SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Rainfall Estimates using NEXRAD Technology

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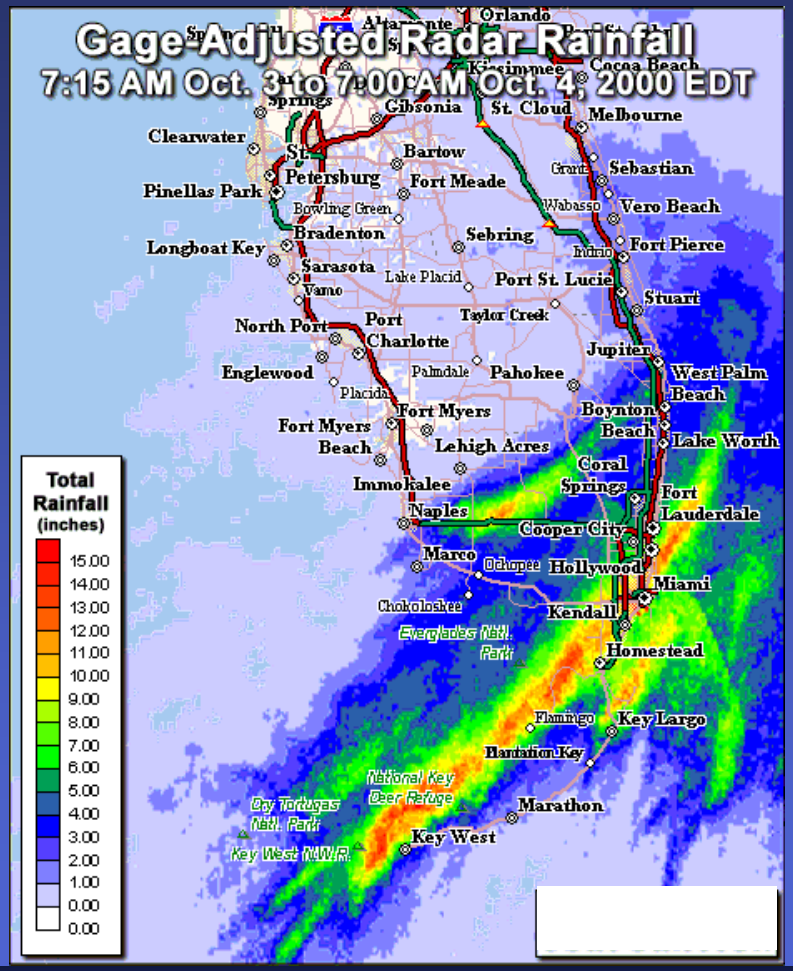

Agenda

- What it is
- Why it is used
- Where it is used
- When it is available
- How it is collected
- Summary

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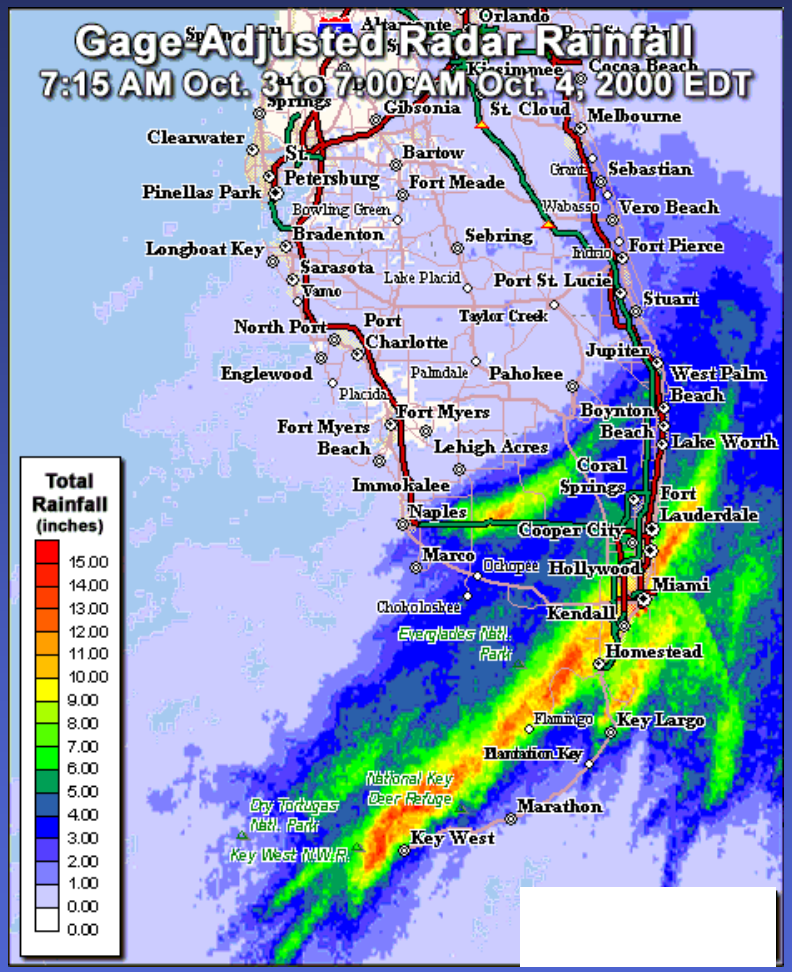
NEXRAD Technology



