

# A HEAT INDEX CLIMATOLOGY FOR THE SOUTHERN UNITED STATES

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## Abstract

*This study has developed a climatology of Heat Index (HI) conditions for the southern United States, a region coinciding with a large section of the NOAA/National Weather Service Southern Region. The climatology includes information on the magnitude and duration of HI conditions in the region. This information can be used by forecasters to evaluate the relative severity of forecasted high heat conditions and assist in the issuance of hazardous heat advisories.*

*For the region, heat is most intense in July and August. Magnitudes of heat are relatively uniform but duration varies widely. The central portions of the region including central Texas and Oklahoma, along with parts of Arkansas, Louisiana, Mississippi, and western Tennessee show the highest durations of extreme heat. Topography has a role in channeling moisture into this central section of the region leading to increased number of hours of hazardous HI conditions compared to coastal stations. Elevation has been shown to mitigate extreme heat in the western and northeastern sections of the region.*

## 1. Introduction

During the summer months, the National Weather Service (NWS) routinely monitors high temperatures and humidities as part of their weather warnings program. The NWS has developed heat stress warning hazard criteria based on the Heat Index temperature (HI), a mathematical construct (see Appendix for the equation) incorporating both air temperature and relative humidity. Ranges of HI associated with these hazard levels are given in Table 1. The issuing of "excessive heat advisories" is based on forecasted HI "depending on local climate" (NOAA 1985). This is because there are regional variations in the way that people respond to heat and humidity. Conditions which are perceived as excessive in the northern United States may be near normal in the southern United States, and thus not exceptional. This NWS policy of allowing for regional adjustment is also found in thresholds governing the issuance of wind chill warnings (Schwerdt 1995). In the NWS Southern Region, excessive heat advisories are issued "when a daytime HI of 105°F or greater and a nighttime minimum ambient temperature of 80°F or greater is expected to persist for at least 48 hours or longer" (NOAA 1992).

## 2. Methodology

This study was designed to develop a descriptive climatology of summertime HI conditions in the southern United States. For each of forty-four synoptic weather stations in the region, hourly values of HI were computed from the observed hourly values of air temperature and relative humidity for the months of June, July, and August during the years of 1980 through 1989. Locations of stations used in the study and identifying information are given in Fig. 1 and Table 2.

The HI series was sorted by value into the heat stress warning categories listed in Table 1. After sorting, only those values of HI in the categories of extreme danger, danger, and extreme caution were retained for further analysis. This had the effect of reducing the size of the data set, initially containing over 22,000 values of HI at each station, by about two-thirds to one-half at each station. Values in the caution category were not retained because they fall far below thresholds used by the NWS in initiating excessive heat advisories. During the study period there were no occurrences of HI in the extreme danger category. Minimum conditions listed in NWS public information charts for HI in the extreme danger category are an air temperature of 95°F with a relative humidity of 75%. This particular combination arises with an extremely high, but rarely occurring, dew point temperature of 86°F. Using a more realistic dew point temperature of around 75°F results in a combination of 105°F and 38% as the minimum required to equate to a HI in the extreme danger category.

The remaining values of the set, which include hours in which the HI was either in the extreme caution or danger category, were used to develop the HI climatology for each station. Climatic summaries showing average number of hours per month in each of the two warning categories and the maximum values of HI experienced for each of the stations used in the study are presented in Tables 3-5.

## 3. Climatology of Summer Heat Index Temperatures

Summer heat is quite uniform over most of the region. Average HI values are only slightly lower (2°F) in the mountainous western sector and the higher elevations of the northeast around Knoxville. Interestingly, the seasonal average danger category HI of 106°F is very close to the lower threshold of the dan-

**Table 1.** Levels of HI and NWS alert criteria (NOAA 1985).

| CATEGORY        | HI RANGE (°F) |
|-----------------|---------------|
| extreme danger  | 130 or higher |
| danger          | 105-129       |
| extreme caution | 90-104        |
| caution         | 80-89         |

