U.S. Climate Normals, 1971-2000: Methodological Considerations

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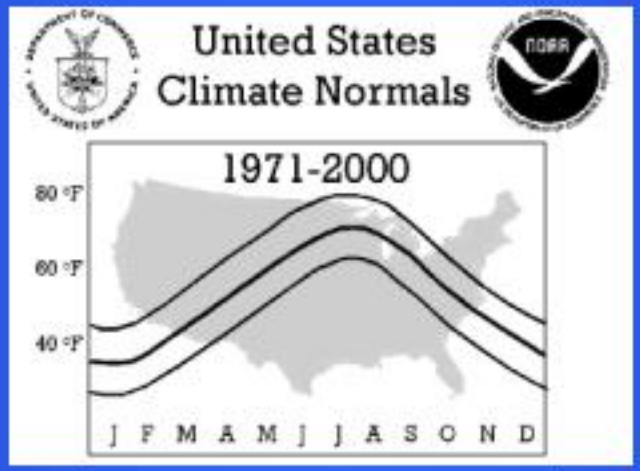


AMS 82nd Annual Meeting

National Climatic Data Center

What Are 'Normals'?

"The layman is often misled by the word. In his every-day language the word normal means something ordinary or frequent. ...When (the meteorologist) talks about 'normal', it has nothing to do with a common event..... For the meteorologist the 'normal' is simply a point of departure or index which is convenient for keeping track of weather statistics..... We never expect to experience 'normal' weather."

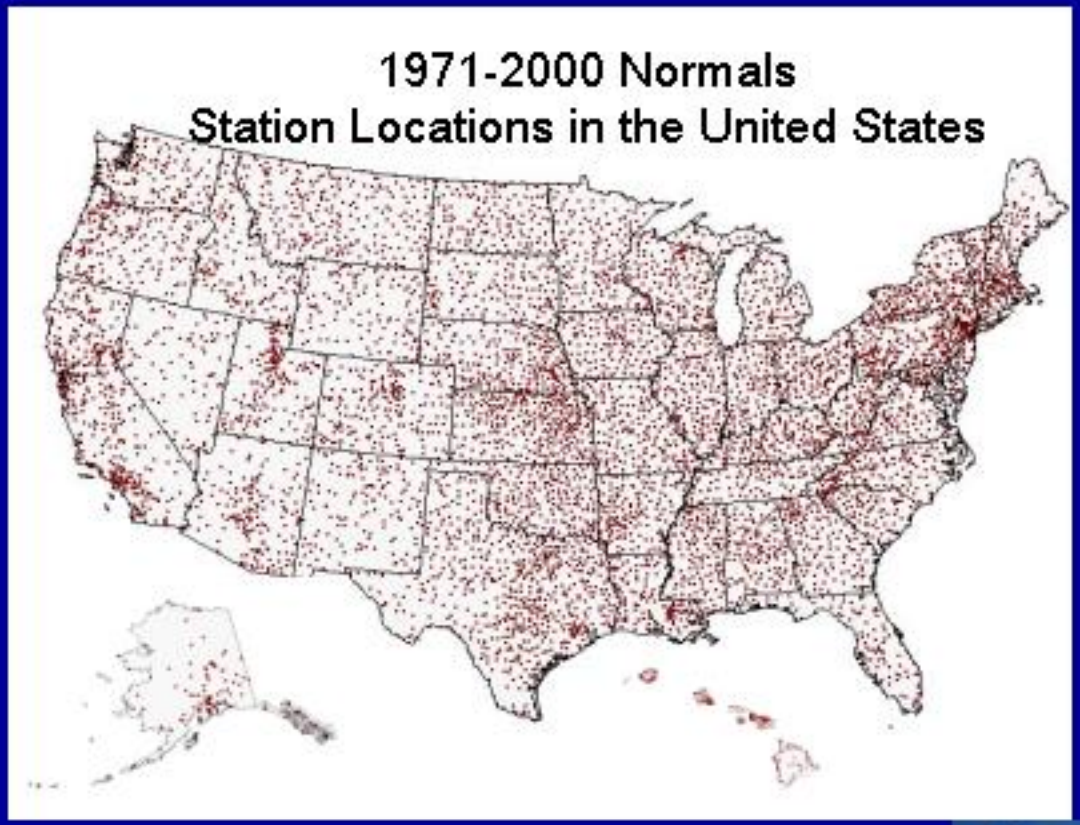
Dr. Helmut E. Landsberg, 1955

"A climate normal is defined, by convention, as the arithmetic mean of a climatological element computed over three consecutive decades"

