

Inter-comparison of the Microclimate between the Pinson and Birmingham, Alabama Observing Sites

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It is a fairly well-known fact within the native forecast communities throughout Central Alabama that there are small but significant differences between the microclimates of the ASOS site in Birmingham, AL and COOP site located in Pinson, AL. Geographically located around 10.5 miles apart (see Figure 1) the terrain effects at PSNA1 lead to forecast challenges, especially with regards to the forecast lows.

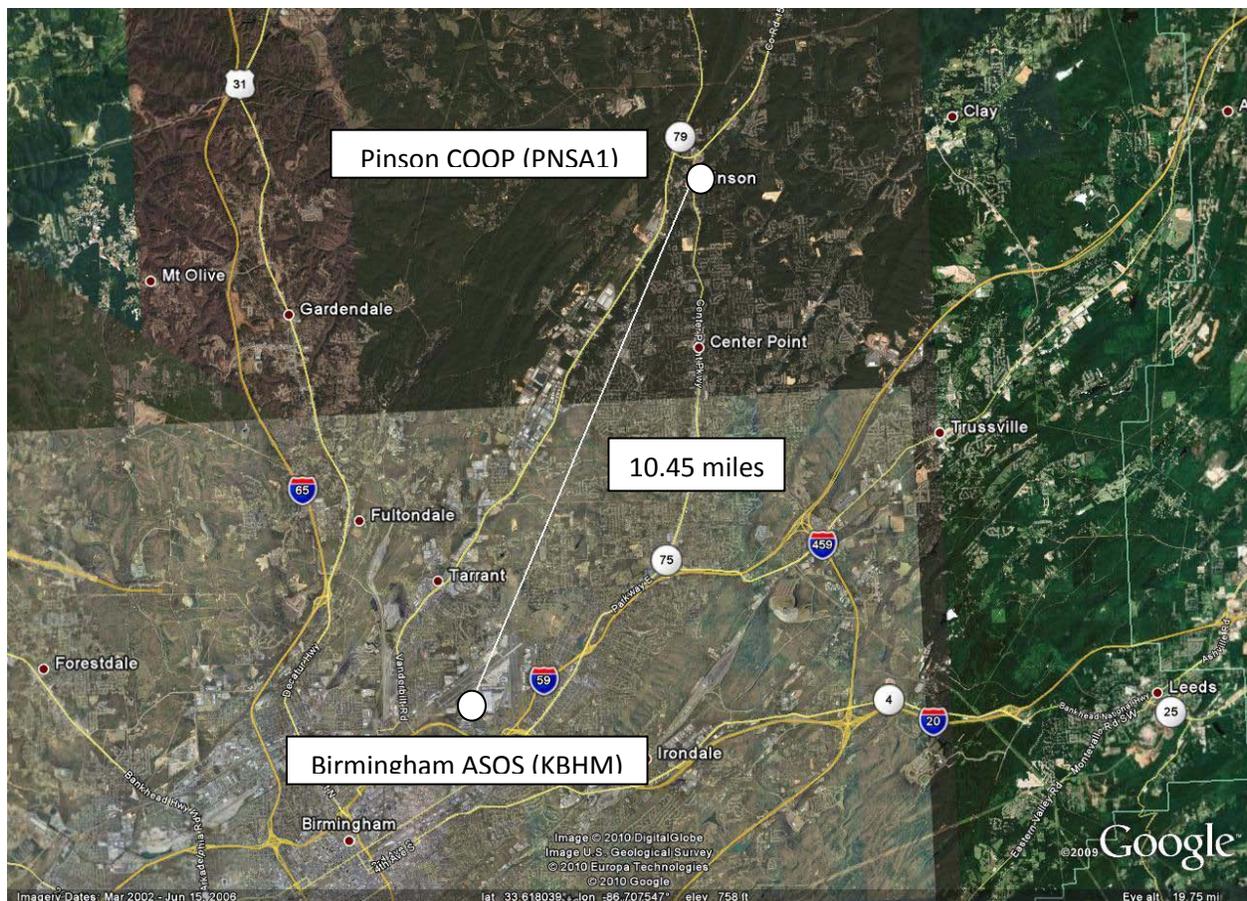


Figure 1. Relative locations of both the Birmingham (KBHM) and Pinson (PNSA1), Alabama observing sites.