**Table 2.** NWS stations used in this study.

| STATION                 | ID  | LAT-N | LON-W  | ELEV [FT] |
|-------------------------|-----|-------|--------|-----------|
| Birmingham, AL          | BHM | 33 34 | 86 45  | 620       |
| Huntsville, AL          | HSV | 34 39 | 86 46  | 624       |
| Montgomery, AL          | MGM | 32 18 | 86 24  | 192       |
| Mobile, AL              | MOB | 30 41 | 88 15  | 211       |
| Fort Smith, AR          | FSM | 35 20 | 94 22  | 447       |
| Little Rock, AR         | LIT | 34 44 | 92 14  | 257       |
| Daytona Beach, FL       | DAB | 29 11 | 81 03  | 29        |
| Jacksonville, FL        | JAX | 30 30 | 81 42  | 26        |
| Miami, FL               | MIA | 25 49 | 80 17  | 7         |
| Tallahassee, FL         | TLH | 30 23 | 84 22  | 55        |
| Tampa, FL               | TPA | 27 58 | 82 32  | 19        |
| Augusta, GA             | AGS | 33 22 | 81 58  | 136       |
| Athens, GA              | AHN | 33 57 | 83 19  | 802       |
| Atlanta, GA             | ATL | 33 39 | 84 25  | 1010      |
| Columbus, GA            | CSG | 32 31 | 84 57  | 445       |
| Macon, GA               | MCN | 32 42 | 83 39  | 354       |
| Savannah, GA            | SAV | 32 08 | 81 12  | 46        |
| Baton Rouge, LA         | BTR | 30 32 | 91 08  | 64        |
| Lake Charles, LA        | LCH | 30 07 | 93 13  | 9         |
| New Orleans, LA         | MSY | 29 59 | 90 15  | 4         |
| Shreveport, LA          | SHV | 32 28 | 93 49  | 254       |
| Jackson, MS             | JAN | 32 19 | 90 05  | 291       |
| Albuquerque, NM         | ABQ | 35 03 | 106 37 | 5311      |
| Oklahoma City, OK       | OKC | 35 24 | 97 36  | 1285      |
| Tulsa, OK               | TUL | 36 12 | 95 54  | 650       |
| Nashville, TN           | BNA | 36 07 | 86 41  | 590       |
| Chattanooga, TN         | CHA | 35 02 | 85 12  | 665       |
| Memphis, TN             | MEM | 35 03 | 90 00  | 258       |
| Knoxville, TN           | TYS | 35 49 | 83 59  | 905       |
| Waco, TX                | ACT | 31 37 | 97 13  | 500       |
| Amarillo, TX            | AMA | 35 14 | 101 42 | 3604      |
| Austin, TX              | AUS | 30 17 | 97 42  | 587       |
| Beaumont-Pt. Arthur, TX | BPT | 29 57 | 94 01  | 16        |
| Brownsville, TX         | BRO | 25 54 | 97 26  | 19        |
| Corpus Christi, TX      | CRP | 27 46 | 97 30  | 41        |
| Dallas-Ft. Worth, TX    | DFW | 32 54 | 97 02  | 551       |
| El Paso, TX             | ELP | 31 48 | 106 24 | 3918      |
| Houston, TX             | IAH | 29 58 | 95 21  | 96        |
| Lubbock, TX             | LBB | 33 39 | 101 49 | 3254      |
| Midland, TX             | MAF | 31 57 | 102 11 | 2857      |
| San Antonio, TX         | SAT | 29 32 | 98 28  | 788       |
| San Angelo, TX          | SJT | 31 22 | 100 30 | 1903      |
| Wichita Falls, TX       | SPS | 33 58 | 98 29  | 994       |
| Victoria, TX            | VCT | 28 51 | 96 55  | 104       |

ger category. This is because the high dew point temperatures and air temperatures required to raise the HI into the upper levels of the danger category are rarely observed. Six of the stations in the region (Atlanta, Albuquerque, Amarillo, El Paso, Lubbock, and Midland) had at least one summer month when no HI in the danger category was recorded. All of these stations, except for Atlanta, are found in the dry western