World Meteorological Organization, 1989

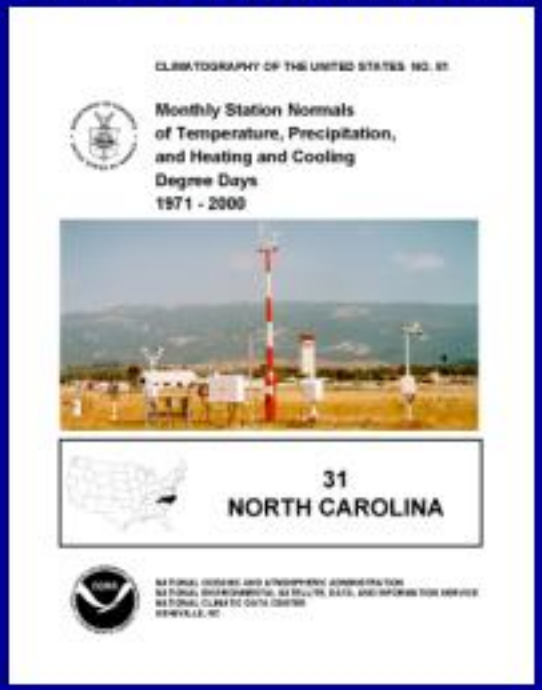
Normals Products

- **Official** Decadal Product
- Nearly **8,000 Stations** in the United States, Puerto Rico, the Virgin Islands, and Pacific Islands.
- **Elements** include:
  - Maximum Temperature
  - Minimum Temperature
  - Mean Temperature
  - Precipitation
  - Heating Degree Days
  - Cooling Degree Days



Normals Products

Monthly Station Normals



Daily Station Normals

- Monthly Quintiles/ Precipitation Probabilities and Annual Degree Days to Selected Bases
- Monthly Divisional Normals and Standard Deviations (Climatography of the U.S. No. 85)
- Area-Weighted State, Regional, and National Monthly Temperature and Precipitation
- Population-Weighted State, Regional, and National Monthly Heating and Cooling Degree Days
- Station Climatological Summaries (Climatography of the U.S. No. 20)
- Frost/Freeze Data and Snow Normals

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Normals Overall Methodology

Station Data

Corrections/Adjustments
- -Time of Observation Correction
- -Statistical QC
- -Station History QC
- -Missing Data Estimation

