Climograph

Steven Black

Project home: https://github.com/StevenBlack/climograph

Introduction

The motivation for this repository is, given a location, create its clomograph.

See: https://en.wikipedia.org/wiki/Climograph.

Definition

In[83]:=

```
ClearAll[Climograph];

(* Custom function to merge lists of options *)
MergeOptions[l_List] := l // Association // Normal // Sort;

(* These are the defaults and options provided by the function *)
(* Shared defaults of the Temperature and precipitation graphs *)
GraphDefaults = {
    Background → None
    , ChartStyle → Automatic
    , GridLines → {None, Automatic}
    , ImageSize → Large
    , Joined → True
    , PlotRange → Automatic
    , Ticks → All
  };
(* Temperature graph specific defaults *)
TemperatureGraphDefaults = {
    FrameLabel → {Automatic, "Temperature"}
  };

(* Precipitation graph specific defaults *)
PrecipitationGraphDefaults = {
    FrameLabel → {Automatic, "Precipitation"}
  };

Options[iClimograph] = {
    (* Styles for the location and the date range display *)
    LocationStyle → {20, Bold}
    , YearRangeStyle → {16, Gray}
```

```
    (* Default start and end years for data *)
    , StartDate → {1980}
    , EndDate → {2020}

    , Background → None
    , ChartStyle → Automatic
    , ImageSize → Large
    , PlotTheme → Automatic

    , GraphOptions → {}

    , TemperatureGraphOptions → {}
    , TemperaturePlotRange → Automatic

    , PrecipitationGraphOptions → {}
    , PrecipitationPlotRange → Automatic

    , InnerFrame → False
    , InnerFrameStyle → Automatic

    , Frame → True
    , FrameStyle → Gray
   };

(* The interface for when a GeoPosition is passed. *)
Climograph[location_GeoPosition, opts : OptionsPattern[iClimograph]] :=
 iClimograph[First[GeoNearest["City", location, 1]], opts]

(* The interface for passing a single Entity and options. *)
Climograph[location_Entity, opts : OptionsPattern[iClimograph]] :=
  iClimograph[location, opts];

(* The interface for passing a list of Entities with options. *)
Climograph[locations_List, opts : OptionsPattern[iClimograph]] :=
  iClimograph[#, opts] & /@ locations;

(* The interface for when nothing is passed. *)
Climograph[] :=
  iClimograph[First[GeoNearest[Entity["City"], $GeoLocation, 1]]];

(* This function does the work *)
iClimograph[location_, OptionsPattern[]] := (
    startDate = OptionValue[StartDate];
    endDate = OptionValue[EndDate];

    (* Temperature plot - the upper plot *)
```

```
tempByMonth =
 WeatherData[location, "MeanTemperature", {startDate, endDate, "Month"}];
tempGroupByMonth =
 GroupBy[tempByMonth["DatePath"], DateValue[First[#], "MonthNameShort"] &];
tempMinMaxMean = {Min[Map[Last, #]], Max[Map[Last, #]], Mean[Map[Last, #]]} & /@
  tempGroupByMonth;
tempRange = OptionValue[TemperaturePlotRange];
If[ tempRange == Automatic,
 (
  maxTemp = Max[tempByMonth[[2]][[1]][[1]]];
  minTemp = Min[tempByMonth[[2]][[1]][[1]]];
  tempRange = {minTemp, maxTemp} // QuantityMagnitude;
 ), Nothing];

TemperatureGraphSettings = MergeOptions[{
   {
    ChartStyle → OptionValue[ChartStyle]
    , Frame → {{True, True}, {None, True}}
    , FrameTicks → {{All, All}, {None, All}}
    , GridLines → {None, Automatic}
    , ImageSize → OptionValue[ImageSize]
    , PlotTheme → OptionValue[PlotTheme]
    , PlotRange → OptionValue[TemperaturePlotRange]
    , Ticks → All
   }
   , GraphDefaults
   , TemperatureGraphDefaults
   , OptionValue[GraphOptions]
   , OptionValue[TemperatureGraphOptions]
  }];
ptemp = BoxWhiskerChart[
  tempMinMaxMean
  , TemperatureGraphSettings
 ];


(* Precipitation plot - the lower plot *)
precipByMonth = DeleteMissing[WeatherData[location,
   "TotalPrecipitation", {startDate, endDate, "Month"}]];
precipGroupByMonth = GroupBy[
  precipByMonth["DatePath"], DateValue[First[#], "MonthNameShort"] &];
precipMeanByMonth = Mean[Map[Last, #]] & /@ precipGroupByMonth;
precipMinMaxMean =
 {Min[Map[Last, #]], Max[Map[Last, #]], Mean[Map[Last, #]]} & /@
  precipGroupByMonth;
maxPrecip = Max[precipByMonth[[2]][[1]][[1]]];
minPrecip = 0; (* By definition *)
```

```
If[ precipRange == Automatic,
 (
  maxPrecip = Max[precipByMonth[[2]][[1]][[1]];
  precipRange = {minPrecip, maxPrecip} // QuantityMagnitude;
 ), Nothing];

PrecipitationGraphSettings = MergeOptions[{
   {
    ChartStyle → OptionValue[ChartStyle]
    , ChartLabels → Automatic
    , Frame → {{True, True}, {True, None}}
    , GridLines → {None, Automatic}
    , FrameTicks → {{All, All}, Automatic}
    , ImageSize → OptionValue[ImageSize]
    , PlotTheme → OptionValue[PlotTheme]
    , PlotRange → OptionValue[PrecipitationPlotRange]
    , Ticks → All
   }
   , GraphDefaults
   , PrecipitationGraphDefaults
   , OptionValue[GraphOptions]
   , OptionValue[PrecipitationGraphOptions]
  }];
pprecip = BoxWhiskerChart[
  precipMinMaxMean
  , PrecipitationGraphSettings
 ];

(* Joining everything together, and returning *)
Return[
 GraphicsColumn[
  {
   Column[
    {
     TextCell[location["Name"], OptionValue[LocationStyle]]
     , TextCell[ToString[startDate[[1]]] <> " - " <> ToString[endDate[[1]]],
      OptionValue[YearRangeStyle]]
    }
    , Alignment → Center
   ],
   GraphicsColumn[
    {ptemp, pprecip}
    , Background → OptionValue[Background]
    , Background → Lighter[Gray, 0.5]
    , Frame → OptionValue[InnerFrame]
    , FrameStyle → OptionValue[InnerFrameStyle]
    , Spacings → {Scaled[0.1], 0}
```

```
      ]
     },
     Background → OptionValue[Background]
     , Frame → OptionValue[Frame]
     , FrameStyle → OptionValue[FrameStyle]
     , Spacings → {Scaled[0.1], 0}
    ]
   ]
  );
```

