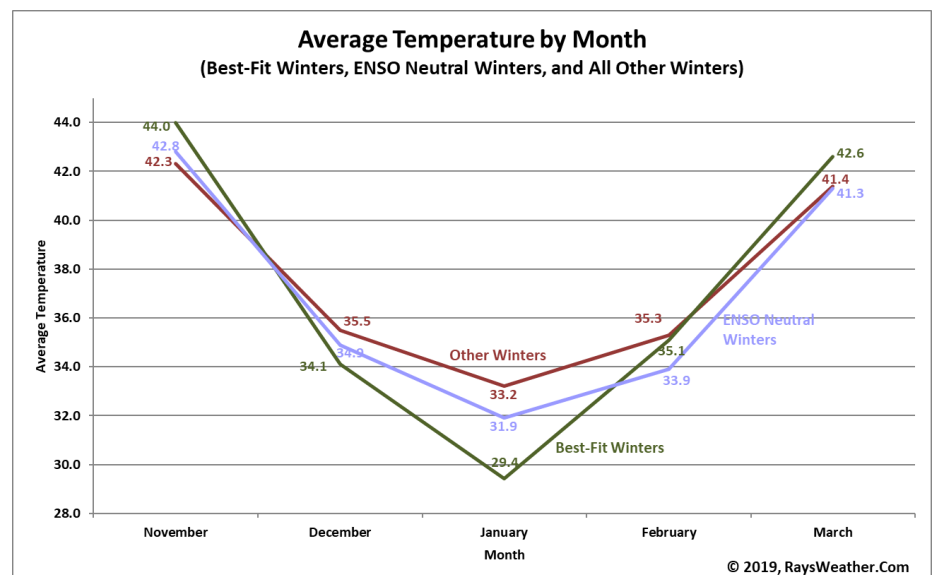
**Figure 6: Typical ENSO-neutral Weather Pattern (from [weather.gov/mhx/ensowhat](http://weather.gov/mhx/ensowhat))**

Figure 7 shows the latest NOAA Climate Prediction Center seasonal model forecast for December through February. While their forecast does not follow the Neutral ENSO playbook exactly, it does have some of the themes.



**Figure 7 Latest NOAA Winter forecast Probabilities**  
(from [cpc.ncep.noaa.gov/products/predictions/long\\_range/seasonal.php?lead=2](https://cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=2))

Figure 8 compares average temperatures in our Best Fit Winters with all ENSO Neutral Winters and all other winters. Our Best Fit Winters averaged about 1 degree colder than all ENSO Neutral Winters. Also in this graph December and January tend to be colder relative to other winters followed by a quick end to winter.



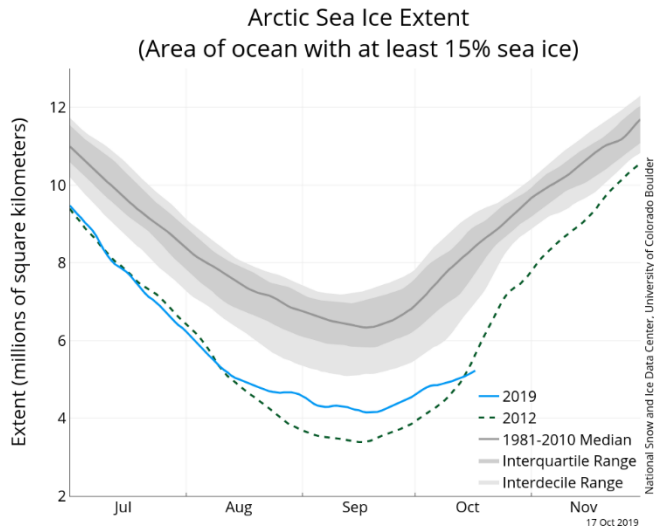
**Figure 8: Average temperatures from our Best-Fit Winters compared with ENSO Neutral Winters and all other winters.**  
Temperature data is from Boone, NC.

