IC 4.3: Microclimates Exercise: Austin Bergstrom Low Temperature Forecast

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Overview: In South Central Texas, terrain provides many examples of microclimates. In the case of Austin Bergstrom International Airport (ASOS ID: KAUS), clear nights with calm or light winds provide a good example of microclimate effects. Terrain and location is the key to why KAUS gets much cooler than Austin Camp Mabry (ASOS ID: KATT).

KAUS is cooler than KATT primarily because of urban heat island effect at KATT. KATT is just west of downtown Austin, where the absorption and trapping of heat is much greater that the more rural KAUS. On nights with few clouds and little or no mixing from winds, KATT is able to harbor that heat while KAUS tends to lose it via radiational cooling. In addition, the altitude change between the two sites is approximately 200 feet (see Figure 1), and Onion Creek also runs near KAUS, both promoting drainage winds and additional cooling.

Temperatures recorded by the KAUS ASOS do not give a good representation of the surrounding area in part because of the terrain and urbanization differences. The colder temperatures may not even be representative of conditions near the Bergstrom Airport Terminal due to the distance and elevation from the ASOS site to the terminal complex. Many people who call for data representing Austin as for KAUS, yet the data are not likely representative of the area they live. This microclimate is an important foundation for forecasters in forecasting low temperature, and secondary effects such as precipitation type and fog formation. Data shown in Fig. 2 are from a portion of February 2010 for both KAUS and KATT.

Synoptic-scale Ingredients: Generally, the most extreme temperature differences occur during two different situations: 1. when south central Texas is on the west side of a surface trough, or 2. directly under a surface ridge. When on the west side of the trough, timing is important such that subsidence begins and cloud cover erodes in time for radiational cooling to lower temperatures. When the area was on the west side of a trough during the selected period of February 2010, the average temperature difference was 5 degrees, and the greatest temperature difference was 8 degrees. In contrast, when the area is under a ridge, the difference between KATT and KAUS is even greater, between 7 and 9 degrees — under clear skies or only a few clouds. Note that the few low clouds can reduce the temperature difference by 2 or 3 degrees.

Diagnosis and Prognosis: Based on data in Fig. 2, the average difference between the Camp Mabry and Bergstrom temperatures is 6.5 degrees. When a cold front is approaching the area, forecasters should expect to modify low temperatures at KAUS. When cloud cover is dissipating during the forecast period, a 5 degree

difference between KATT and KAUS is typical. However, rapid clearing can result is temperature differences around 7 degrees. In addition, if subsidence will produce clear skies, light winds and maximum radiational cooling, the temperature at KAUS will be 8 to 9 degrees cooler than at KATT.

MOS Guidance: MOS guidance performs well in depicting the temperature difference between KATT and KAUS. The NAM MOS verifies better than the GFS MOS, likely due to better horizontal and vertical grid spacing. However, some longer terms soil moisture anomalies, and other model or MOS artifacts can make temperatures differences too high or too low.

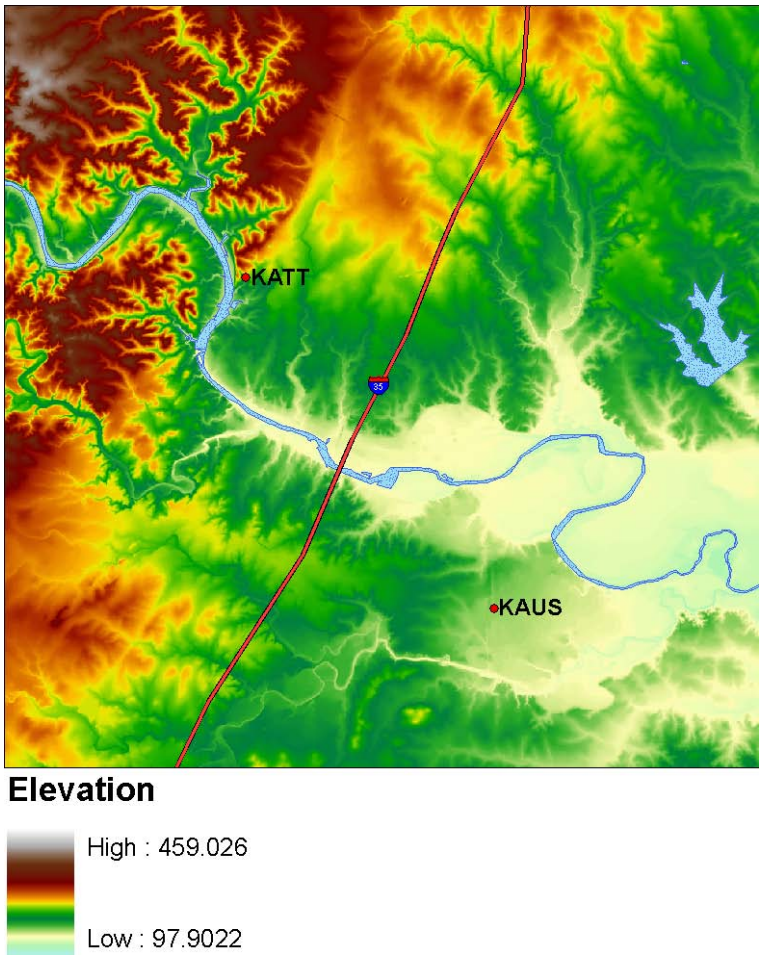

Figure 1: Topographic map comparing elevation of Austin Bergstrom (KAUS) and Austin Camp Mabry (KATT) (m).

Date	**Camp Mabry**	**Bergstrom**	Difference
5-Feb	43	38	5
6-Feb	39	31	8
9-Feb	35	30	5
12-Feb	33	28	5
14-Feb	37	30	7
15-Feb	32	27	5
16-Feb	30	24	6
17-Feb	30	22	8
18-Feb	33	26	7
25-Feb	32	23	9
27-Feb	37	32	5
28-Feb	37	29	8
Average			6.5

Figure 2: Low temperature data for part of February 2010.