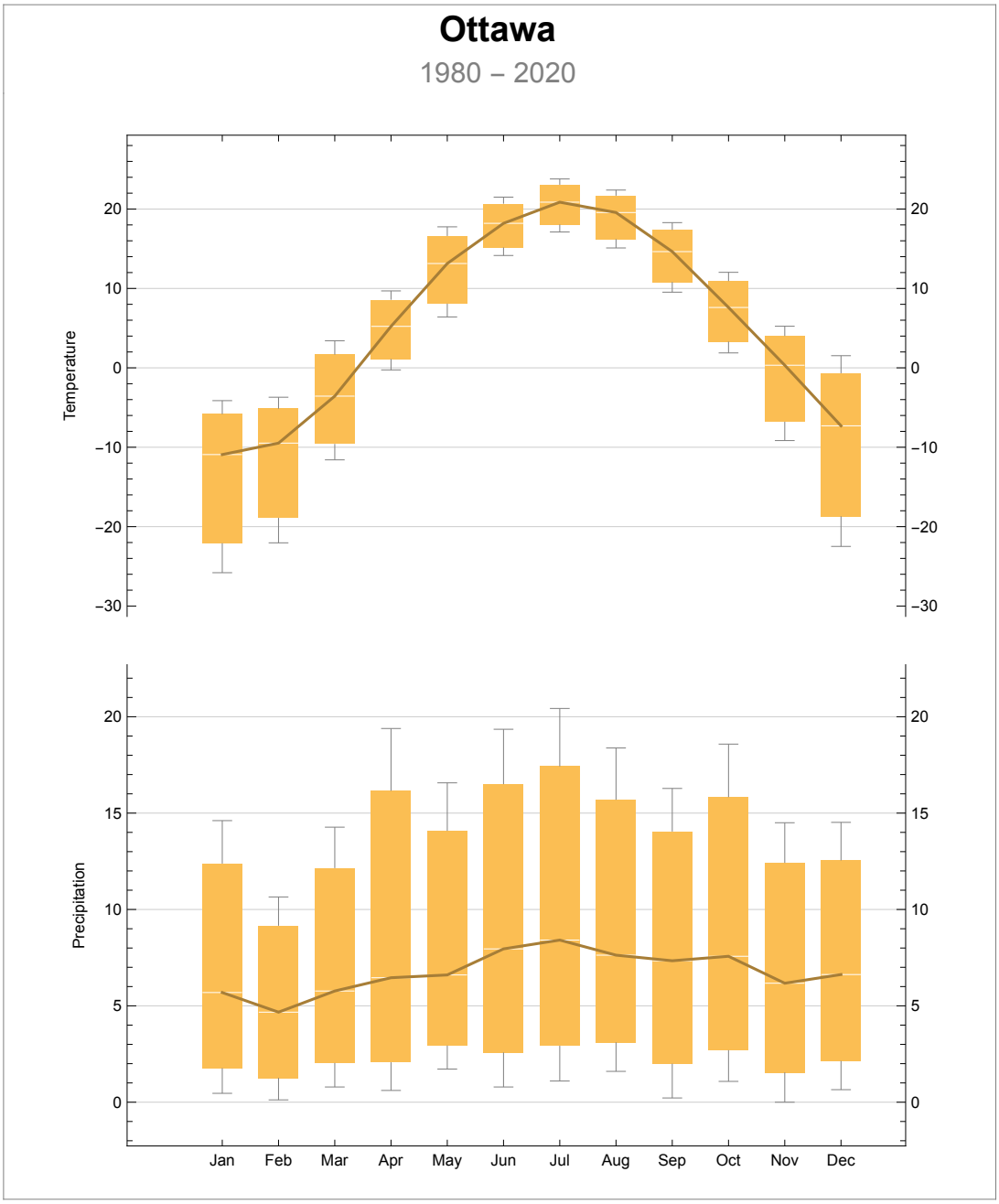
Live Examples

Example 1: default climograph

This call with a City Entity with no options produces a default climograph.