**Table 3.** Climatic Summary for June (1980-1989). Percent of month in categories given in parentheses.

| Station | Ext Caution<br>Avg Hrs | Danger<br>Avg Hrs | Danger<br>Max Hrs | HI<br>Max |
|---------|------------------------|-------------------|-------------------|-----------|
| BHM     | 120 (17)               | 2 (<1)            | 9                 | 106       |
| HSV     | 9 (1)                  | <1 (<1)           | 3                 | 106       |
| MGM     | 161 (22)               | 10 (1)            | 46                | 112       |
| MOB     | 161 (22)               | 2 (<1)            | 15                | 114       |
| FSM     | 140 (19)               | 10 (1)            | 49                | 114       |
| LIT     | 163 (23)               | 9 (1)             | 56                | 117       |
| DAB     | 161 (22)               | 3 (<1)            | 22                | 106       |
| JAX     | 179 (25)               | 15 (2)            | 81                | 117       |
| MIA     | 270 (38)               | 2 (<1)            | 9                 | 106       |
| TLH     | 193 (27)               | 10 (1)            | 53                | 113       |
| TPA     | 265 (37)               | 3 (<1)            | 15                | 115       |
| AGS     | 163 (23)               | 9 (1)             | 52                | 112       |
| AHN     | 124 (17)               | 2 (<1)            | 10                | 109       |
| ATL     | 101 (14)               | 0 (0)             | 0                 | 104       |
| CSG     | 180 (25)               | 9 (1)             | 52                | 110       |
| MCN     | 179 (25)               | 9 (1)             | 107               | 113       |
| SAV     | 168 (23)               | 10 (1)            | 41                | 112       |
| BTR     | 207 (29)               | 7 (1)             | 25                | 115       |
| LCH     | 238 (33)               | 7 (1)             | 40                | 115       |
| MSY     | 217 (30)               | 16 (2)            | 64                | 115       |
| SHV     | 186 (26)               | 13 (2)            | 79                | 116       |
| JAN     | 185 (26)               | 9 (1)             | 40                | 117       |
| ABQ     | 19 (3)                 | 0 (0)             | 0                 | 96        |
| OKC     | 106 (15)               | 5 (1)             | 41                | 110       |
| TUL     | 152 (21)               | 16 (2)            | 92                | 119       |
| BNA     | 92 (13)                | 2 (<1)            | 11                | 108       |
| CHA     | 100 (14)               | <1 (<1)           | 4                 | 106       |
| MEM     | 176 (24)               | 8 (1)             | 23                | 116       |
| TYS     | 75 (10)                | <1 (<1)           | 3                 | 105       |
| ACT     | 213 (30)               | 24 (3)            | 83                | 117       |
| AMA     | 52 (7)                 | 0 (0)             | 0                 | 104       |
| AUS     | 216 (30)               | 12 (2)            | 78                | 111       |
| BPT     | 244 (34)               | 17 (2)            | 65                | 115       |
| BRO     | 341 (47)               | 27 (4)            | 89                | 117       |
| CRP     | 290 (40)               | 16 (2)            | 39                | 112       |
| DFW     | 190 (26)               | 16 (2)            | 106               | 118       |
| ELP     | 116 (16)               | <1 (<1)           | 1                 | 106       |
| IAH     | 244 (34)               | 18 (2)            | 107               | 120       |
| LBB     | 92 (13)                | <1 (<1)           | 2                 | 105       |
| MAF     | 128 (18)               | 0 (0)             | 0                 | 104       |
| SAT     | 221 (31)               | 8 (1)             | 40                | 110       |
| SJT     | 145 (20)               | <1 (<1)           | 3                 | 106       |
| SPS     | 166 (23)               | 14 (2)            | 77                | 118       |
| VCT     | 257 (36)               | 6 (1)             | 25                | 112       |

sections of the region. In many of these cases a high temperature is counterbalanced by a low dew point, thus producing a "cooling effect" where the HI is less than the air temperature.

The highest HI values for each month for each station are listed in Tables 3 - 5. These represent the maximum HI recorded during the 10-year period of record of this study. There is a slight tendency for the highest values to occur in July. Albuquerque had the lowest maximum HI of 95°F in August of 1980 and 1981. Chattanooga and Jacksonville both recorded a maximum HI of 125°F in July 1980. New Orleans recorded its maximum HI of 124°F that same month. Stations in the central section of the region have recorded maximum HIs of 115°F or higher and are subjected to severe heat throughout the sum-

mer. The western sections of the region are cooler and no station recorded a maximum HI over 110°F. In the eastern third of the region, the area of north Florida and south Georgia tends to have higher maximum HI than the other eastern stations.