Adjusted Month-Year Sequential Data

Normals Calculations
- -Means/Totals
- -Standard Deviations
- -Other Statistics

Monthly Normals

Spline Fit Calculations

Daily Normals

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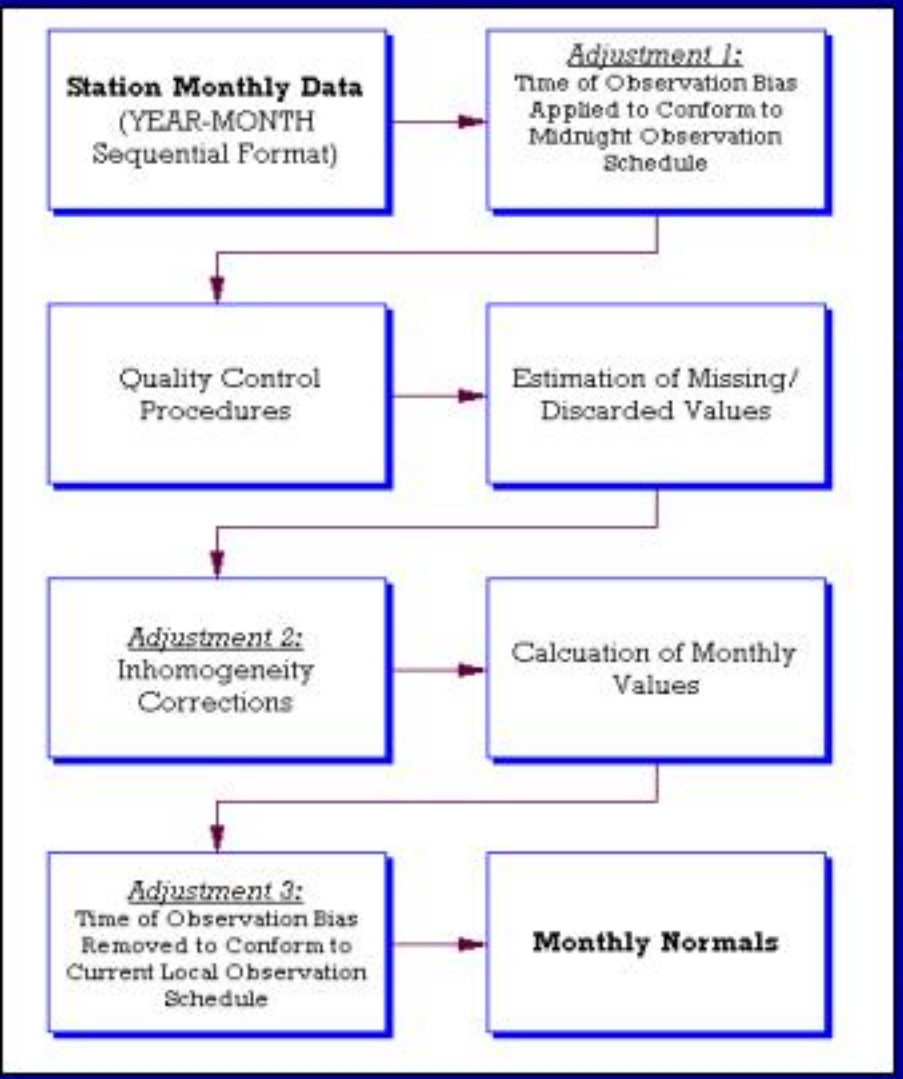
Computational Procedure for Monthly Normals