In[94]:= `Climograph[ Ottawa CITY ]`

Out[94]=

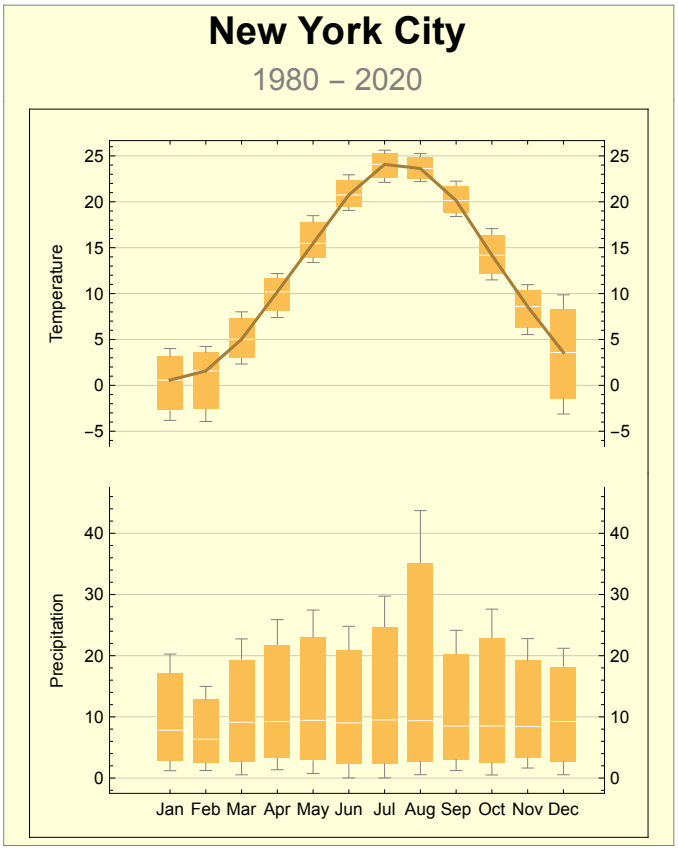


Example 2: normalizing scales across climographs

This call uses options to set the background color, and normalizes the vertical ranges for both the temperature and precipitation plots .

In[95]:=
```
Climograph[{New York City CITY, Paris CITY}
 , TemperaturePlotRange → {0, 30}
 , PrecipitationPlotRange → {0, 45}
 , Background → LightYellow
 , GraphOptions → {
   ImageSize → Medium
  }
 , TemperatureGraphOptions → {
   PlotRange → {-5, 25}
  }
 , PrecipitationGraphOptions → {
   Joined → False
   , PlotRange → {0, 45}
  }
 , InnerFrame → True
]
```

Out[95]=


New York City
1980 – 2020
Temperature
Precipitation
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

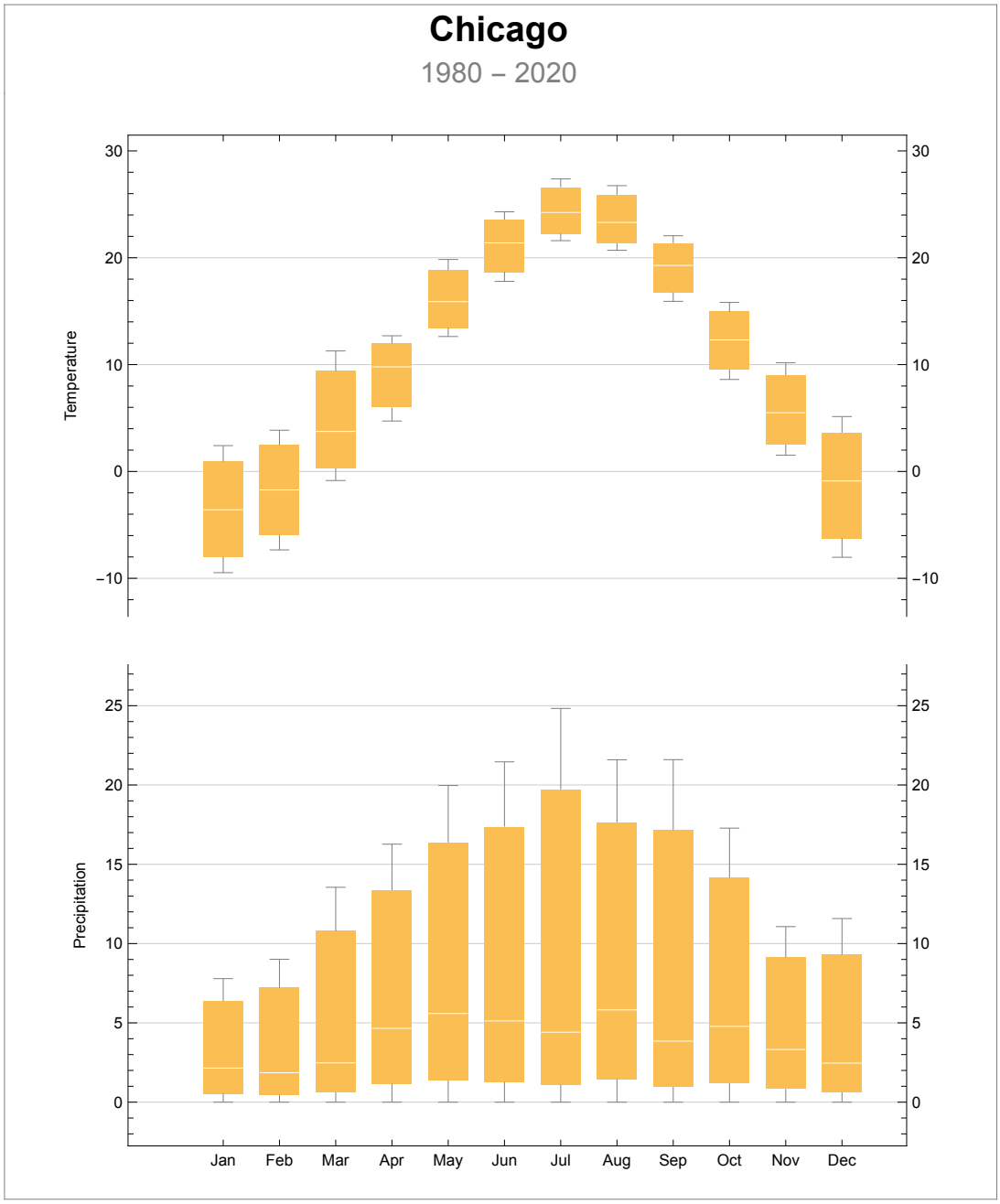

Paris
1980 – 2020
Temperature
Precipitation
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Example 3: omit joining bars

This call uses options to omit the lines joining temperature and precipitation mean values .