The main takeaways from the analysis of ENSO forecast for the coming winter are:

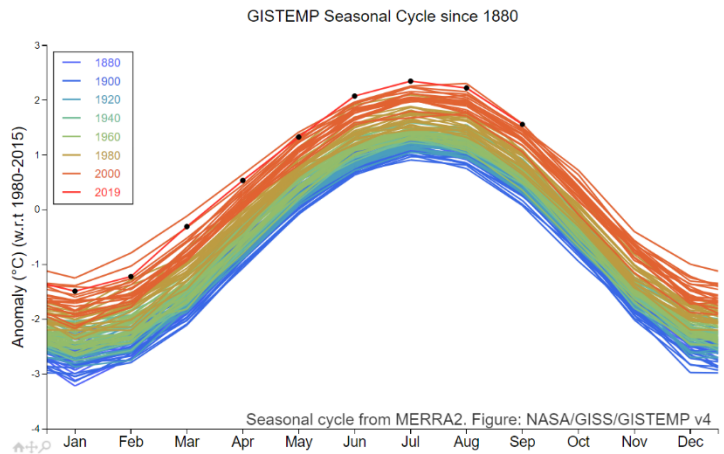
1. Slightly less than average snow.
2. Temperatures slightly colder than average.
3. Winter focused in the December to early February timeframe with a quicker than average exit from winter's grip.

## Climate Change

Climate change is real. If you are interested in a good source of scientific data and analysis on the subject, see <http://climate.nasa.gov/evidence/>. Figures 9 and 10 show broad measures of climate change effects. Figure 9 shows the extent of Arctic Ice. At the time this forecast is being written, the Arctic Sea as the least ice ever observed in October. Figure 10 shows month-by-month average temperature in North America. Thus far in 2019, June, July, and September were the warmest ever recorded in North America.



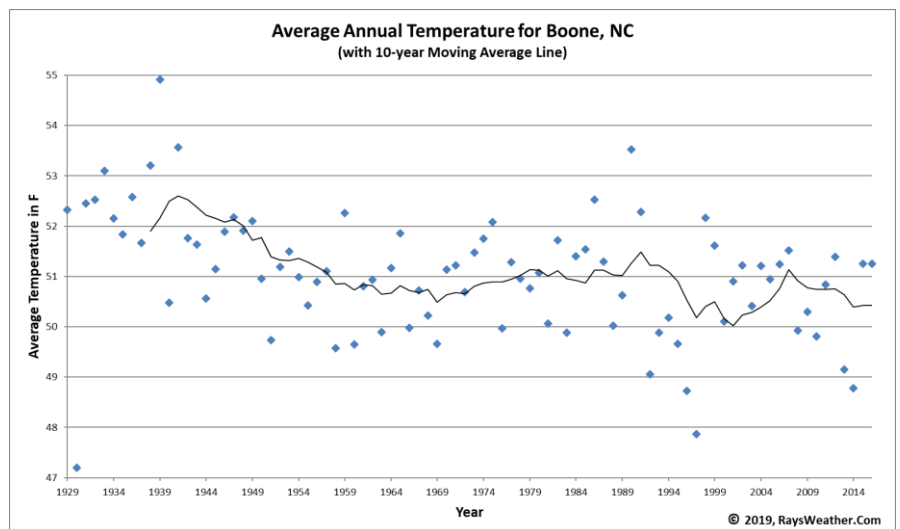
**Figure 9: Extent of Arctic Ice (from [nsidc.org/arcticseaicenews/](https://nsidc.org/arcticseaicenews/))**



