## Bayesian Radar Rainfall, Applicable to All Hydrologic Analyses
## Data Download Available for West-Central Florida, 1995 through 2019


### ABSTRACT

Spatial and temporal distributions of rainfall significantly impact surface water processes and the dynamic exchange between groundwater and surface water. Magnitude and distributions of rainfall also impact groundwater recharge. In west-central Florida, rain gauge records have been the primary source of historical rainfall data for water resources analyses and model development to support water management decision making. The Integrated Northern Tampa Bay (INTB) model, a calibrated application of the Integrated Hydrologic Model (IHM, https://www.integratedhydrologicmodel.org) code was originally developed using exclusively gauged rainfall.

Rainfall data derived from the Next Generation Radar (NEXRAD) data available since 1995 was expected to provide improved accuracy and resolution of the estimated historical rainfall from gauged records. However, an assessment of NEXRAD data revealed significant high bias for low magnitude daily rainfall and low bias for high magnitude daily rainfall compared to gauged rainfall. The assessment also revealed NEXRAD data low bias of 3 inches/year as a long-term average compared to gauged rainfall. These biases cause reduced water mass input to the simulated hydrologic system resulting in model parameterization that does not accurately represent the hydrologic system. A poorly- parameterized system can lead to decisions causing under or over-utilization of water resources, which is especially troublesome for a region that is already resource limited with large potential for growth in population and water demand.

To improve the accuracy and resolution of the estimated historical rainfall, a Bayesian statistical approach has been utilized to integrate the rain gauge data and rainfall data derived from NEXRAD. Rain gauge data were used to develop the prior distribution and radar rainfall uncertainty was used to derive a likelihood function. The resulting Bayesian radar rainfall accentuates the strengths of the rain gauge and radar data while de-emphasizing their weaknesses. Bayesian radar rainfall agrees with the gauged data at radar pixels co-located with gauges and is corrected for the radar rainfall biases. In addition, it reduces the uncertainty of the estimated rainfall.

Bayesian radar rainfall data and reports (GSI 2021a, b, c) documenting the data assessment and implementation processes are available for download using links at: https://www.integratedhydrologicmodel.org/Publications. Bayesian radar rainfall can be used for any application for which the original radar rainfall is used. These data are available for all or parts of west-central Florida counties including Citrus, Sumter, Lake, Hernando, Pasco, Polk, Pinellas, Hillsborough, Manatee, and Hardee for calendar years 1995 through 2019. Available resolution of Bayesian radar rainfall include:

- INTB model basins and daily time steps
- INTB model basins and 15-minute time steps
- 2 km pixels and 15-minute time steps


### DESCRIPTION OF DATA FILES AND SHAPEFILES

CSV data file structure is used to store Bayesian radar rainfall. All files contain a header record. The first column of each file holds datetime where date format is DD-MMM-YYYY and military time is used for 15 minute data. All subsequent columns contain a time series of rainfall values for an INTB model BasinID or a 2 km PixelID, depending on the file. All values are assigned to the datetime at the beginning of the time increment. For example, for rainfall that occurred between 1:00 am and 1:15 am, the value is assigned to time stamp 1:00.

**All CSV rainfall files are compressed into zip files** which are available for download for years 1995 through 2019:

- BasinRainDaily.zip — INTB model basin scale and daily time steps for all years
- BasinRain15min.zip — INTB model basin scale and 15-minute time steps for all years
- BasinRain15min_YYYY.zip — INTB model basin scale and 15-minute time steps for year YYYY
- PixelRain15min_YYYY.zip — Radar pixel scale and 15-minute time steps for year YYYY

PixelIDs within the header of data files match those used in the original radar rainfall data available from the SWFWMD (https://www.swfwmd.state.fl.us/). BasinIDs within the header of data files match those used in the INTB model. **Polygon shapefiles** of radar rainfall pixels (field Pixel) and INTB model basins (field BasinID) are available for download.

**If a rainfall CSV file is imported into MS Access** using the Import Text Wizard, use the Advanced . . . button at the bottom of the wizard window to specify import specifications for the Datetime column. Use DMY for Date Order, use forward slash (/) for Date Delimiter, and use colon (:) for Time Delimiter. Checkmark boxes for Four Digit Years and Leading Zeros in Dates.

#### REFERENCES


GSI Environmental Inc. (2021a). "Evaluation of Rain Gauge and Doppler Radar Rainfall Data in the Integrated Northern Tampa Bay Hydrologic Model Domain."

GSI Environmental Inc. (2021b). "Integration of Rainfall Rata from Rain Gauges and Doppler Radar in the Integrated Northern Tampa Bay Hydrologic Model Domain."

GSI Environmental Inc. (2021c). "Supplemental Report on Integration of Rainfall Data from Rain Gauges and Doppler Radar in the Integrated Northern Tampa Bay Hydrologic Model Domain from 2017 through 2019."