In[96]:=
```
Climograph[ Chicago CITY , GraphOptions → {Joined → False}]
```

Out[96]=

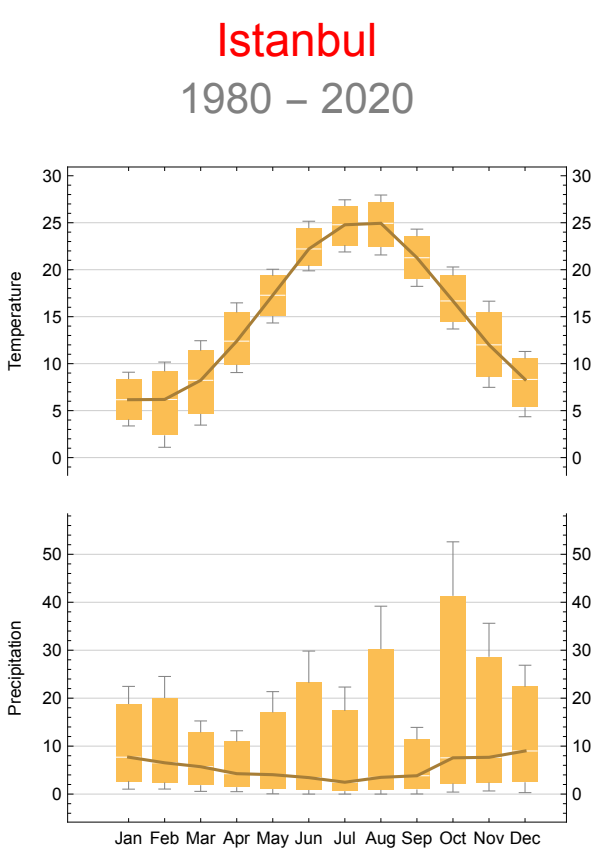


Example 4: omit the outer frame

This call uses options to not show an outer frame, and applies a custom styles to the location and year range.

In[97]:=
```
Climograph[ Istanbul CITY
  , Frame → False
  , LocationStyle → {Red, 24}
  , YearRangeStyle → {Gray, 22}
  , GraphOptions → {
    ImageSize → Medium
   }
 ]
```

Out[97]=

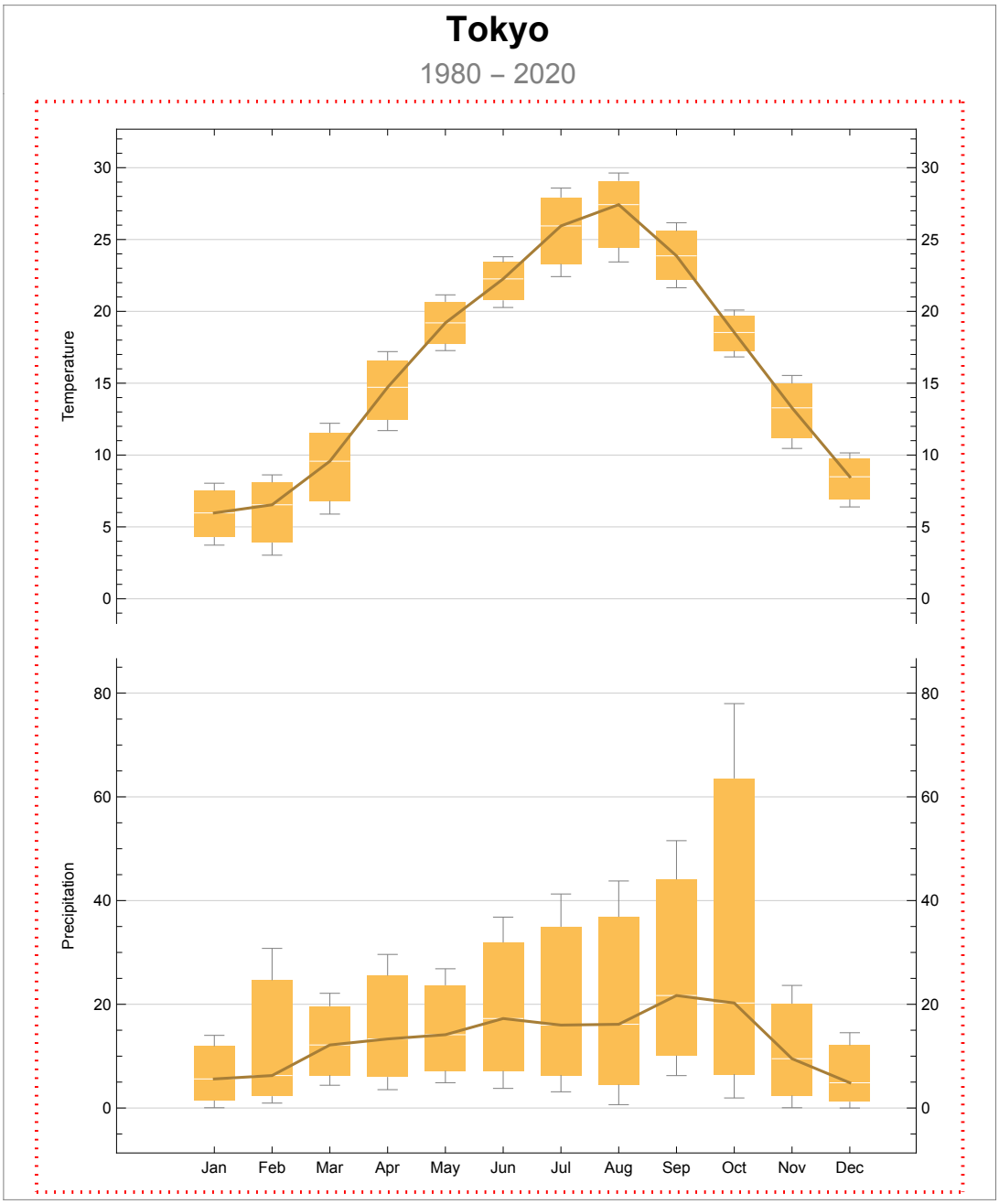


Example 5: styling the inner frame

This call uses options to show the inner frame with a particular style.