The Pinson, AL cooperative observing site (PSNA1) was established on January 1, 1951, and is arguably one of the most comprehensive and complete weather databases in the country. The instrumentation site, which has never been relocated, provides the WFO Birmingham (BMX) with daily observations of high and low temperature, along with 24-hour rain and snowfall totals. The site is located near downtown Pinson, in the Pinson Valley area of Central Alabama, which is nestled between the Sand Mountain chain to the immediate northwest, and the Red Mountain chain to the southeast (see Figure 2). Both mountain chains are at the extreme southern extent of the Appalachian Mountains that cover much of the eastern quarter of the continental United States. This places the COOP observing site in the heart of a significant cold air drainage valley as both the northern and southern chain surround and tower several hundred feet above the station.

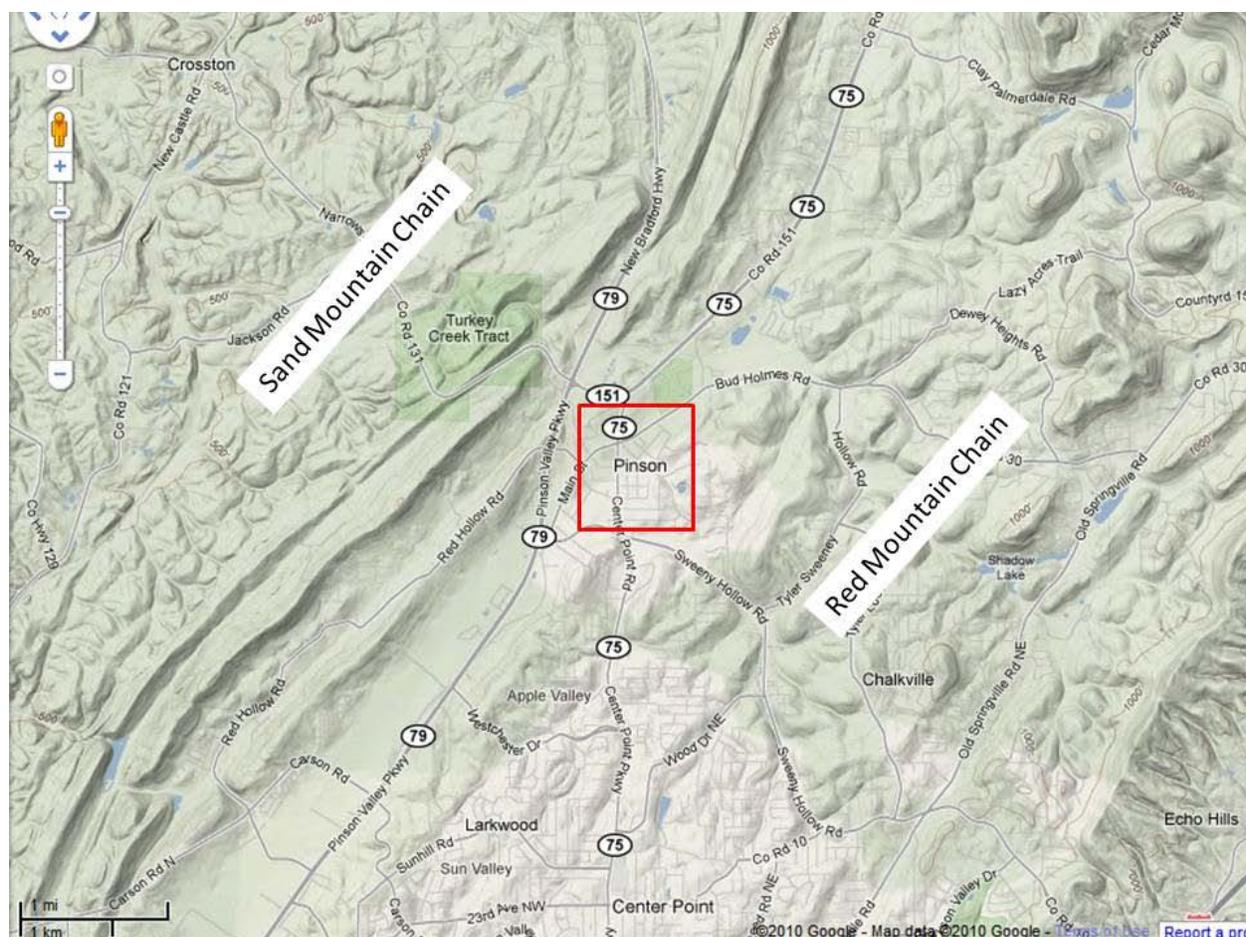


Figure 2. Location and terrain surround the cooperative observing site in Pinson, Alabama (PNSA1).