- National Weather Service deployed Next Generation Radar (NEXRAD) a.k.a. WSR-88D Weather Radar
- Opportunity to improve the spatial estimation of rainfall amounts
- NEXRAD sends out a radio signal and measures the signal reflected from falling raindrops (reflectivity)

NEXRAD Technology

- NEXRAD uses reflectivity to estimate the amounts of rainfall (using calibrated algorithms)
- It can measure reflectivity out to a distance of 230 km
- District areal coverage comes from 5 radars (Tampa, Melbourne, Jacksonville, Miami and Key West)
- Data are available with 2km x 2km grid resolution every 15 minutes

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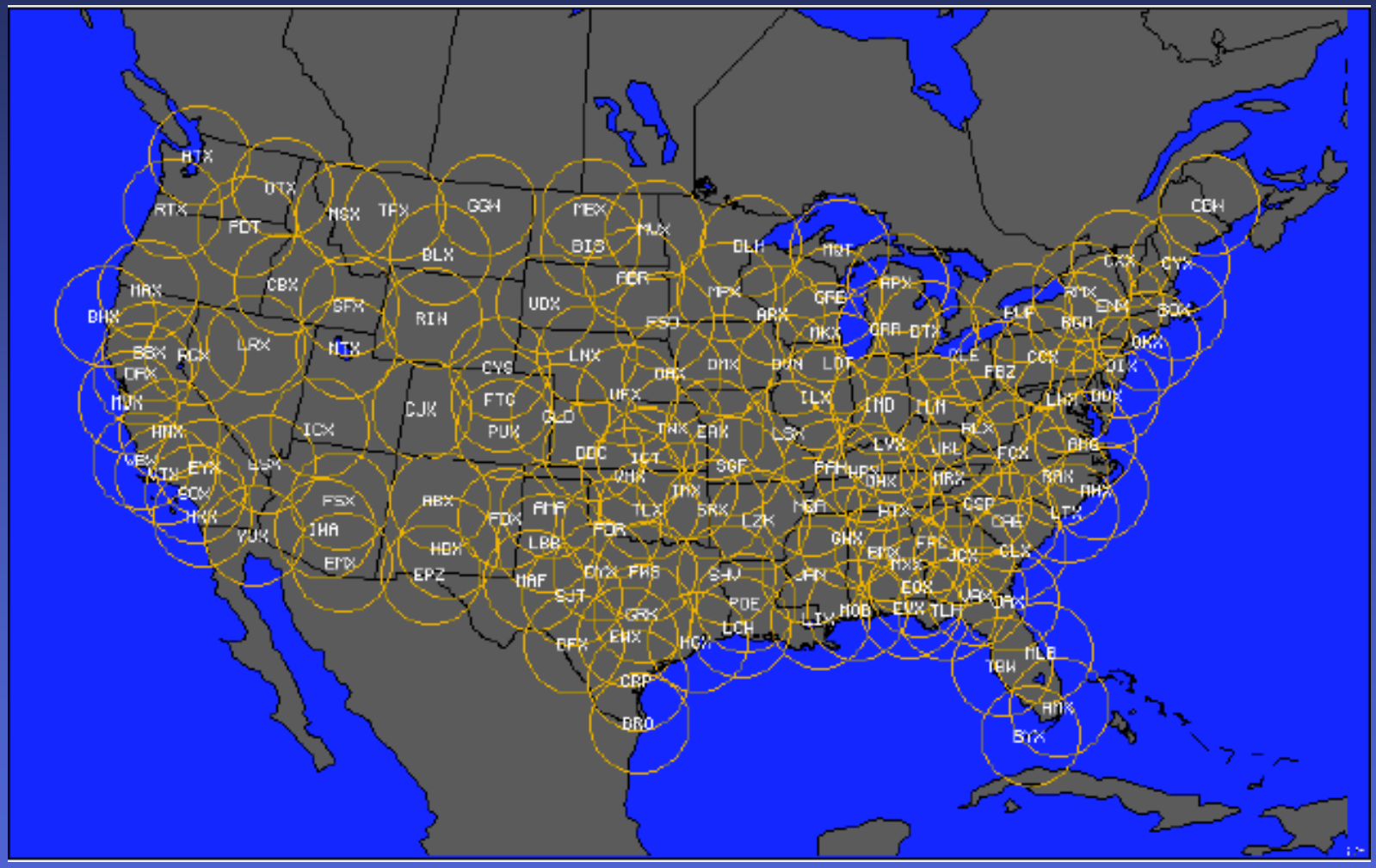
WSR-88D Radar