**Figure 10: Average Temperature in North America (from [data.giss.nasa.gov](https://data.giss.nasa.gov))**

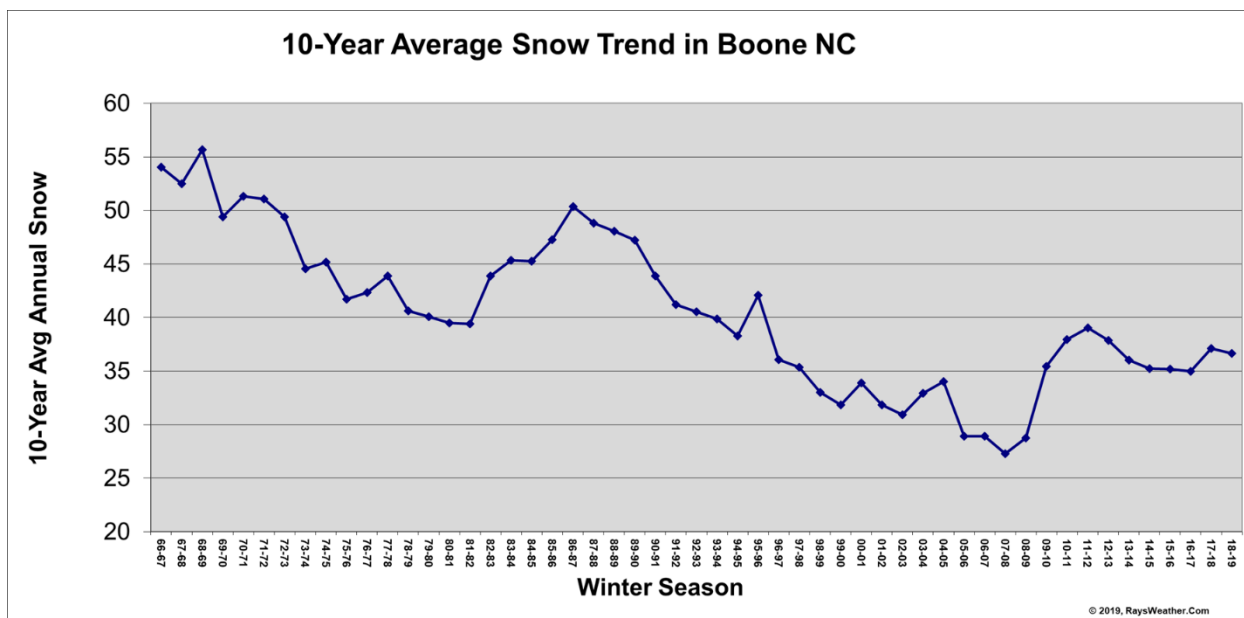
However, the effects of climate change are not linear or uniform in either time or from region to region. Warming, that has been experienced across most of the world, has not evidenced itself as strongly in the Southeast U. S. Figure 11 shows average annual temperature in Boone, NC through 2017. (The "Dust Bowl Years" are clearly evident in the 1930s and 1940s.)

Even though temperatures in Boone do not show warming since the 1980s, evidence of climate change exists. One of the effects is generally less snow since the 80s. A 10-year running average of total snow in Boone is shown in the Figure 12 (next page). Included in the current 10-year average are two anomalous winters (2009-10 and 2010-11); in all likelihood, when these years fall out of the 10-window, the trendline will be significantly lower.



**Figure 11: Average Annual Temperature for Boone, NC**





**Figure 12: Average Seasonal Snow in Boone, NC**

Takeaway: Any prudent seasonal forecast must lean toward warmer and less snow compared to long-term averages because of climate change.

## The North Atlantic Oscillation and Arctic Oscillation Wildcards

Every year, the North Atlantic Oscillation (NAO) and the Arctic Oscillation are the biggest wildcards for long-range winter forecasts in the Eastern U. S. The NAO index is based on the pressure difference between the Icelandic low and Azores high. The Arctic Oscillation describes the state of atmospheric circulation over the Arctic. (See [climate.ncsu.edu/climate/patterns/nao](http://climate.ncsu.edu/climate/patterns/nao) for details.) These indicators tend to move together and have an enormous impact on winter weather. Both a negative NAO and negative AO generally correlate to cold and snow in the Eastern U. S. Three factors could argue for a colder and snowier winter:

1. Some evidence exists that warmer than average sea surface temperatures in the Gulf of Alaska and just off the NE U. S. Coast (as exists currently) tend to promote negative AO and negative NAO.
2. Evidence also exists that warming at the poles has actually increased the likelihood for a negative NAO and negative AO during the winter.
3. Computer modelling for the next 45 days suggests a couple periods of negative NAO and negative AO. This could get us off to a good start for snow, particularly around the middle of November.

If all these factors come together, a colder/snowier winter than forecast here would occur. However, long-term NAO and AO forecasting is a low-confidence venture and will not be factored into the winter forecast here.



## Summary

Every year, I caution readers NOT put too much stock in this or any other long-range forecast; pure luck and the AO/NAO will have their say before winter ends. Furthermore, always discard any long-range forecast that lacks a scientific rationale. With all the prudent disclaimers... here's what we think:

- Snow totals about 10% less than the long-term average and slightly less than the 10-year average.
- Temperatures near seasonal averages.
- The bulk of winter coming between mid-November through the end of January followed by milder weather by late February and March.

Yes, there will be skiing in the Western North Carolina. And yes, schools will have snow days. 😊