In[98]:=
```
Climograph[
  Tokyo CITY
  , InnerFrame → True
  , InnerFrameStyle → Directive[Red, Dotted, Thick]
]
```

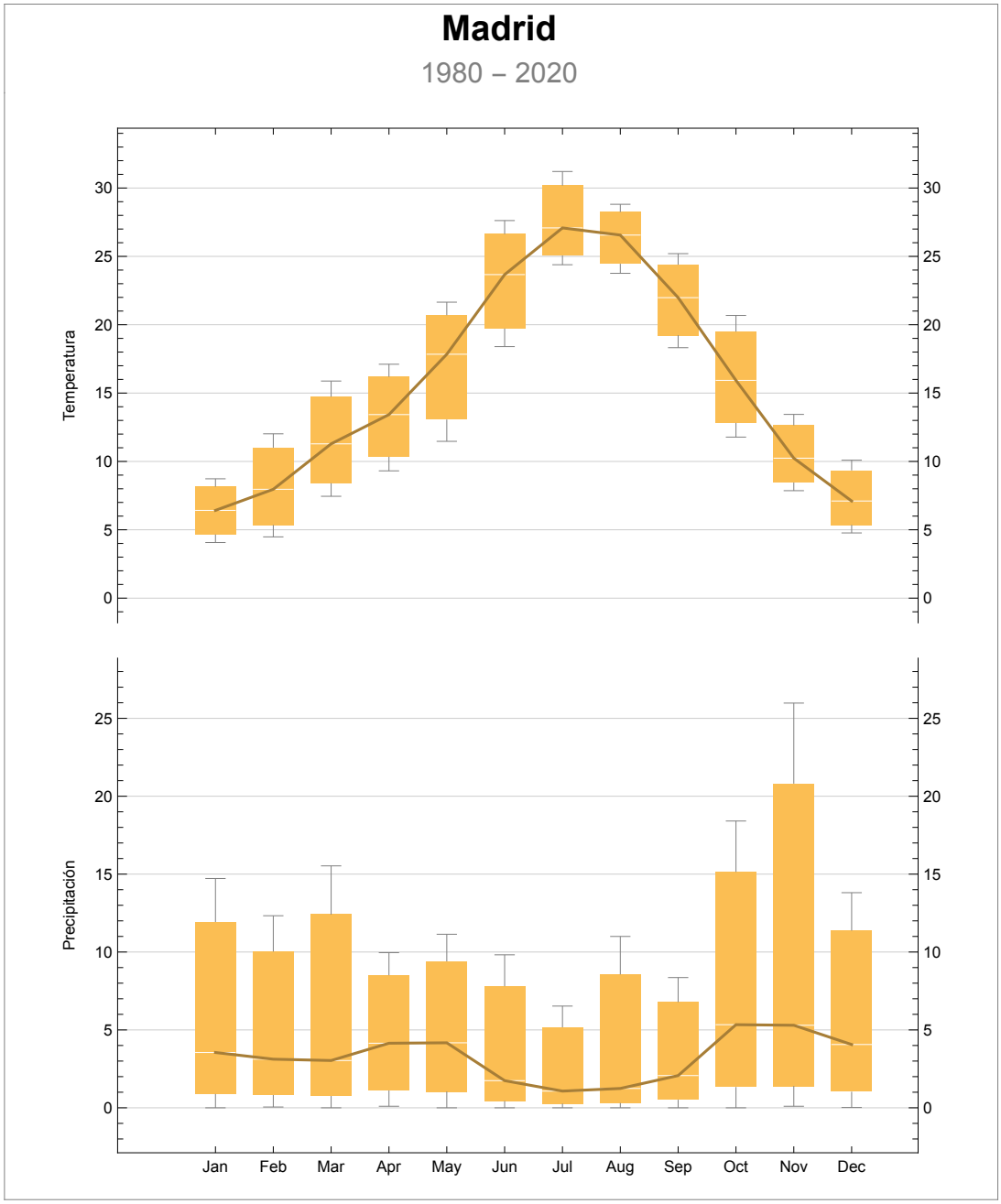
Out[98]=



Example 6: set the axis labels for temperature and precipitation

In[99]:=
```
Climograph[ Madrid CITY ,
 TemperatureGraphOptions → {FrameLabel → {Automatic, "Temperatura"}}
 , PrecipitationGraphOptions → {FrameLabel → {Automatic, "Precipitación"}}
]
```