The intensity of hazardous heat has two components: magnitude and duration. Examination of duration statistics can reveal areas where hazardous heat is persistent during the summer season. Figures 2 - 4 show the average number of hours per month that HI conditions were in the extreme caution category. Moderate HI conditions, reflected in the high number of hours, dominate throughout the summer, with lower number of hours being found in the western section of the region. Across the region the number of hours per month shows a large increase from June to July. A more modest increase in August is noted in south Florida. Southerly stations tend to show the highest number of hours per month. Brownsville has the highest number of extreme caution hours in June, while Miami dominates in July and August. Central stations record near 200 hours per month in June but increase to near 300 hours per month in July and August.

The average number of hours per month for the danger category are shown in Figs. 5 - 7. Brownsville has the highest number of danger hours in June with 27 hours, slightly less than 4% of the time. In July and August, Tulsa and Waco exhibit dangerous conditions about 8% - 9% of the time, the highest in the entire region. June danger hours are much less than July and August danger hours throughout the region. Highest values are found in northeastern Texas and Oklahoma, as well as Arkansas, Louisiana, Mississippi, and western Tennessee. This pattern is much more meridional than the near zonal pattern of extreme caution hours.

#### 4. Analysis

The pattern of HI across the region is of course closely controlled by those of temperature and humidity. June through August are the high sun months and solar heating is at a maximum. Examination of maps given in the *Climatic Atlas of the United States* shows there is very little differentiation of daily maximum temperature during the summer months in this region (NOAA 1968). The 90°F isotherm runs along the Gulf Coast and across the northern portion of the region. Temperatures within this interior area are rarely over 94°F. This area of warmer maximum ambient temperatures extends from the southwest to north central Texas, and is especially developed during July and August. Occasional daily maximum temperatures near 100°F are found along the central Rio Grande

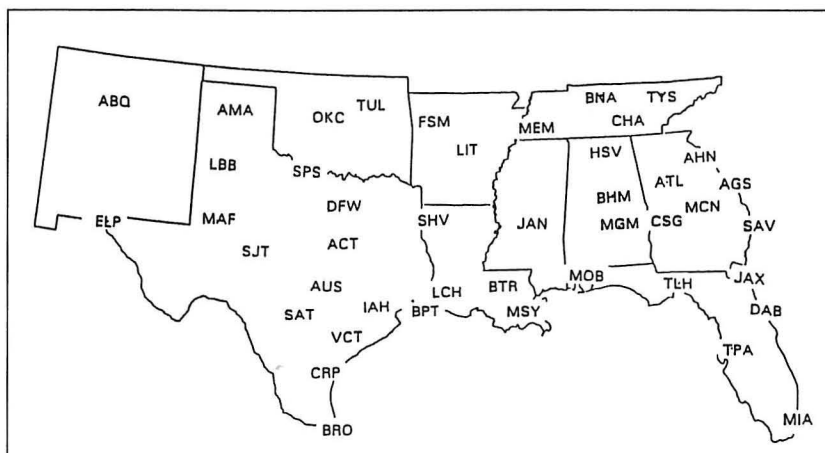


Fig. 1. Location map of synoptic stations used in study.

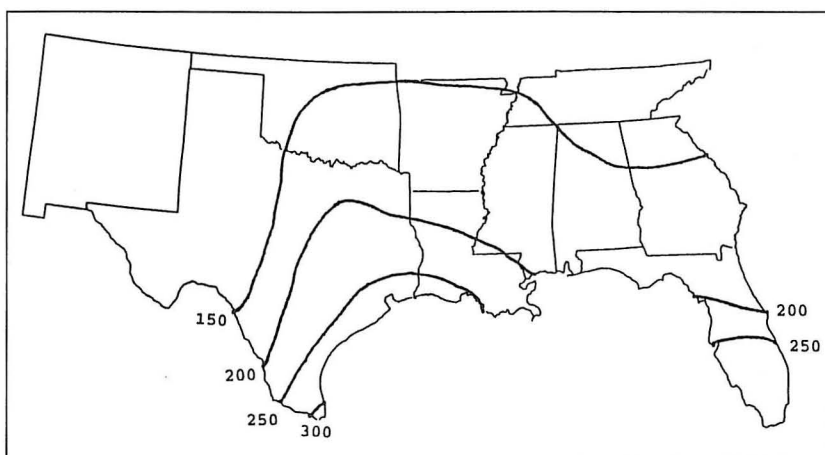


Fig. 2. Average hours extreme caution June.