Make data comparable

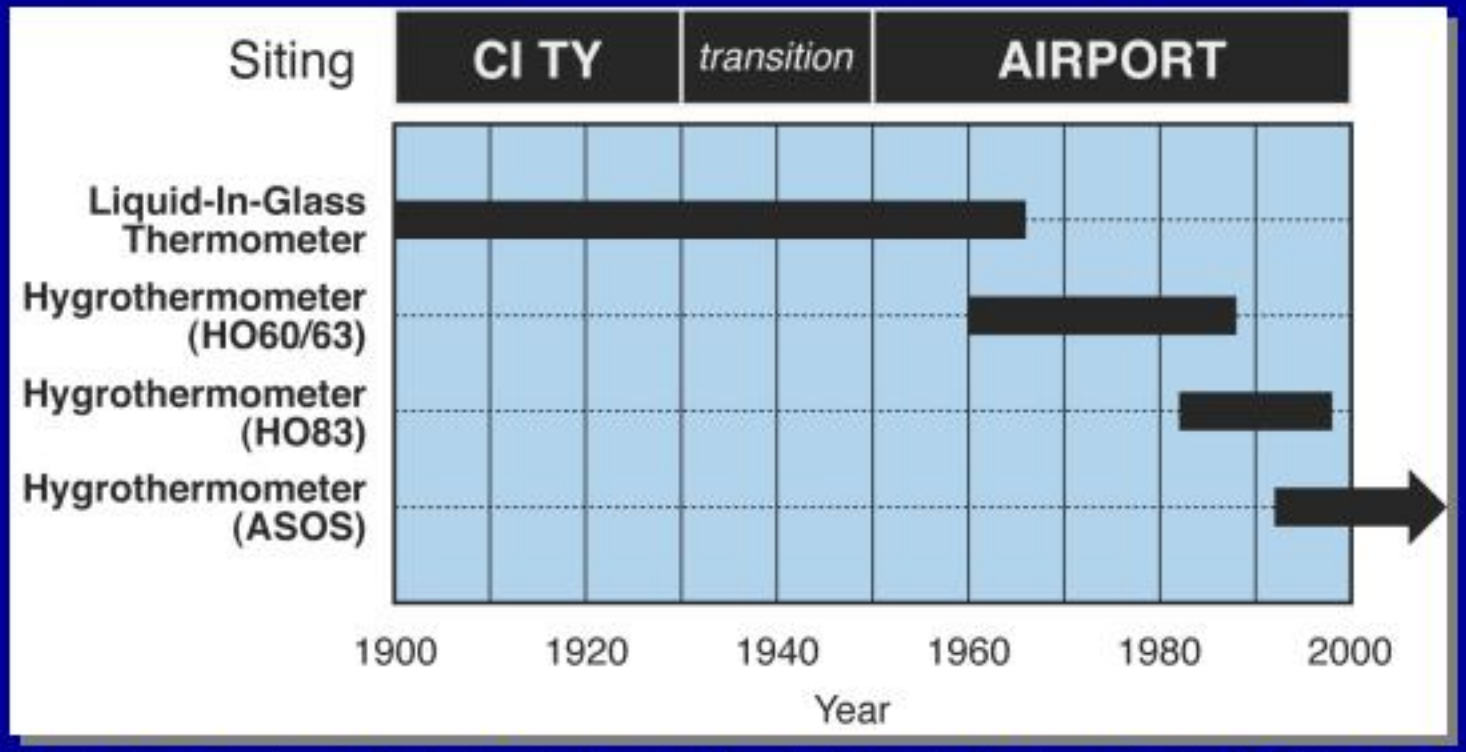
- Internal consistency checks -
Nearest neighbor checks -
Estimations based on nearest neighbors

Adjust for inconsistencies in observational practices (*e.g.*, changes in station location, instrumentation, *etc.*)