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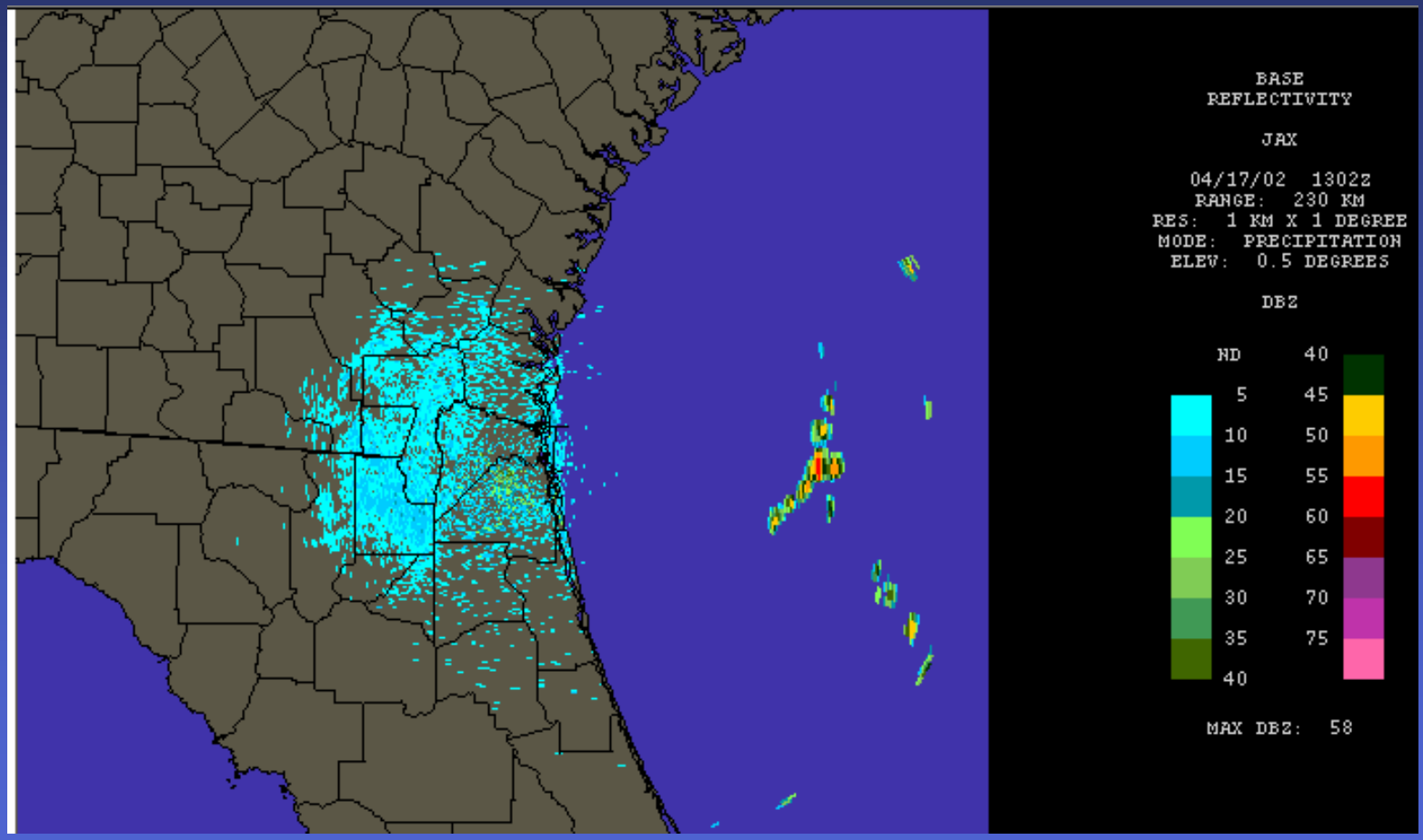
Base Reflectivity