Out[99]=

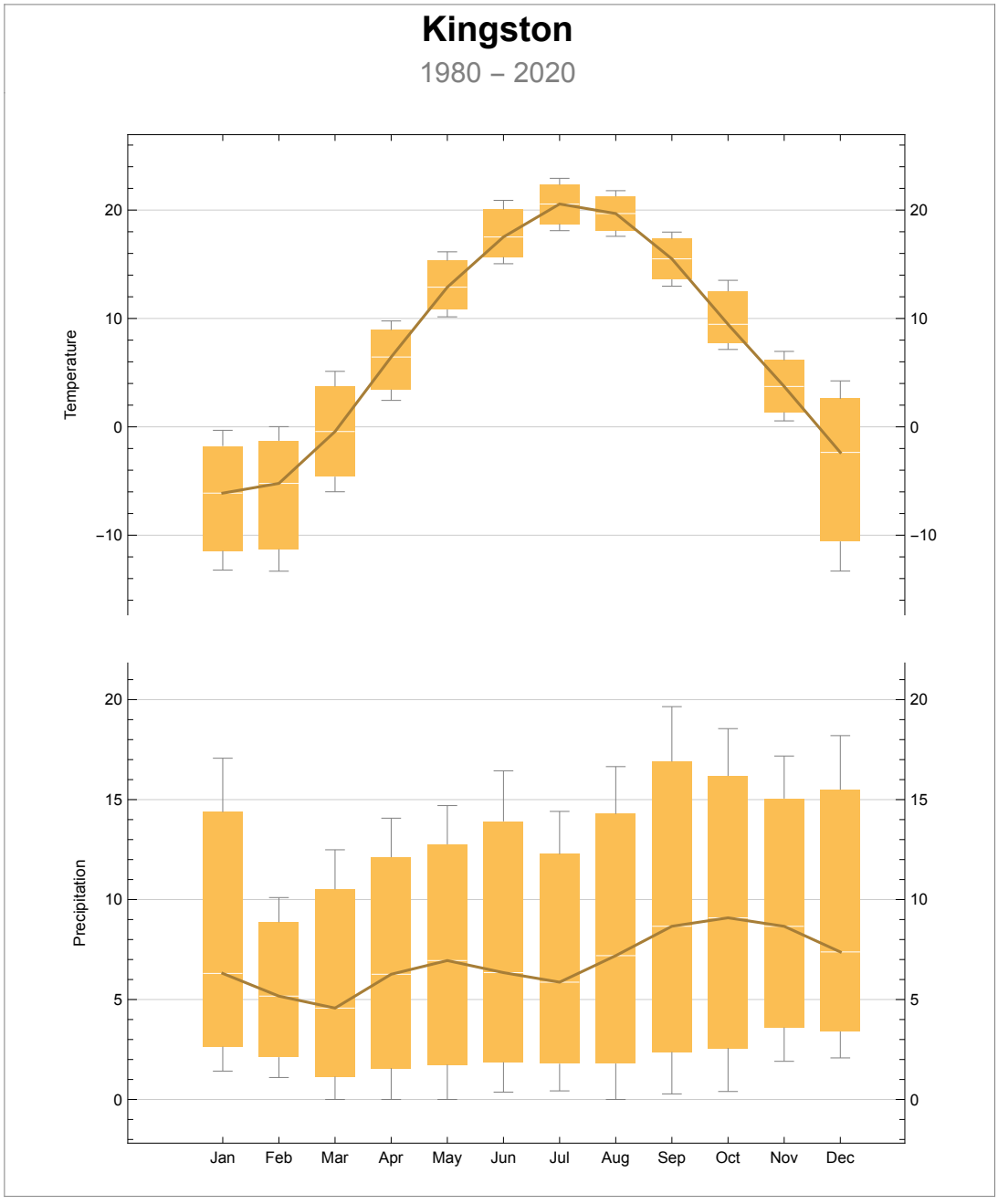


Example 7: uses the current location when no paramers passed

In[100]:=

```
Climograph[]
```

Out[100]=

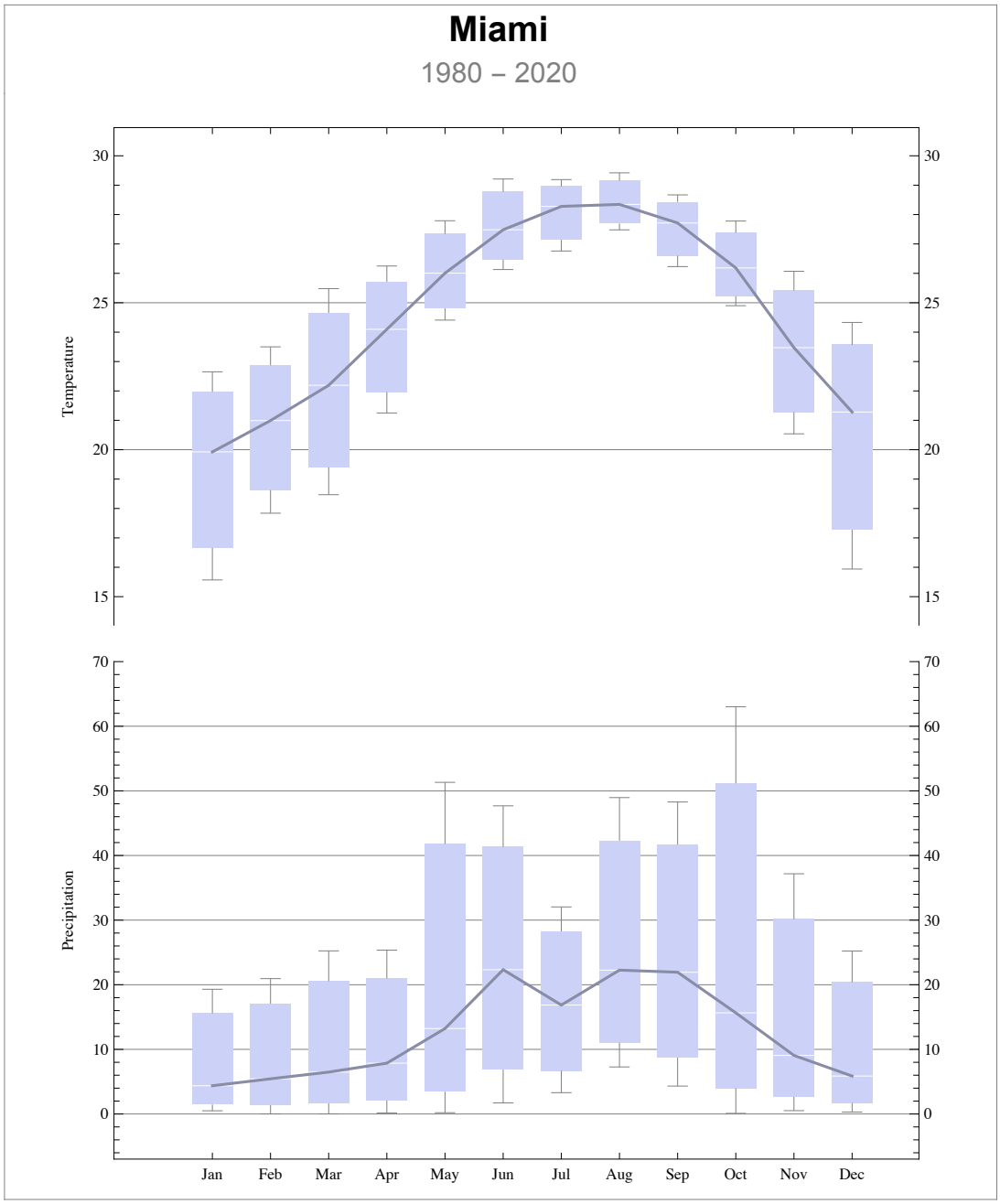


Example 8: Using the PlotTheme option

In[101]:=

```
Climograph[ Miami CITY , GraphOptions → {
   PlotTheme → "Classic"
  }
]
```

