The Microclimate of the Hamilton, Alabama Climatological Observation Site

Kevin Pence, WFO BMX

25 February 2010

When you analyze climate data across WFO BMX's CWA, or the entire state of Alabama for that matter, the temperature data from the Hamilton 3 S Climatological Observation (COOP) site, in Marion County, easily stand out. The Hamilton 3 S site is typically the coldest station when it comes to minimum temperatures throughout the year, although it is most noticeable during the cool season. Figure 1 shows the average minimum temperatures for January. The Hamilton site is at the white circle.

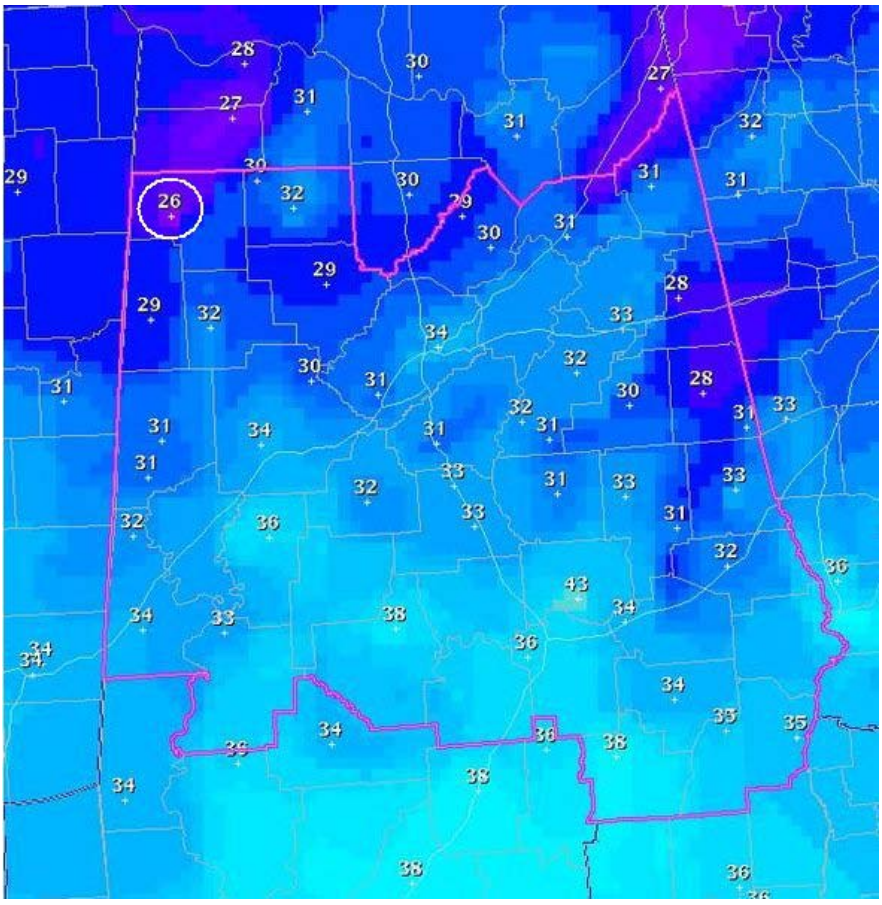

Figure 1. Average minimum temperatures for January (1971-2000), for COOP and METAR stations.

Other locations are just as cold when looking at average maximum temperatures. Hamilton's average monthly minimum temperature is generally 6 to 8 degrees colder than the average monthly minimum temperature at Birmingham. How much of the difference in average minimum temperatures is a reflection of morning reset temperatures at the COOP site is unknown.

A comparison of daily minimum temperatures shows the greatest difference between minimum temperatures at Birmingham and Hamilton typically occur on ideal radiation cooling nights, i.e. the sky is clear and the wind in calm. A perfect setting for this situation is a dry air mass and a surface ridge of high pressure extending over north Alabama through the night.

An examination of the topography in the Hamilton area, particularly where the COOP site is located, suggests cold-air drainage is the primary source of the cold temperatures. In figure 2 below, Hamilton is outlined in yellow, while the Hamilton 3 S COOP site is outlined in red. The Buttahatchee River runs southward from east of Hamilton, to north of the COOP site, and then to the southwest. Cold air drains out of the surrounding hills and into the Buttahatchee River Valley. The valley slopes slightly downward from Hamilton to the COOP site, as well as from the northeast to the COOP site.