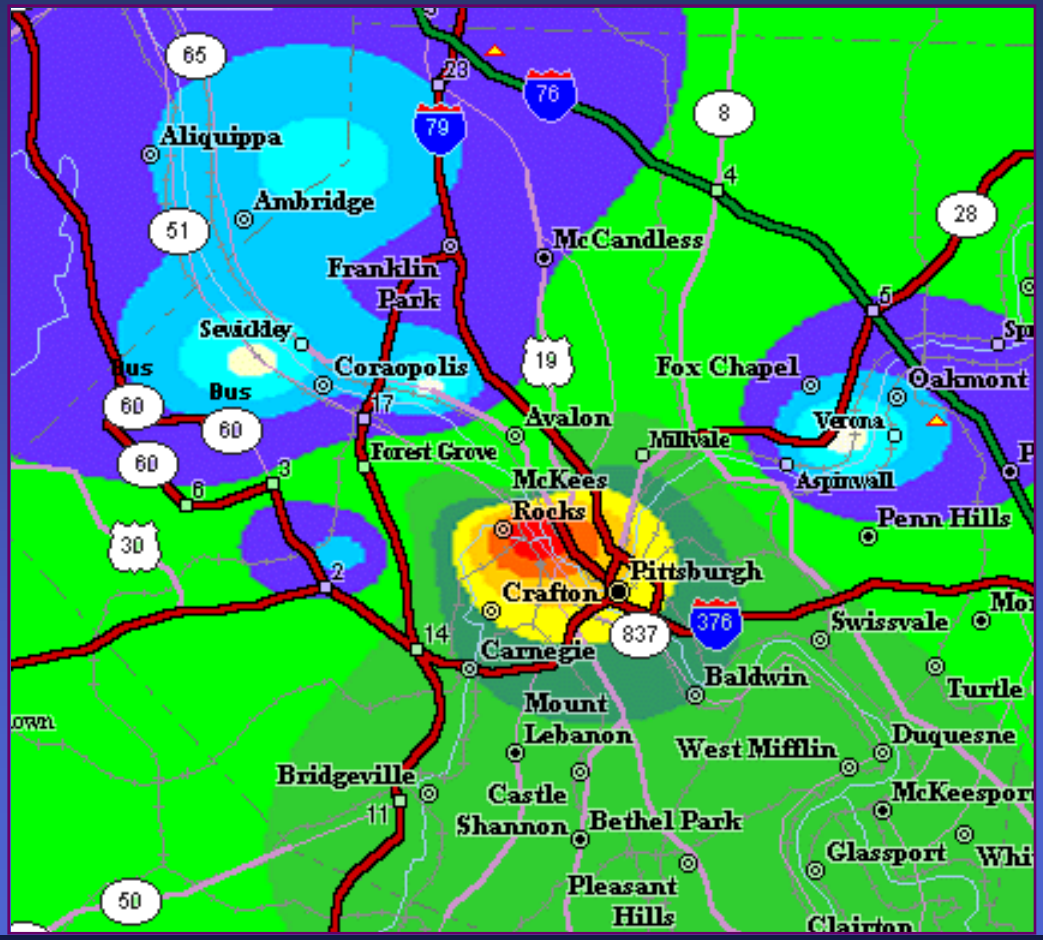
Deriving Rainfall Estimates

- Z-R relationships
  - $Z=200R^{1.6}$ – Marshall Palmer
  - $Z=130R^{2.0}$ – Winter Stratiform
  - $Z=300R^{1.4}$ – Summer Convective Storms
- Empirical Look-up Table
  - Using upper air parameters, reflectivity values and observed rainfall

Conventional Methods for Spatial Analysis of Rainfall

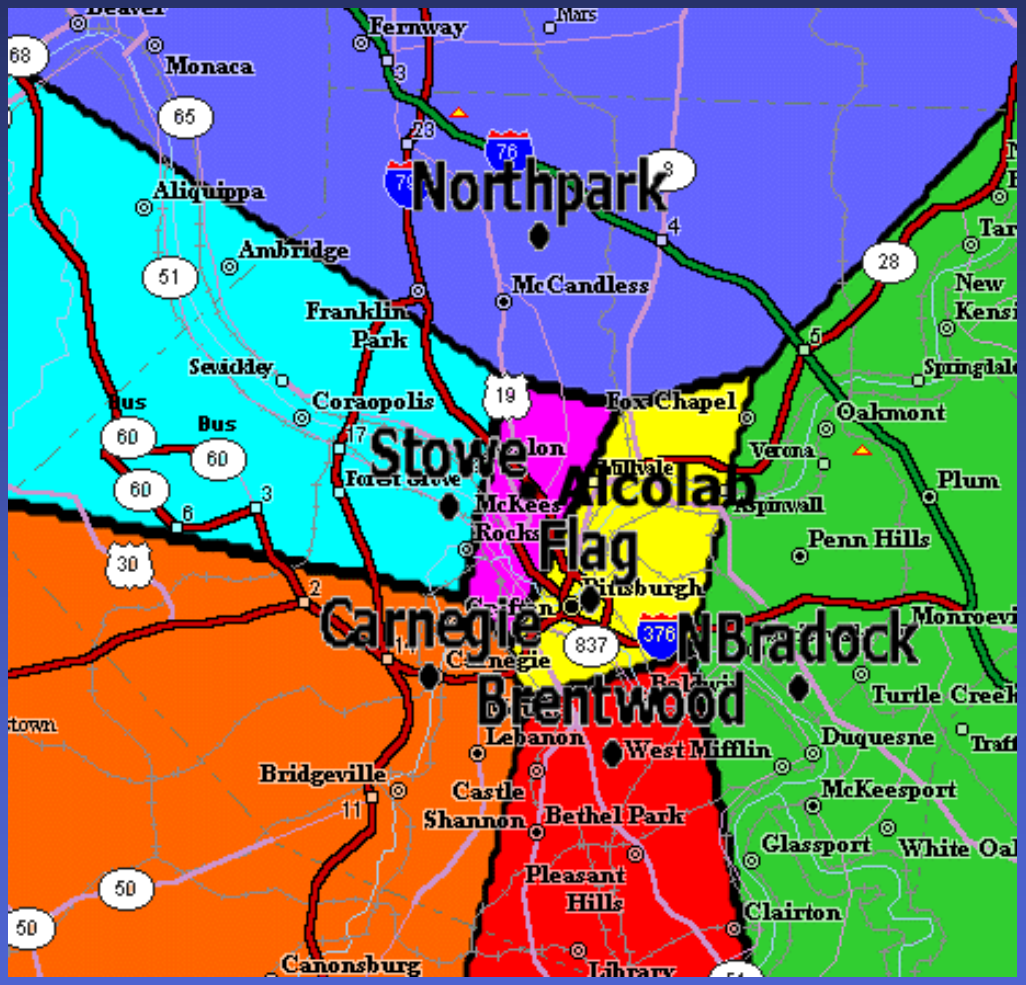
- Point Rainfall Estimates
  - Rain gages
- Spatial Inferences or Interpolation
  - Inverse distance square ($1/d^2$)
  - Thiessen polygons