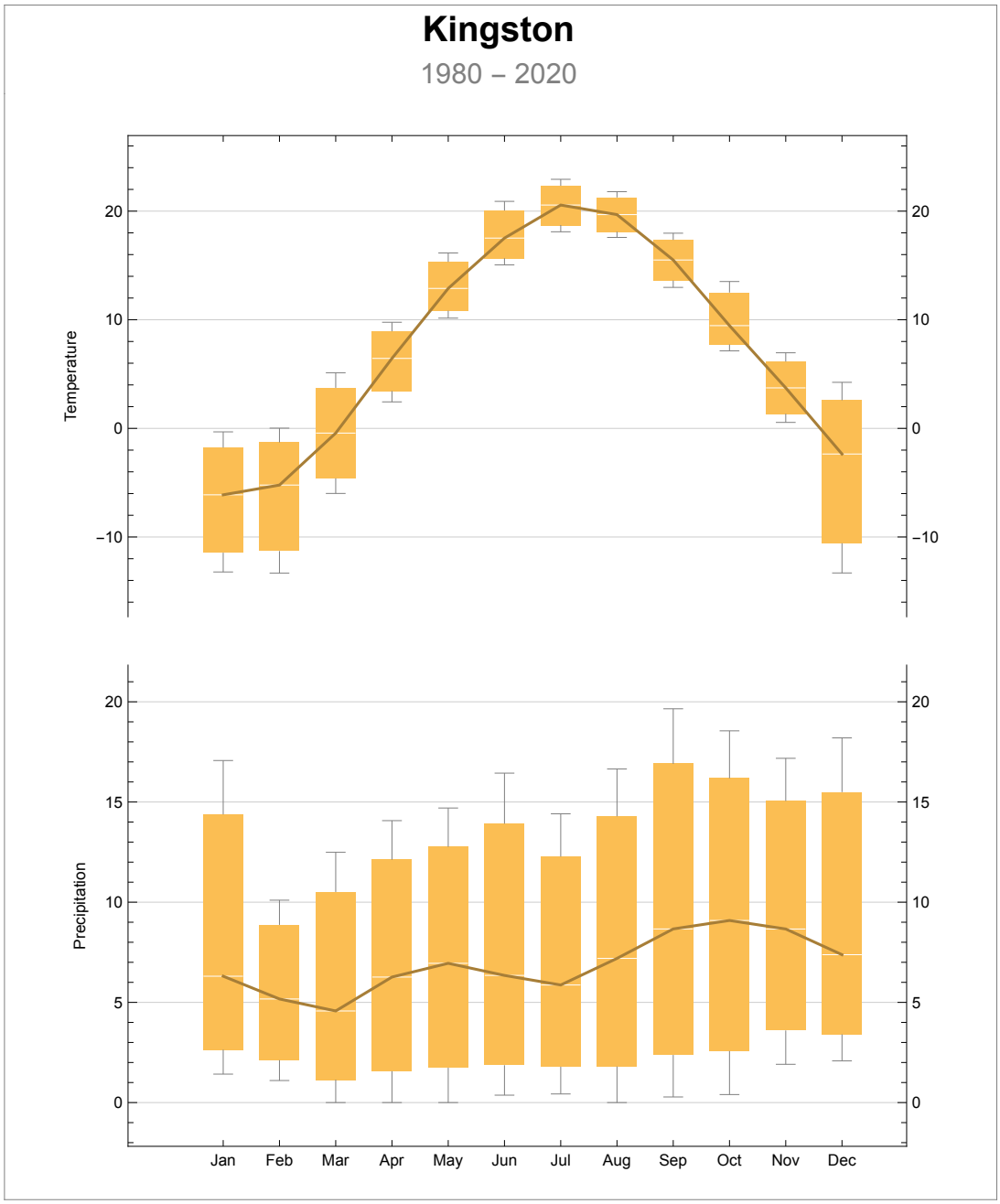
Out[101]=



In[102]:=

```
Climograph[Here]
```

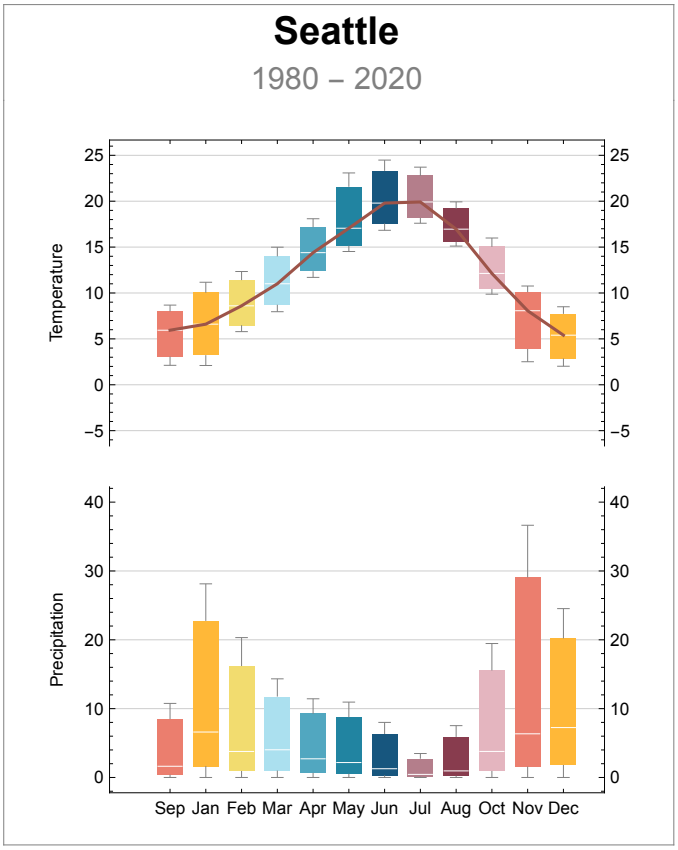
Out[102]=



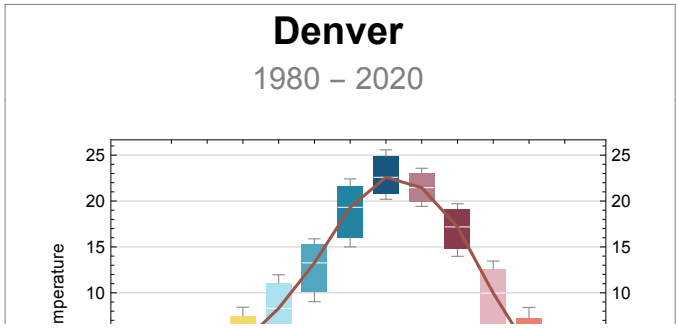
In[103]:=

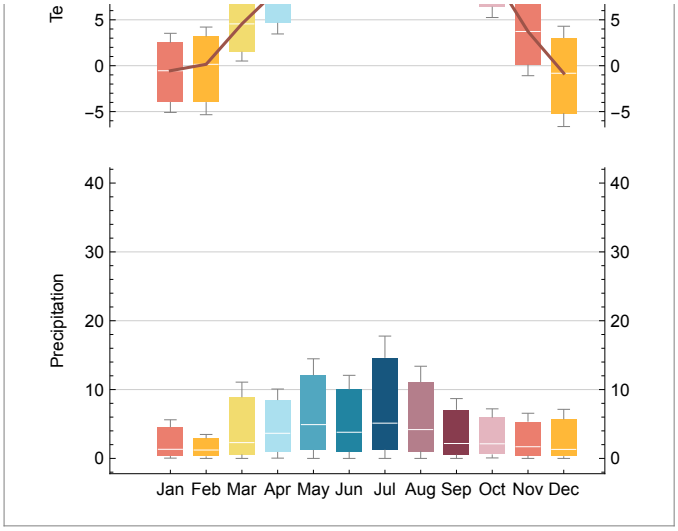
```
Climograph[{Seattle CITY, Denver CITY, Los Angeles CITY}
 , GraphOptions → {
    ChartStyle → 24
   , ImageSize → Medium
  }
 , TemperatureGraphOptions → {