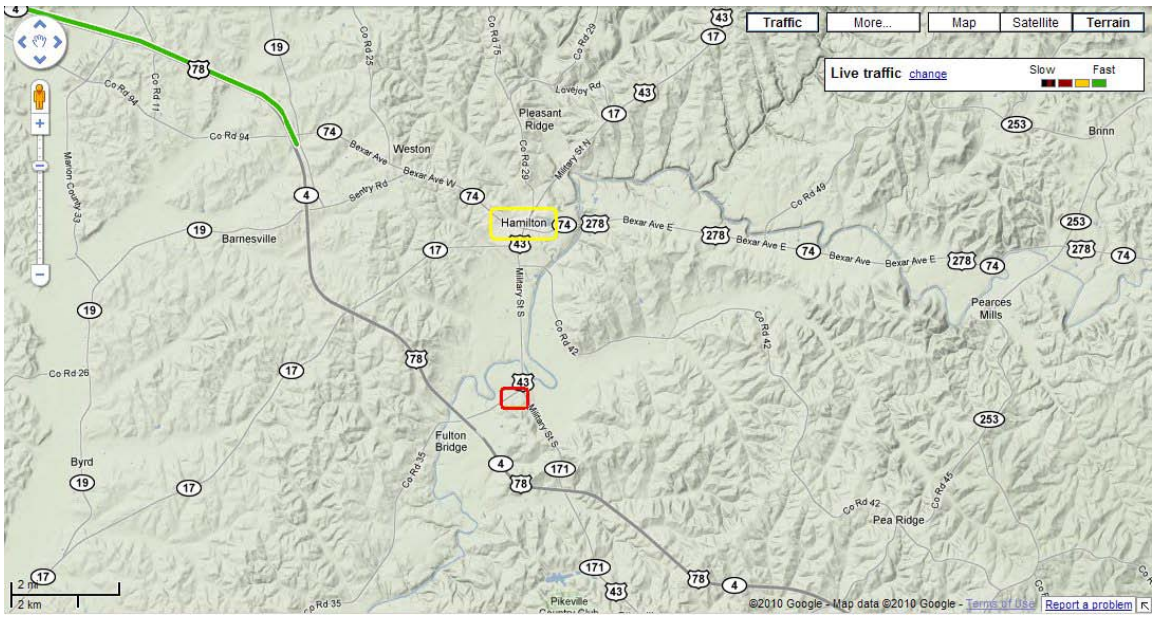

Figure 2. Topographical map of Hamilton and surrounding areas.

Figure 3 shows a "zoomed in" terrain map at the COOP site, which is circled in red. There is a knoll immediately to the south of the observation site. The COOP site has an elevation of 435 ft MSL. The top of the knoll is around 600 ft MSL. In fact, most of the hills surrounding the valley area rise up to 600+ ft MSL.

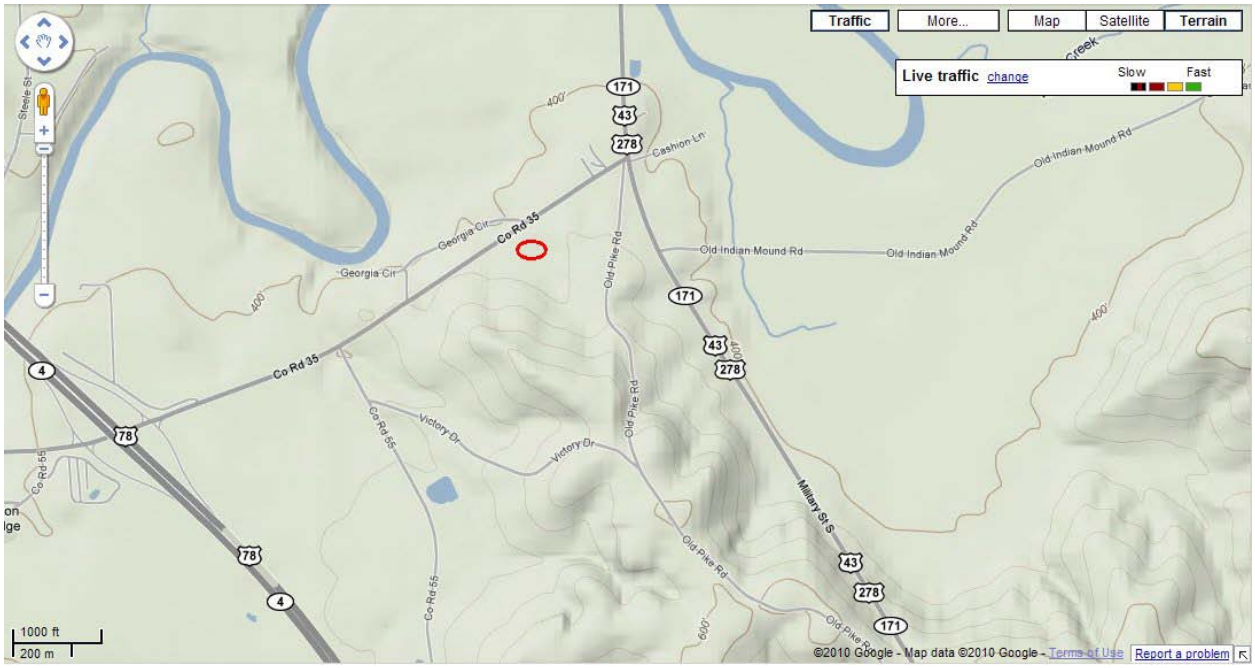

Figure 3. Topographical map of Hamilton 3 S COOP site and surrounding areas.

The COOP site is located at the foot of the north-facing side of the knoll, and is surrounded by hills that extend 100-200 feet above the valley floor.

As an example of the challenge this microclimate poses to the forecast, the minimum temperature at Hamilton 3 S was 14 degrees this morning (25 February 2010). Birmingham reported a minimum of 24 degrees.

The COOP MOS data should be helpful in catching the colder minimum temperatures at Hamilton, but keep in mind the differences between Hamilton and surrounding sites will not be as great with overnight winds and clouds. The significant cooling occurs during ideal radiation cooling nights. On those nights, forecasters should consider lowering the temperature for the Hamilton area at least 6 to 8 degrees from the minimum temperature at Birmingham.