Return adjusted data to local time of observation

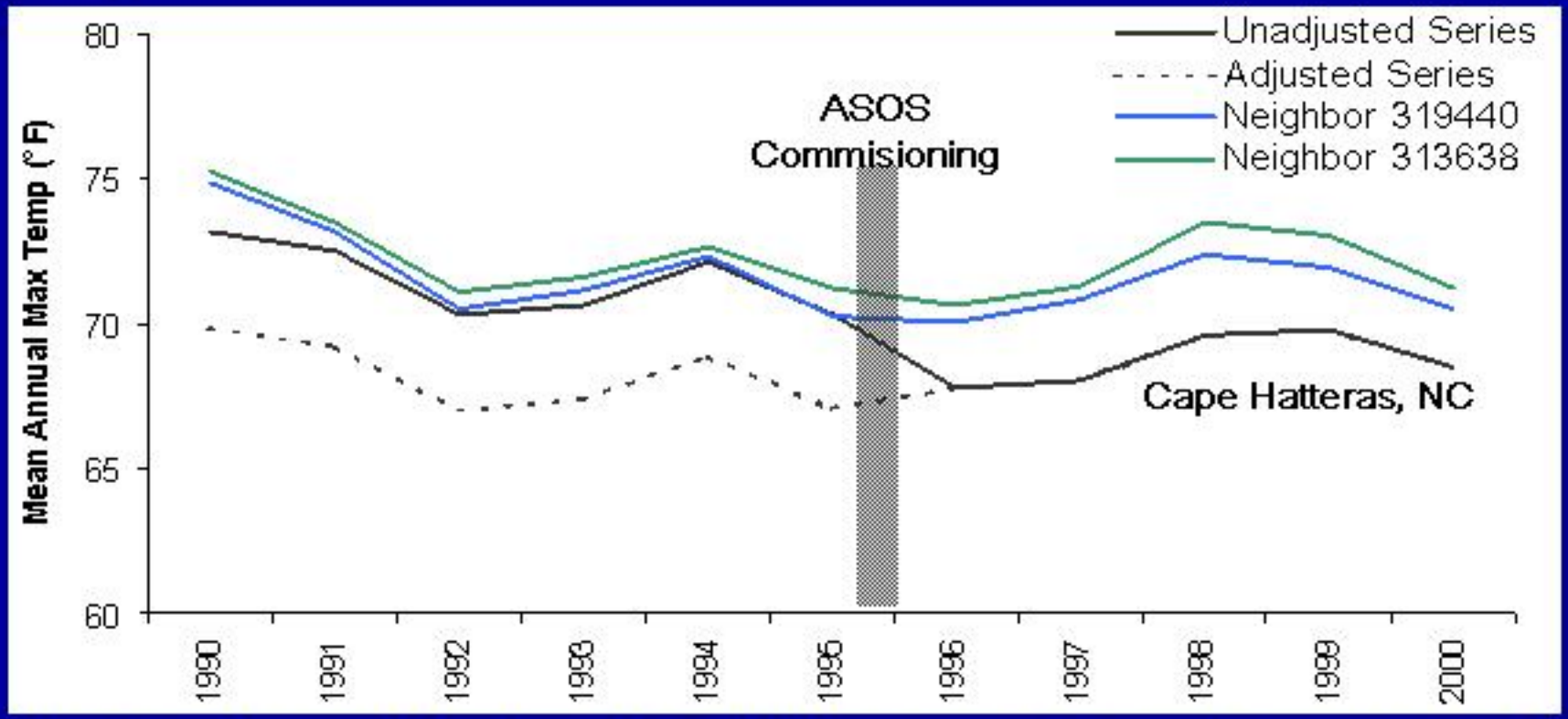
Correcting for Inhomogeneities

- ALL stations (COOP and First-Order) were adjusted for inhomogeneities based on the Peterson and Easterling (1994) and Easterling and Peterson (1995) [PEEP] method.