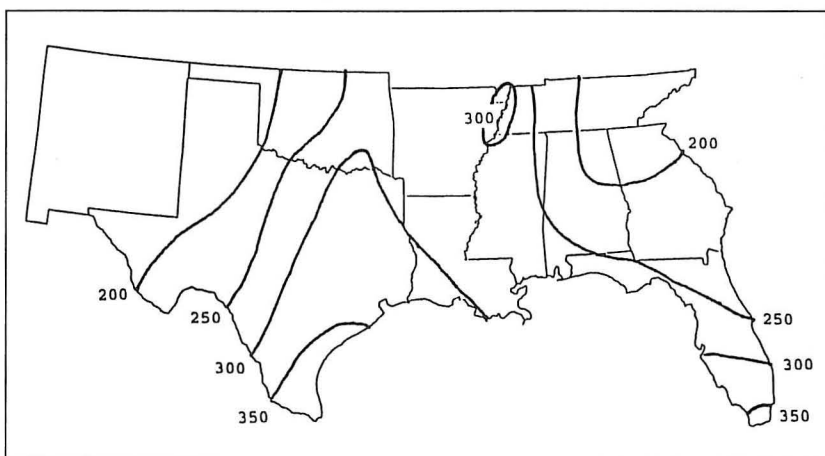


Fig. 3. Average hours extreme caution July.

Valley. To the west the dryness, which would otherwise produce higher maximum temperatures, is just about compensated by elevation increase. Lower maximum temperatures (around 85°F) are also recorded in northern Georgia and eastern Tennessee, again as the result of elevation increase.

Water vapor content, as indicated by the atlas dew point temperature maps, is also quite uniform in the summer in the study region (NOAA 1968). There is a slight

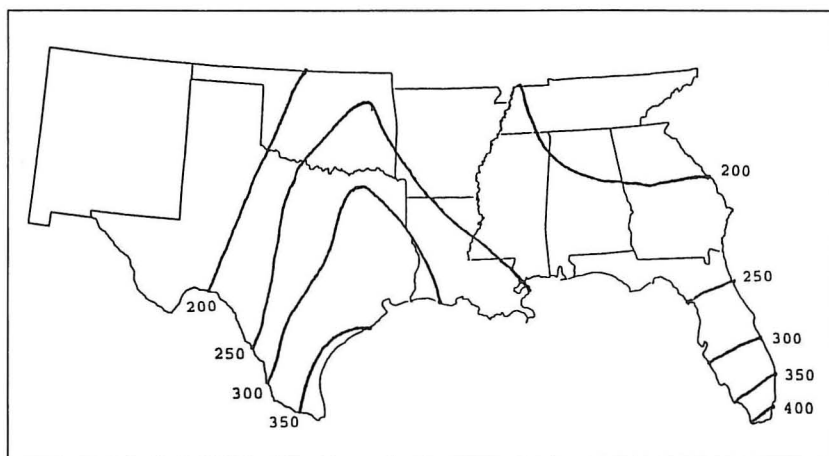


Fig. 4. Average hours extreme caution August.

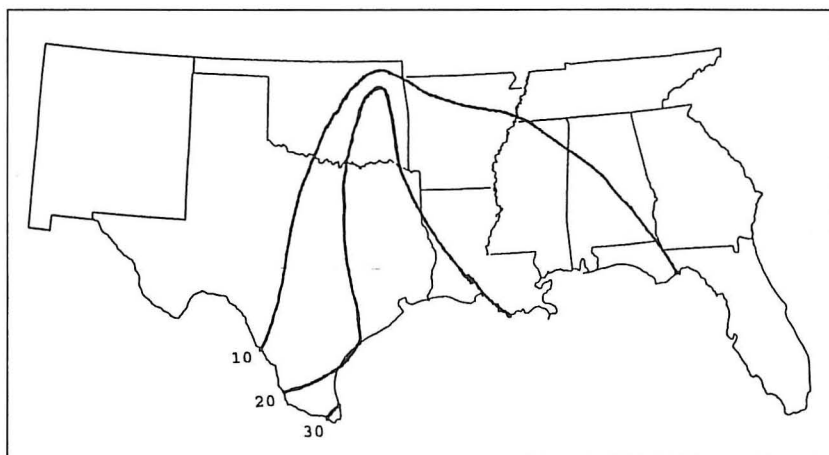


Fig. 5. Average hours danger June.