Inverse Distance Squared

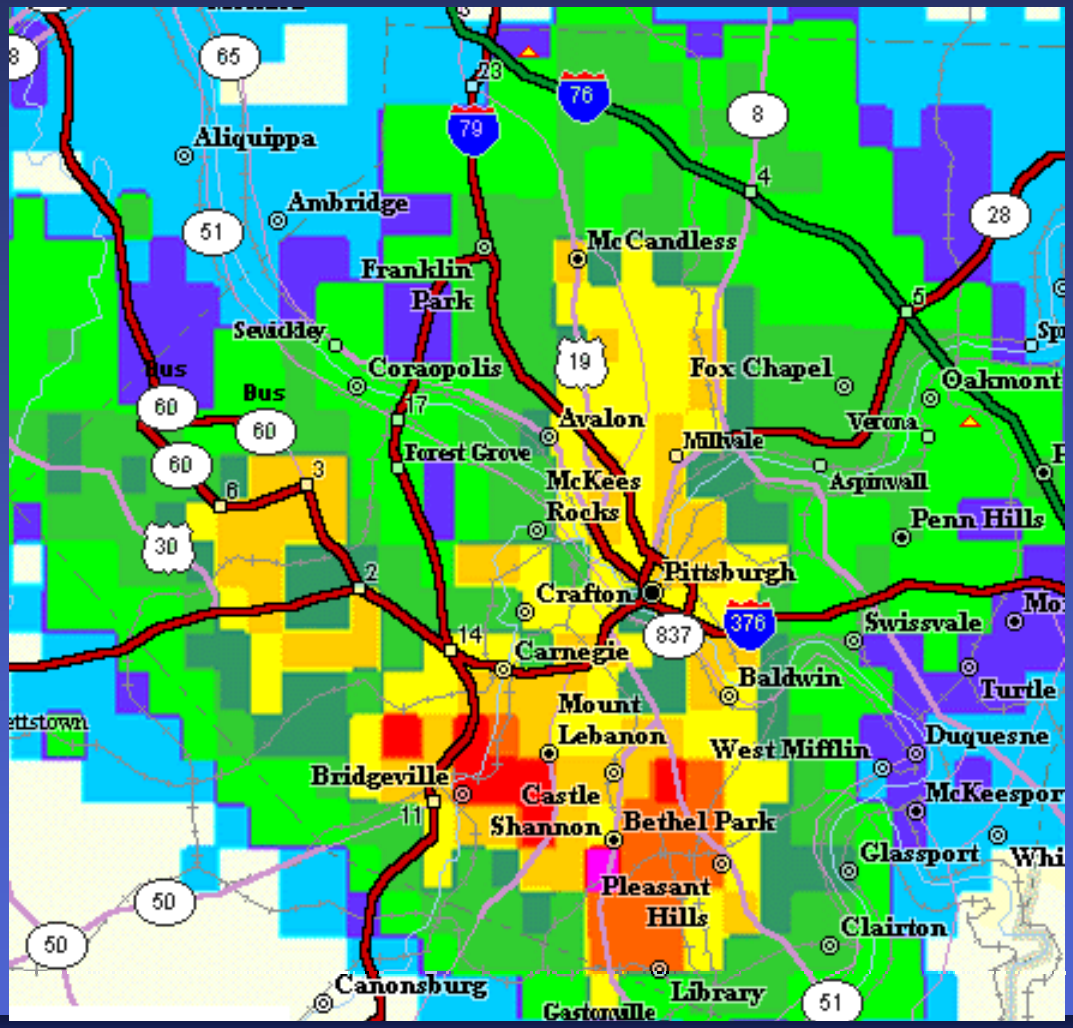


- $1/d^2$

Theissen Polygons



Radar Distribution



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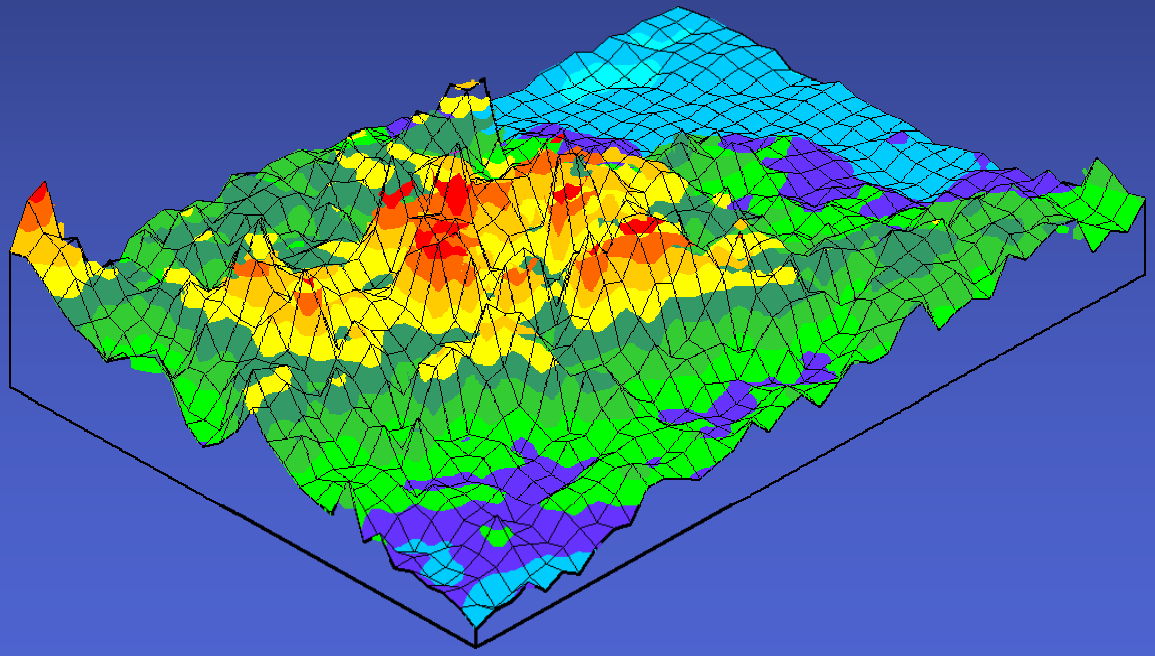
True Rainfall Value



Between Radar and