   PlotRange → {-5, 25}
  }
 , PrecipitationGraphOptions → {
   PlotRange → {0, 40}
   , Joined → False
  }
]
```

Out[103]=

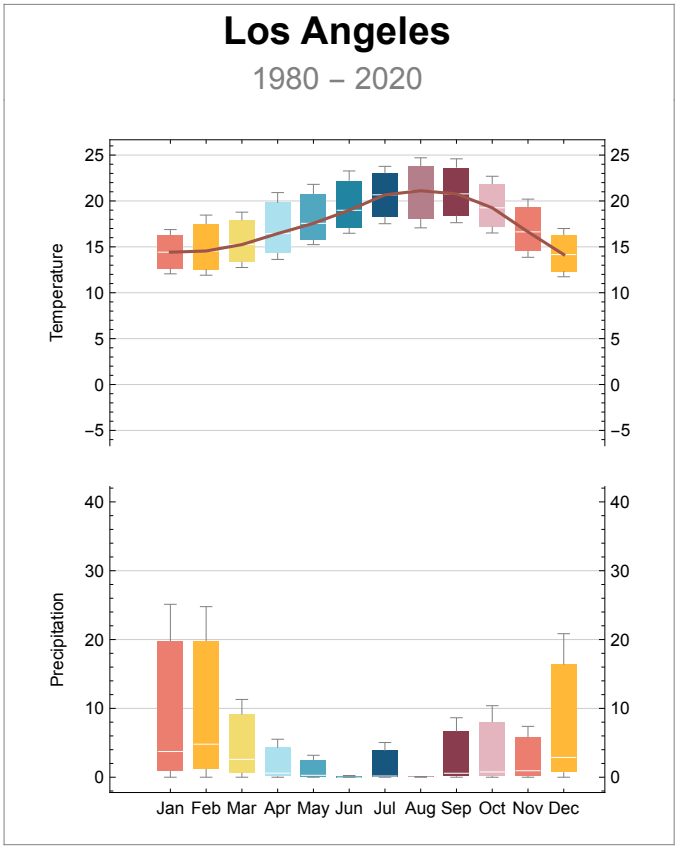


,




Te
5
0
−5
40
30
20
10
0
Precipitation
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

,


Los Angeles
1980 – 2020
25
20
15
10
5
0
−5
Temperature
40
30
20
10
0
Precipitation
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

}