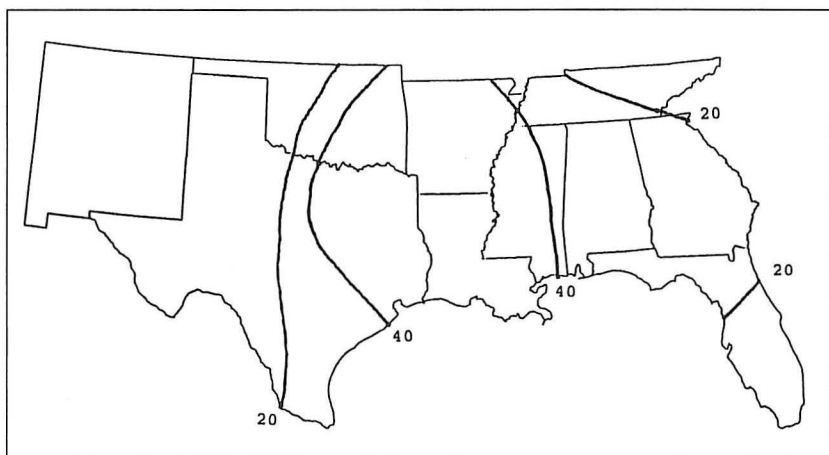


Fig. 6. Average hours danger July.

north-south increase due to the proximity of a moisture source near coastal areas, and slightly greater values in the central interior of the region. Thus, Little Rock and Memphis have summer dew points similar to those at San Antonio and Victoria. This uniform pattern is the result of the strengthening of the Western North Atlantic subtropical high pressure center (Bermuda High). This center elongates across the Atlantic into the Gulf of Mexico in summer with a coincident advection of moist, tropical air

into the interior. This flow is influenced by local topography, such that extreme penetration of warm, moist air can occur along the Mississippi River Valley.

The HI patterns are sensitive to changes in the moisture conditions brought about by topography. For example, a relatively minor topographic feature such as the Ouachita Mountains can exert significant influence on HI distributions. Fort Smith in the lee (north) of the Ouachitas receives far less sultry conditions than Tulsa where warm, moist air is funneled between the Ouachita/Ozark complex and the higher elevations to the west. The funneling of warm, moist air along the Mississippi River Valley results in stations such as Little Rock and Memphis recording higher hours of dangerous HI conditions than the more southerly, coastal stations such as Houston, New Orleans, or Brownsville.

The effect of elevation on moisture is seen in west Texas where cities on the Llano Estacado have very low instances of extreme HI values. Albuquerque, in the foothills of the Rocky Mountains, records on average only 79 hours each summer when HI conditions are in the extreme caution range. Stations in the eastern section of the region also show a temperature response to elevations associated with the southern Appalachians. Stations in eastern Tennessee, northeastern Alabama, and northwestern Georgia are much less sultry than coastal plain stations.

## 5. Conclusions

A climatology of summer hazardous heat in the southern United States has been developed. This climatology uses the Heat Index (HI) temperature, a construct of air temperature and relative humidity. The HI is used operationally by the NWS to assist in the issuance of hazardous heat advisories. This climatology provides a means for a forecaster to determine the relative severity of a particular forecasted high heat event. Analysis of the climatological pattern shows the expected dependence on air temperature but indicates the importance of topography and elevation in modifying both the temperature and moisture fields.

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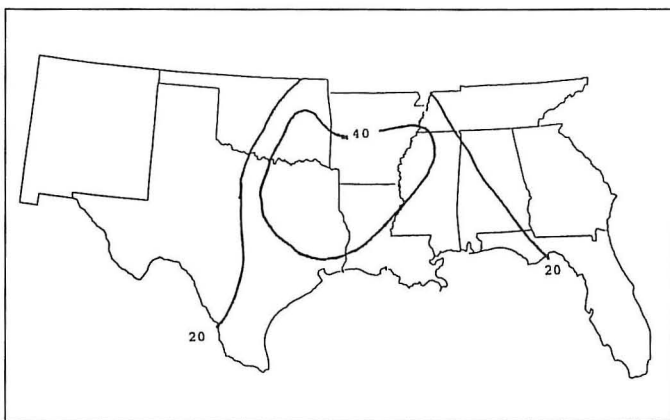


Fig. 7. Average hours danger August.