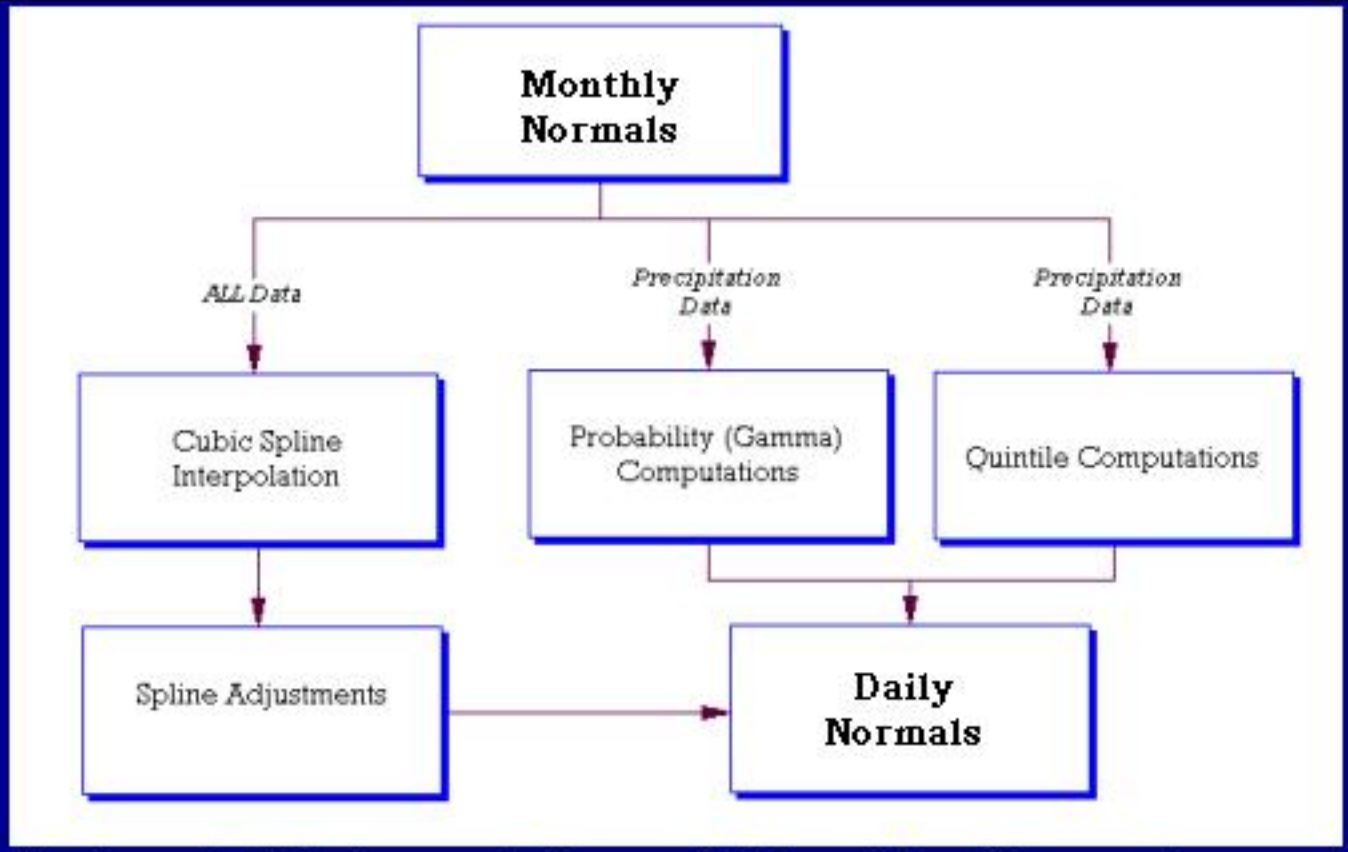
Changes in Temperature Equipment and Location at First Order Stations

Correcting for Inhomogeneities



Adjustments made to the Cape Hatteras series are shown as dashed line. These adjustments are made to create a time series so that all observations **conform more to the most recent period.**

Computational Procedure for Daily Normals



Cubic Spline Fit Interpolation of Monthly Normals:

- 'Smoothed' Daily Curves of Elements
- Consistency Between Average/Total of Daily Values and Monthly Value*

A New Way of Computing Degree Day Normals

GOAL: Produce the most **accurate** degree day monthly totals, especially at National Weather Service sites.

APPROACH: Replacement of the H.C.S. Thom Estimation Method for Monthly Degree Days.

*IMPLICATION: In some cases, the sum of the daily degree day totals will *not* match the monthly degree day total computed using the new approach.

