Local Climate from an Empirical Perspective

Climate data are systematically collected because they are extremely useful for many purposes. Farmers use their knowledge of weather and climate over a long period to determine what crops to plant and for guidance on when to plant and when to harvest. Utilities use climate data for planning production and distribution of energy supplies and the reallocation among types of such supplies. The building industry used climate data in the design of structures, including their necessary strength, heating and cooling energy requirements, and the associated building codes that regulate them. Scientists modeling Earth’s climate system employ derived products built on climatological data sets in model development and for verifying climate and climate change models. These are just a few of the uses of climate data.

In the U.S., weather data are gathered by NOAA’s National Weather Service offices and other organizations and compiled at state, regional, and national centers for distribution to users. NOAA’s National Climatic Data Center (NCDC) in Asheville, NC, is responsible for compiling and archiving U.S. data as well as being a depository for worldwide data on weather and the environment. This information, in turn, is made available to users on a variety of media.

A primary publication of the NCDC based on weather data from local National Weather Service (NWS) offices is the Local Climatological Data (LCD). It is published for about 275 NWS observing sites in monthly and annual summaries and available free online.

The LCD, Annual Summary with Comparative Data for Honolulu, Hawaii (PHNL for the Year 2020 is used in this investigation). To retrieve Honolulu’s LCD, go to https://www.ncdc.noaa.gov/IPS/lcd/lcd.html


Upon retrieval, you will be viewing the front page of the 2020 LCD Annual Summary for Honolulu. Either print out pages, 1, 2, 3, and 7 of the document for reference or refer to them onscreen to respond to the following questions.

1. Examine the temperature graph appearing on the report’s front page. The first of each month is indicated by the vertical dashed line directly above the monthly label, starting with 1 January at the left. Daily temperature ranges are plotted as vertical lines on the graph. The top end of each line signifies the maximum daily temperature and the bottom end reports the day’s minimum temperature. The lowest minimum temperature for 2020 was 60 F degrees and occurred on [(February 8) (March 2) (April 6)].
2. Locate on the temperature graph the highest maximum temperature reported at Honolulu for the Year 2020. It and the lowest minimum temperature for the year indicate that the annual temperature range at Honolulu in 2020 was [(32) (33) (34)] F degrees.

3. The **green** curve drawn across the Daily Max/Min Temperature graph presents the normal (or average) maximum temperatures. The **brown** curve delineates the normal daily minimum temperatures. These normal values are based on the average of maximum or minimum temperatures over a recent 30-year period (1981-2010). According to the graph the date of the coldest day in 2020 was [(earlier than) (within a day or two) (later than)] normal.

4. The middle graph on the *LCD* front page reports daily precipitation in liquid equivalence. The maximum precipitation in one calendar day in 2020 occurred on about 16 March. According to the graph, the amount of was approximately [(2.26) (2.58) (3.76)] inches.

Examine page 2 of the Honolulu *LCD, Annual Summary*, entitled “METEOROLOGICAL DATA FOR 2020”, and complete the following:

5. The lowest monthly average daily temperature (“Average Dry Bulb”) for 2020 occurred during [(December) (January) (February)].

6. The average daily temperature during that month was [(84.2) (81.8) (81.6)].

7. The highest monthly daily temperature for the year (93 F deg.) occurred during which month [(July) (August) (September)].

8. How many days during each of the three months given in question 7 were 90 F deg. or more? [(9 or more days) (13 or more days) (20 or more days)].

9. The monthly precipitation (water equivalent) ranged from .10 inches in June and September to March’s 3.76 inches. The total 2020 precipitation was [(11.61) (13.65) (15.10)] inches.

10. The maximum 2-minute Wind Speed in MPH was [(33) (36) (39)] MPH and occurred on [(March 12) (February 10) (January 7)] 2020.

Examine page 3 of the Honolulu *LCD, Annual Summary* entitled “NORMALS, MEANS, AND EXTREMES”. The “Normals” presented are averages of observations taken during the 1981-2010 time period. “Mean” values are averages for the entire period of record of the weather element. **The values appearing on this page are commonly considered to be the “climate” of the station or region.** Complete the following:

11. The Highest Daily Maximum temperature ever recorded at Honolulu over the entire 70 years of the record was [(90) (95) (100)] F deg in August of 2019.
12. The normal total annual precipitation at Honolulu is [(16.62) (17.10) (20.79)] inches.

13. Comparing the actual annual value of a climate with it normal value is a measure of climate variability. Comparison of actual 2020 annual precipitation at Honolulu from item 9 above with the normal value in item 12 shows a variability (or departure from normal) of [(3.45 in. below) (3.49 in. above) (0 in. from)] normal.

14. According to the narrative, thunderstorms are [(frequent) (infrequent)] around Honolulu.

15. The Honolulu narrative also describes the cause of Kona Weather which is a generally brought about by ________________________________.

If you are interested in Honolulu climate data based on observations made as recently as yesterday, go to our local NWS Office Website’s Local Climate Link: https://w2.weather.gov/climate/index.php?wfo=hnl

Climate Normals

Climate Normals are three-decade averages of climatological variables, including temperature and precipitation, used as references for comparing observational data. These are updated at the end of each decade. NOAA’s National Climate Data Center (NCDC) released the 1981-2010 Normals on July 1, 2011, replacing the 1971-2000 Normals used through 2011. Comparison of selected 1931-1960, 1941-1970, 1951-1980, 1961-1990, 1971-2000 Annual Normals with 1981-2010 Annual Normals for Honolulu, HI follows in Table 1:

Table 1. Comparison of selected “Old” and “New” Honolulu Annual Normals

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<tr>
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</thead>
<tbody>
<tr>
<td>Mean Max Temperature (F deg.)</td>
<td>81.9</td>
<td>83.3</td>
<td>84.2</td>
<td>84.0</td>
<td>84.7</td>
<td>84.9</td>
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<tr>
<td>Mean Temperature (F deg.)</td>
<td>75.9</td>
<td>76.6</td>
<td>77.0</td>
<td>77.2</td>
<td>77.5</td>
<td>77.7</td>
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<tr>
<td>Mean Min Temperature (F deg.)</td>
<td>69.8</td>
<td>69.8</td>
<td>69.7</td>
<td>70.0</td>
<td>70.2</td>
<td>70.9</td>
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<tr>
<td>Precipitation (in.)</td>
<td>21.89</td>
<td>22.90</td>
<td>23.47</td>
<td>20.02</td>
<td>18.29</td>
<td>17.10</td>
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<tr>
<td>Cooling Degree Days</td>
<td>Not Given</td>
<td>4221.0</td>
<td>4389.0</td>
<td>4474.0</td>
<td>4561.0</td>
<td>4628.0</td>
</tr>
</tbody>
</table>

Adapted from AMS Climate Studies Manual 3rd Edition 2012
16. Comparison of the 1971-2000 and the 1981-2010 Annual Normals shows that Honolulu's climate normals [(remained the same) (changed)] from the earlier period to the later period.

17. The changes, if any, in mean temperature or temperature-related normals at Honolulu are consistent with that of a [(cooling) (steady) (warming)] local climate.

18. Comparison of the 1961-1990, 1971-2000 and the 1981-2010 Annual Normals shows that Honolulu’s precipitation normals [(increased) (remained the same) (decreased)] from the earlier period to the later period.


If you are interested in taking a 3 graduate credit online course in Climate Studies, please be sure to check out: https://www.ametsoc.org/ams/index.cfm/education-careers/education-program/k-12-teachers/datastreme-program/datastreme-earth-s-climate-system/ for more information.