Table 4. Climatic Summary for July (1980-1989). Percent of month in categories given in parentheses.

| Station | Ext Caution<br>Avg Hrs | Danger<br>Avg Hrs | Danger<br>Max Hrs | HI<br>Max |
|---------|------------------------|-------------------|-------------------|-----------|
| BHM     | 206 (28)               | 19 (2)            | 93                | 114       |
| HSV     | 191 (26)               | 12 (2)            | 73                | 113       |
| MGM     | 229 (31)               | 30 (4)            | 83                | 115       |
| MOB     | 224 (30)               | 17 (2)            | 71                | 114       |
| FSM     | 238 (32)               | 36 (5)            | 110               | 114       |
| LIT     | 244 (33)               | 58 (8)            | 183               | 119       |
| DAB     | 248 (33)               | 10 (1)            | 27                | 115       |
| JAX     | 253 (34)               | 31 (4)            | 84                | 125       |
| MIA     | 391 (52)               | 4 (<1)            | 12                | 109       |
| TLH     | 242 (32)               | 21 (3)            | 50                | 122       |
| TPA     | 307 (41)               | 12 (2)            | 48                | 116       |
| AGS     | 228 (31)               | 33 (4)            | 101               | 117       |
| AHN     | 197 (26)               | 17 (2)            | 51                | 114       |
| ATL     | 181 (24)               | 14 (2)            | 102               | 118       |
| CSG     | 245 (33)               | 26 (3)            | 87                | 115       |
| MCN     | 241 (32)               | 30 (4)            | 94                | 119       |
| SAV     | 252 (34)               | 34 (4)            | 81                | 119       |
| BTR     | 270 (36)               | 24 (3)            | 71                | 117       |
| LCH     | 314 (42)               | 20 (3)            | 44                | 115       |
| MSY     | 275 (37)               | 47 (6)            | 178               | 124       |
| SHV     | 272 (36)               | 36 (5)            | 145               | 113       |
| JAN     | 240 (32)               | 39 (5)            | 156               | 118       |
| ABQ     | 45 (6)                 | 0 (0)             | 0                 | 98        |
| OKC     | 229 (31)               | 14 (2)            | 76                | 113       |
| TUL     | 276 (37)               | 62 (8)            | 225               | 122       |
| BNA     | 196 (26)               | 16 (2)            | 82                | 114       |
| CHA     | 185 (25)               | 15 (2)            | 103               | 125       |
| MEM     | 293 (39)               | 47 (6)            | 102               | 122       |
| TYS     | 155 (21)               | 7 (1)             | 48                | 114       |
| ACT     | 314 (42)               | 59 (8)            | 102               | 113       |
| AMA     | 110 (15)               | 0 (0)             | 0                 | 100       |
| AUS     | 327 (44)               | 16 (2)            | 75                | 112       |
| BPT     | 310 (42)               | 41 (6)            | 107               | 115       |
| BRO     | 386 (52)               | 28 (4)            | 101               | 111       |
| CRP     | 356 (48)               | 23 (3)            | 51                | 113       |
| DFW     | 312 (42)               | 36 (5)            | 164               | 115       |
| ELP     | 171 (23)               | 0 (0)             | 0                 | 104       |
| IAH     | 337 (45)               | 37 (5)            | 166               | 122       |
| LBB     | 152 (20)               | <1 (<1)           | 4                 | 108       |
| MAF     | 201 (27)               | 2 (<1)            | 14                | 111       |
| SAT     | 325 (44)               | 5 (1)             | 25                | 108       |
| SJT     | 232 (31)               | 2 (<1)            | 14                | 109       |
| SPS     | 270 (36)               | 40 (5)            | 156               | 118       |
| VCT     | 351 (47)               | 11 (1)            | 24                | 110       |

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Table 5. Climatic Summary for August (1980-1989). Percent of month in categories given in parentheses.