A New Way of Computing Degree Day Normals

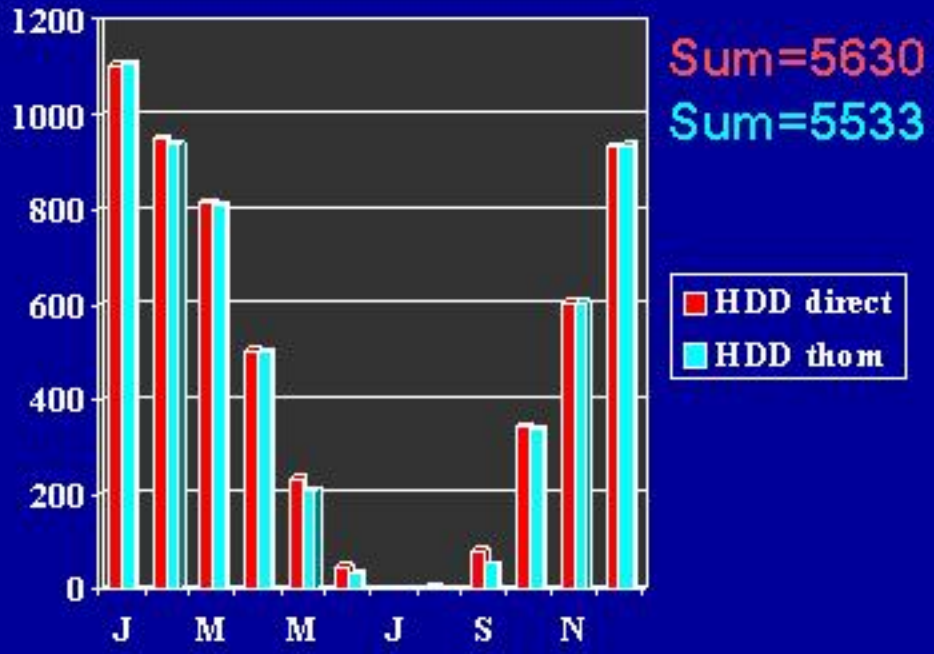
SOLUTION: A Two-tiered Approach

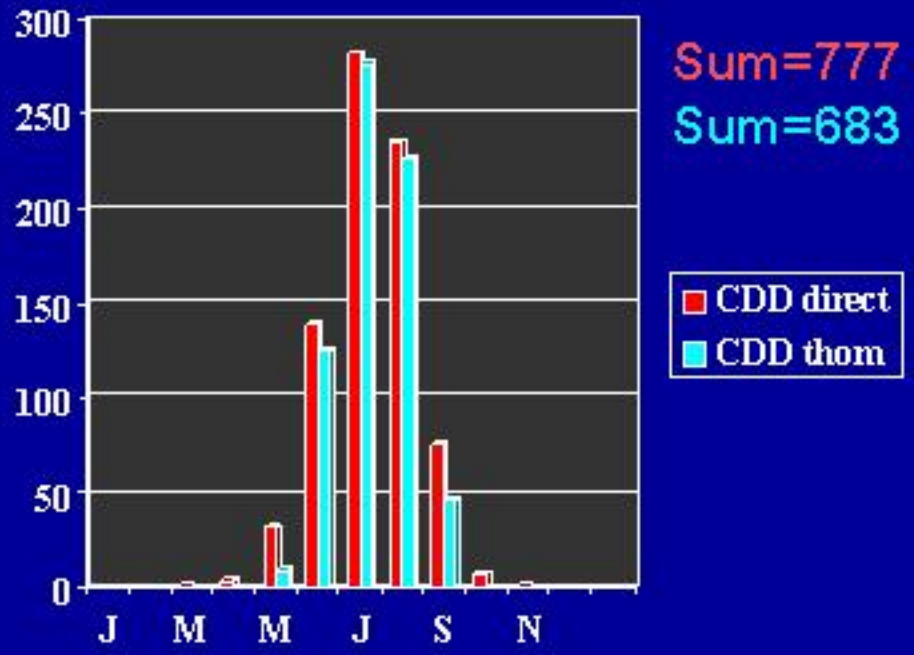
- First-Order Stations:
  - **Direct** computation from *daily* values.

- Cooperative Network Stations:
  - *Modified* Thom Method using *daily* fit of means and standard deviations.
  - Direct computation limited by incomplete periods of record and varying times of observation.

Degree Day Normals: Direct Computation

Example: Boston, MA (1971-2000 Normals)