Ground Rain Gage Data

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Gage Adjustment Methods

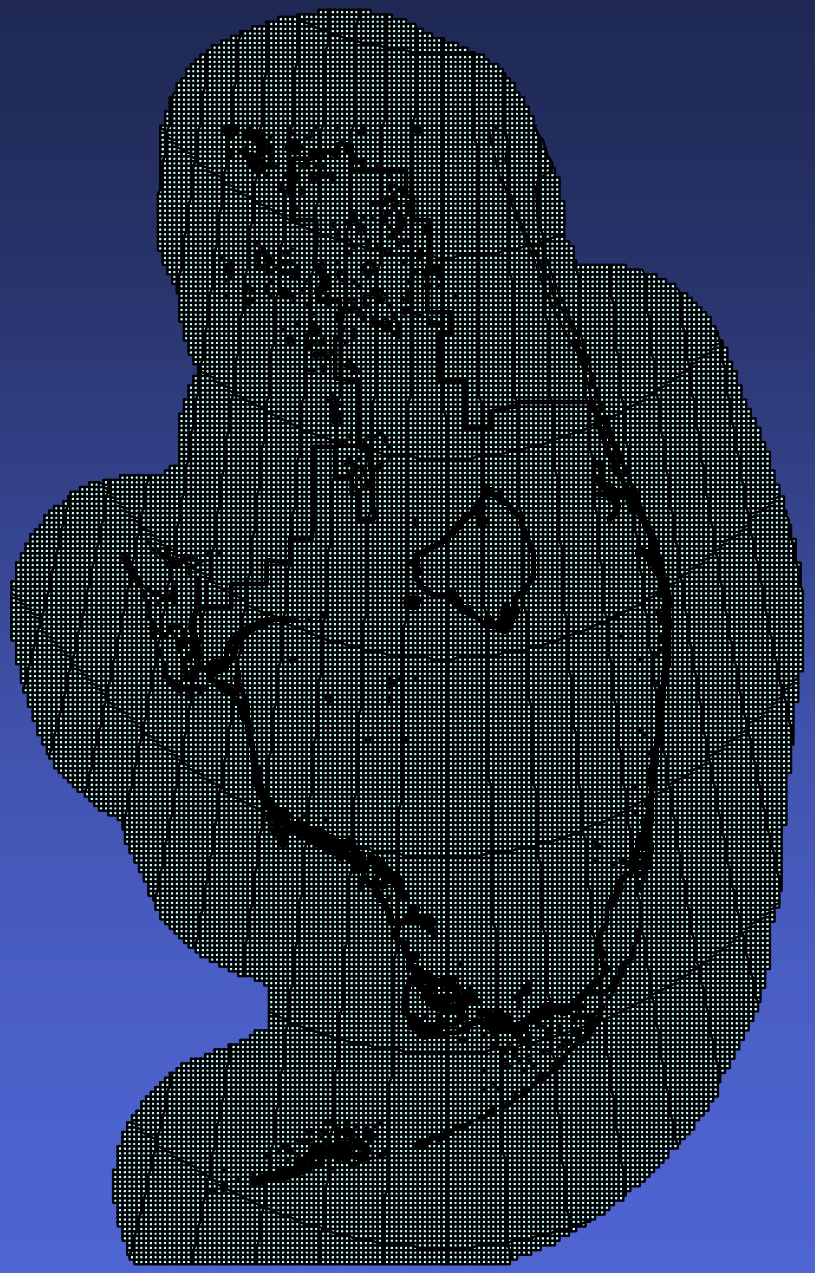
- Uniform G/R Ratio
- Uniform G/R Ratio within Calibration Zones
- Brandes Method
- NWS Mean-Field Bias
- NWS P1 Method

