Exercises that require the use of the climatological-mean data

1. Identify at least two widely separated stations in the following climatic zones

   (a) equatorial with year-round rainfall
   (b) northern hemisphere monsoon
   (c) southern hemisphere monsoon
   (d) equatorial dry zone
   (e) subtropical (20°–35°), dry summers
   (f) subtropical (20°–35°), wet summers
   (g) temperate (35°–55°), strong marine influence
   (h) temperate (35°–55°), continental
   (i) subpolar (55°–70°) marine
   (j) subpolar (55°–70°) continental

   Hint: Use objective criteria for classifying the stations; e.g., stations in (a) must lie within 10 degrees of latitude of the equator and must receive at least 20 cm of rainfall in every calendar month; stations in (b) and (c) must receive at least 50 cm per month in at least one summer month and less than 10 cm month during at least one winter month; stations in (g) must have an annual range of at least 30°C in monthly mean temperature.

2. Make a scatter-plot of annual-mean temperature versus latitude. (a) Identify a selection of tropical stations that are conspicuously warm. Is there anything that they share in common? (b) Repeat (a) for tropical stations that are conspicuously cool. (c) Repeat (a) and (b) for a selection of high latitude stations.

3. Repeat (2) for July and January temperatures.

4. On the basis of the scatter plots in Exercises 2 and 3, estimate the meridional temperature gradient of surface air temperature at 40N in (a) the annual mean, (b) in January, and (c) in July.

5. (a) Rank (i.e., sort) the stations in terms of July-mean precipitation and note the locations of the wettest stations. (b) repeat this exercise for January precipitation.

6. Make scatter-plots of (a) annual-mean (b) January and (c) July precipitation versus latitude. (d) Interpret the differences between the plots in terms of the monsoons. (e) In the July plot at latitudes between 30°N and 40°N, some stations are much wetter than others. Show that the drier stations tend to be located on the west side of the continents and

the wetter stations on the east side. Why are the rainfall amounts in these locations so different? (f) Identify the stations in the 35°–55°N belt that experience conspicuously high January precipitation. What aspect of their geographical location makes them wetter than other stations at the same latitude? (g) Repeat (e) and (f) for stations at comparable latitudes in the southern hemisphere.

7. Most stations experience their highest monthly-mean temperatures in the month following the solstice, but this is not always the case. Some stations experience their highest temperatures the month before the summer solstice. Locate some examples either by visual inspection of the table or by sorting the northern hemisphere stations on the basis of (May temperature minus July temperature.) Why do temperatures peak so early at these stations?

8. Make a scatter-plot of July minus January monthly-mean temperature versus latitude. (a) Identify a selection of stations that exhibit conspicuously large or small annual temperature ranges compared to other stations at the same latitude. Is there anything that they share in common? (b) In which hemisphere does the annual temperature range tend to be larger? Why?

Exercises that require the use of the time series data

1. Verify that the means of the four time series are zero and calculate the standard deviations. Note that the standard deviations of the monthly time series are larger than those of the corresponding annual time series.

2. For each of the following combinations, make a scatter plot and calculate the correlation coefficient. (a) Monthly values of Darwin sea-level pressure (SLP) and the equatorial Pacific cold tongue index (CTI). (These time series are shown in Fig. 10.20 of the text.) (b) Annual (April–March) values of Darwin SLP and the CTI. Note that the correlation is stronger for the annual values.

3. Calculate the correlation coefficient between successive values of all four time series. This statistic is referred to as the *lag-1 autocorrelation*.