The Birmingham-Shuttlesworth International Airport automated surface observing system station (KBHM) was established on January 1, 1930, however, official observations began in 1895. Situated on the airport grounds, the KBHM suite of instruments has provided reliable routine and special observations for the Birmingham metro and airfield, which are regularly utilized for daily forecast comparisons by WFO BMX. Terrain influences at this site are negligible when compared to PNSA1, as it remains in the shadow of the Red Mountain to the south; however, the absence of a northern slope keeps the observational site outside of the confines of the Pinson drainage valley.

A review of the low temperature data over the past 30 years (shown in Table 1), reveals that the cold air drainage in the Pinson Valley has an approximate lower average difference of 3.3° F when compared to the warmer metro site KBHM. It is interesting to note that in the winter months when the difference may be perceived as being at its greatest, it is actually very similar to the summer months. From a forecast prospective, the influence on the forecast grids would be relatively straight forward, especially on clear and calm nights. As noted, the mere fact that PNSA1 takes direct observations within the cooler drainage valley is likely a direct cause of the low temperature difference, however, urbanization around KBHM may also play a role in biasing the temperature differences. Numerous studies indicate urban sprawl influences are most noticeable within low temperature trends (i.e. at night or in the early morning hours).

A review of the data indicates that differences in the low temperatures also play a role in the relative growing seasons. The average date of the first freeze at KBHM was found to be November 9th, while at PNSA1 it was on October 26th. Meanwhile, the date of the last freeze at Birmingham was April 2nd and at Pinson it was found to be April 12th. While this may seem insignificant, in fact, it decreases the growing season in Pinson by nearly one month although it is only several miles away in physical location.

Table 1. Comparison of low temperatures at KBHM and PSNA1 from 1981-2010.

<u>Month</u>	<u>Average Low (PSNA1)</u>	<u>Average Low (BHM)</u>	<u>Difference</u>
January	30.1	33.1	3.0
February	33.2	36.5	3.3
March	39.5	43.1	3.6
April	46.4	49.9	3.5
May	55.6	59.0	3.4
June	63.5	66.7	3.2
July	67.7	70.6	2.9
August	67.1	70.0	2.9
September	60.4	63.5	3.1
October	48.6	52.3	3.7
November	39.1	42.8	3.7
December	32.6	35.9	3.3
Annual	48.7	52.0	3.3

The inter-comparison of the average high temperatures for both sites (Table 2), shows that there is very little difference from month to month, nor on an annual basis. This is likely the result of similar daytime mixing regimes and the close proximity of geographical location. It is obvious that the drainage valley region and urbanization plays a much smaller or no role in influencing the high temperature bias.

The utilization of the COOP MOS data will likely be helpful in forecasting low temperatures at PNSA1, especially during calm and clear conditions. On those particular days, it would seem likely that the forecaster could account for microclimate of the Pinson Valley by lowering temperatures by around 3 degrees with regards to the low and by keeping the high temperatures similar to the Birmingham metro area.

Table 2. Comparison of high temperatures at KBHM and PSNA1 from 1981-2010.

<u>Month</u>	<u>Average High (PSNA1)</u>	<u>Average High (BHM)</u>	<u>Difference</u>
January	53.5	53.8	0.3
February	58.2	58.4	0.2
March	67.2	66.7	-0.5
April	75.2	74.5	-0.7
May	81.7	81.5	-0.2
June	87.7	87.7	0.0
July	90.6	90.6	0.0
August	90.6	90.6	0.0
September	84.8	84.9	0.1
October	74.8	75.1	0.3
November	65	65.3	0.3
December	55.8	56.1	0.3
Annual	73.8	73.8	0.0