NEXRAD Data Acquisition By

- South Florida Water Management District
- St. Johns River Water Management District
- Suwannee River Water Management District
- Southwest Florida Water Management District

NEXRAD Data Acquisition

- Every year Purchase Order with OneRain, Inc.
  - under 5-year St Johns River W.M.D. Contract
- NEXRAD data obtained from January 1, 2002 to current
- Near real-time (NRT) data product
- End-of-the-Month (EOM) data product



NEXRAD Data

- 2 km X 2 km grid
- 35 mile boundary buffer from shore line
- base map (in state plane coordinates)
- 33,774 pixels (polygons)
  - ~ 12,000 pixels within District
- Unique pixel id

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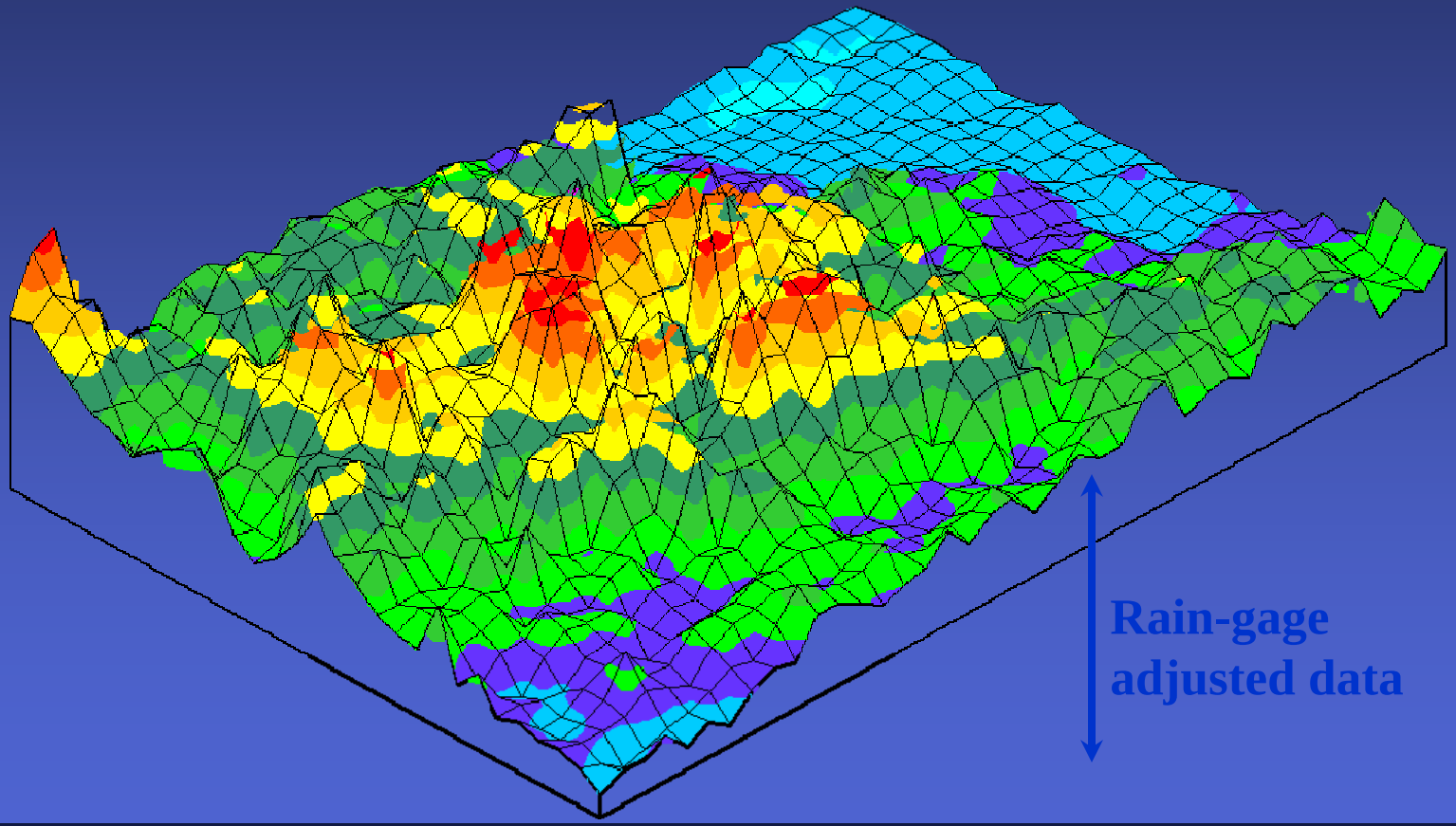
Gage Adjusted NEXRAD Data



