Rainfall Summary Statistics Calculation Procedure

Purpose

To aid in the management of water resources in the Southwest Florida Water Management District, reports are produced at daily, weekly, monthly, and annual intervals that characterize present-day rainfall over the District in relation to historical rainfall amounts.

Background

District Hydrologic Data Section staff has drawn upon all available data to develop estimates of historical rainfall occurring within selected political and geographical units, including counties, USGS primary watersheds and District regions (Northern, Central, and Southern). For the period between 1915 and 1970, most rainfall data were from observer stations and data recorder stations, operated and/or maintained by the National Oceanic and Atmospheric Administration (NOAA). After 1970, the District also became active in its rainfall data collection efforts, greatly increasing the number of monitored rainfall stations within its 16-county region. The District's near-real-time electronic data collection also became a valuable tool for collecting rainfall data beginning in 1989. Thus, the number of rainfall stations available for the calculation of rainfall summary statistics between 1915 and the present day varied greatly, and gradually increased as years progressed. Calculations of rainfall used all available stations with complete data in any given year, and the methodology for calculations changed as newer technologies became available. In 2002, gauge-adjusted radar rainfall (GARR) estimates became available to the state's Water Management Districts.

For the period 1915 to 1999

To estimate rainfall totals for selected geographic units, data were screened for every rainfall station to ensure that they were complete for each year of the period of record. Any stations with fewer than 365 days of data per year were excluded from the data set. Selected station locations were then used to construct Thiessen polygons using a geographic information system (GIS) technique, a method in which polygons are constructed around each rainfall station such that any area within the polygon is closer to the central rainfall station than to any other rainfall station. Rainfall anywhere within the polygon area is assumed to be the same as the rainfall at the station central to the polygon.   The polygons were then intersected with each selected geographic unit so that each unit (e.g., county) contained only the area of each polygon that fell within that unit. The sum of the polygon area and rainfall products for all the polygons within the unit, divided by the total area of the unit, yielded an area-weighted estimate of rainfall within the unit. Thiessen polygons were reconstructed for each year based on the number of stations with complete, available data. Thus, the final estimates of monthly, seasonal, and annual rainfall were always based upon the best available data for each subject year.

Since 1999

From December 1999 to present, the areal rainfall totals have been calculated from GARR data acquired from OneRain, Inc. Although the GARR product was first acquired in 2002, the District purchased back-calculated data, which was used for years 1999 and 2000. Since October 2007, the vendor for these data has been Vieux, Inc. In both cases, the vendor uses digitally-captured rainfall imagery data from the National Weather Service's NEXRAD weather radar network. By comparing these high-resolution rainfall intensity signature data with District-supplied 15-minute rainfall totals measured at 130+ field locations,

the vendor calibrates the radar data to estimate rainfall amounts over the SWFWMD at a 15-minute timescale. Fifteen-minute rainfall estimates derived from the calibrated radar data are provided to the District in a 2-kilometer-square grid resolution. Each grid cell is associated with a region, county, or USGS primary watershed using a GIS overlay procedure. No area-weighting is required using the GARR dataset as each grid cell is the same size and cells are not split across selected geographic area boundaries. Note that these totals are calculated for only the portion of geographic unit within the District boundaries, not for the entire geographic unit, e.g., that portion of Marion County within the SWFWMD, not for all of Marion County.

Official rainfall summary dataset

The data from these two sources have been combined into a single dataset of monthly areal-mean rainfall totals by county, watershed, and region for the period from 1915 to the present. The data are further aggregated into moving 12-month, calendar-year, water-year, dry-season, and wet-season totals, with mean, minimum and maximum values provided for each time series.

Data statistics and usage

These data are the source dataset for calculation of other statistics used to define normal ranges and levels of significance for evaluating drought and flood conditions. The calculation of historical 12-month percentiles uses the monthly historical dataset to calculate a data series of running 12-month totals. The advantage of this calculation is that it results in a very large dataset (over 1,200 years samples) rather than limiting the data to simple calendar-year analysis which would only have 105+ samples. This dataset was used to calculate means, maxima, and minima, and percentiles that identify normal ranges (25th – 75th percentiles), and exceptional ranges (less than the 10th percentile and greater than the 90th percentile) used in analysis of hydrologic conditions.