| Station | Ext Caution<br>Avg Hrs | Danger<br>Avg Hrs | Danger<br>Max Hrs | HI<br>Max |
|---------|------------------------|-------------------|-------------------|-----------|
| BHM     | 203 (27)               | 7 (1)             | 29                | 110       |
| HSV     | 163 (22)               | 5 (1)             | 21                | 112       |
| MGM     | 225 (30)               | 20 (3)            | 52                | 117       |
| MOB     | 225 (30)               | 6 (1)             | 17                | 111       |
| FSM     | 217 (29)               | 34 (4)            | 93                | 114       |
| LIT     | 217 (29)               | 49 (6)            | 102               | 115       |
| DAB     | 266 (36)               | 5 (1)             | 13                | 110       |
| JAX     | 245 (33)               | 27 (4)            | 80                | 117       |
| MIA     | 412 (55)               | 2 (<1)            | 11                | 108       |
| TLH     | 236 (32)               | 18 (2)            | 48                | 117       |
| TPA     | 296 (40)               | 13 (2)            | 51                | 117       |
| AGS     | 200 (27)               | 20 (3)            | 63                | 117       |
| AHN     | 171 (23)               | 7 (1)             | 60                | 114       |
| ATL     | 151 (20)               | 4 (<1)            | 30                | 112       |
| CSG     | 239 (32)               | 13 (2)            | 44                | 113       |
| MCN     | 228 (31)               | 21 (3)            | 73                | 117       |
| SAV     | 228 (31)               | 19 (2)            | 52                | 117       |
| BTR     | 262 (35)               | 18 (2)            | 53                | 115       |
| LCH     | 294 (40)               | 26 (3)            | 58                | 113       |
| MSY     | 288 (39)               | 33 (4)            | 138               | 119       |
| SHV     | 265 (36)               | 39 (5)            | 68                | 113       |
| JAN     | 239 (32)               | 25 (3)            | 69                | 114       |
| ABQ     | 15 (2)                 | 0 (0)             | 0                 | 95        |
| OKC     | 231 (31)               | 11 (1)            | 29                | 111       |
| TUL     | 249 (33)               | 54 (7)            | 139               | 121       |
| BNA     | 154 (21)               | 7 (1)             | 34                | 112       |
| CHA     | 146 (20)               | 7 (1)             | 29                | 115       |
| MEM     | 255 (34)               | 45 (6)            | 109               | 116       |
| TYS     | 126 (17)               | 4 (<1)            | 23                | 113       |
| ACT     | 293 (39)               | 69 (9)            | 122               | 122       |
| AMA     | 85 (11)                | 0 (0)             | 0                 | 99        |
| AUS     | 326 (44)               | 21 (3)            | 53                | 112       |
| BPT     | 292 (39)               | 40 (5)            | 105               | 114       |
| BRO     | 384 (52)               | 36 (5)            | 64                | 110       |
| CRP     | 353 (47)               | 30 (4)            | 64                | 114       |
| DFW     | 306 (41)               | 35 (5)            | 92                | 112       |
| ELP     | 128 (17)               | 0 (0)             | 0                 | 103       |
| IAH     | 338 (45)               | 36 (5)            | 85                | 117       |
| LBB     | 133 (18)               | 0 (0)             | 0                 | 103       |
| MAF     | 187 (25)               | 0 (0)             | 0                 | 104       |
| SAT     | 326 (44)               | 7 (1)             | 31                | 110       |
| SJT     | 230 (31)               | 1 (<1)            | 5                 | 108       |
| SPS     | 255 (34)               | 38 (5)            | 62                | 115       |
| VCT     | 351 (47)               | 19 (2)            | 53                | 112       |

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## Appendix

The equation used operationally by the NWS to compute HI was developed using a multiple regression analysis of the output of the original model of Apparent Temperature (AT) developed by Steadman (1979a). This model was later modified to include the effects of wind, pressure, and excess radiation on AT (Steadman 1979b). This refinement is not incorporated into the NWS equation but is addressed in public information programs (NOAA 1985).

The Heat Index is given by:

$$\begin{aligned} \text{HI} = & 16.923 + 0.185212T + 5.37941R - 0.100254TR \quad (1) \\ & + 0.941695 \times 10^{-2}T^2 + 0.728898 \times 10^{-2}R^2 \\ & + 0.345372 \times 10^{-3}T^2R - 0.814971 \times 10^{-3}TR^2 \\ & + 0.102102 \times 10^{-4}T^2R^2 - 0.38646 \times 10^{-4}T^3 \\ & + 0.291583 \times 10^{-4}R^3 + 0.142721 \times 10^{-5}T^3R \\ & + 0.197483 \times 10^{-6}TR^3 - 0.218429 \times 10^{-7}T^3R^2 \\ & + 0.843296 \times 10^{-9}T^2R^3 - 0.481975 \times 10^{-10}T^3R^3 + 0.5 \end{aligned}$$

where: HI = Heat Index Temperature [°F]

T = Air Temperature [°F]

R = Relative Humidity [%]

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