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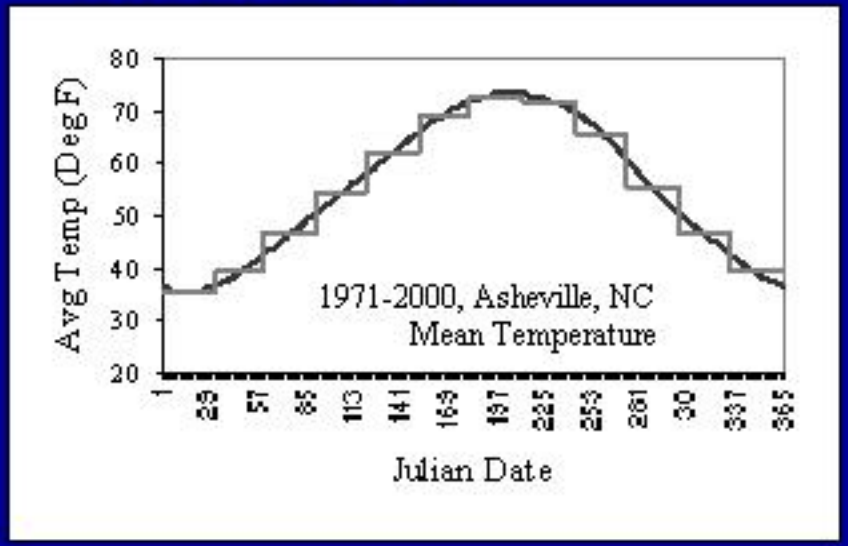
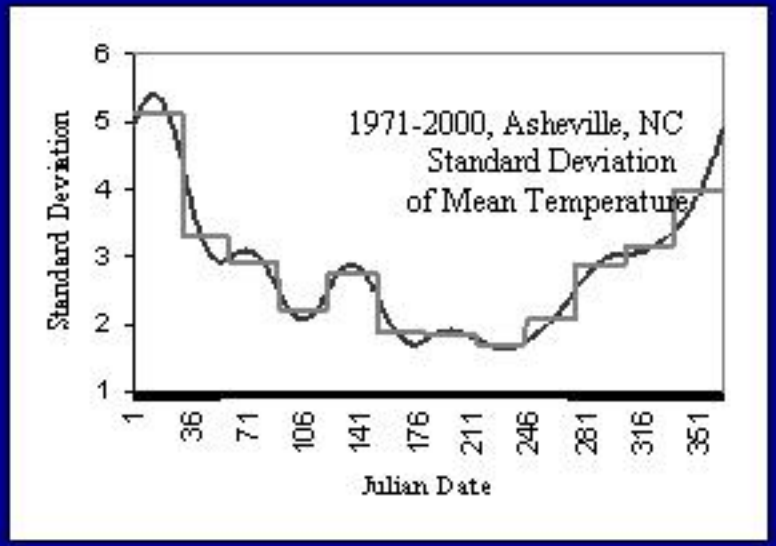
Degree Day Normals: Estimation

- The 'Modified' Thom Method

  - Monthly totals based on estimates using *daily* fits of means and standard deviations obtained through a spine function.





— Modified inputs of mean and standard deviation

— Original inputs of mean and standard deviation

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Conclusion: How to Access the Normals

www.ncdc.noaa.gov/normals.html

NCDC / Climate / GetView / U.S. Climate Normals / Search / Help

Overview

Product Selection

Unlimited Access

NWS Inquiries

U.S. Climate Normals

Product Selection

Climate normals products currently available online:

- NEW! Monthly Station Normals 1971-2000 (CLIM81)
- Frost/Freeze Data 1951-1980 (CLIM20-01)
- Population-Weighted State, Regional, and National Monthly Degree Days (HCS 5-1:2)
- Maps of Annual 1961-1990 Normal Temp., Precip. and Degree Days (CLIM81-03)

Newly computed (1971-2000) products **below to be available online in 2002** (release schedule):

- Daily Station Normals (CLIM84)
- Station Climatological Summaries (CLIM20)
- Frost/Freeze Data (CLIM20-01)
- Annual Degree Days to Selected Bases (CLIM81-02)
- Monthly Precipitation Probabilities (CLIM81-01)
- Monthly Divisional Normals/Standard Deviations (CLIM85)
- Area-Weighted State, Regional, and National Monthly Temp. and Precip. (HCS 4-1:2)
- Population-Weighted State, Regional, and National Monthly Degree Days (HCS 5-1:2)
- Maps of Annual 1961-1990 Normal Temp., Precip. and Degree Days (CLIM81-03)

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