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Data Types

- Near Real-time (NRT) Data
  - District receives 15-min NEXRAD data every 15-min. interval
  - This data is rain-gage adjusted every 15-min. Rain gage data are obtained from 80 telemetry stations
- End-of-the-Month (EOM) Data
  - NRT data is revised with additional 30 rain gages obtained from CR10 stations
  - Perform complex adjustments and QA/QC

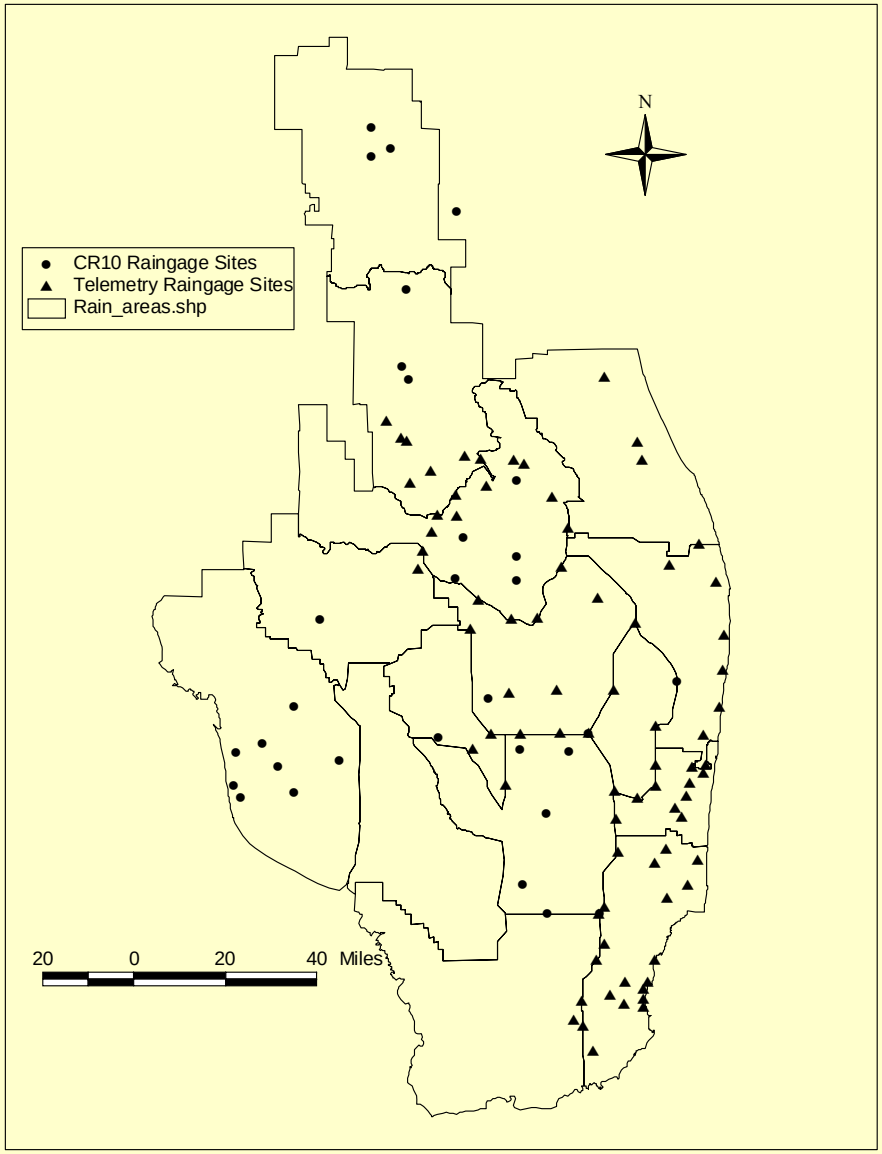
Near Real-Time Data

- Uses only gages over the District
- Delivery delayed by 5 to 20 minutes
- Uniform gage adjustment
  - No warping of radar rainfall estimates
- Does not eliminate bad gage data
- Might be inconsistent from District to District

End-of-the-Month Data

- Use all available rain gages data
- Delivery in about 7 days from end of the month
- “Brandes” adjustment method
  - Softly warps radar rainfall estimates to match gages
  - Does not force radar to match rain gage estimate
- Eliminate bad rain gage data
- Consistent rainfall estimates from District to District

Rain Gages Used for NEXRAD Data



- ▲ 80 Telemetry Sites
- ● 30 CR10 Sites

Data Analysis for EOM Data

Gage data processing

QC Gage data

Download radar data

QC radar data

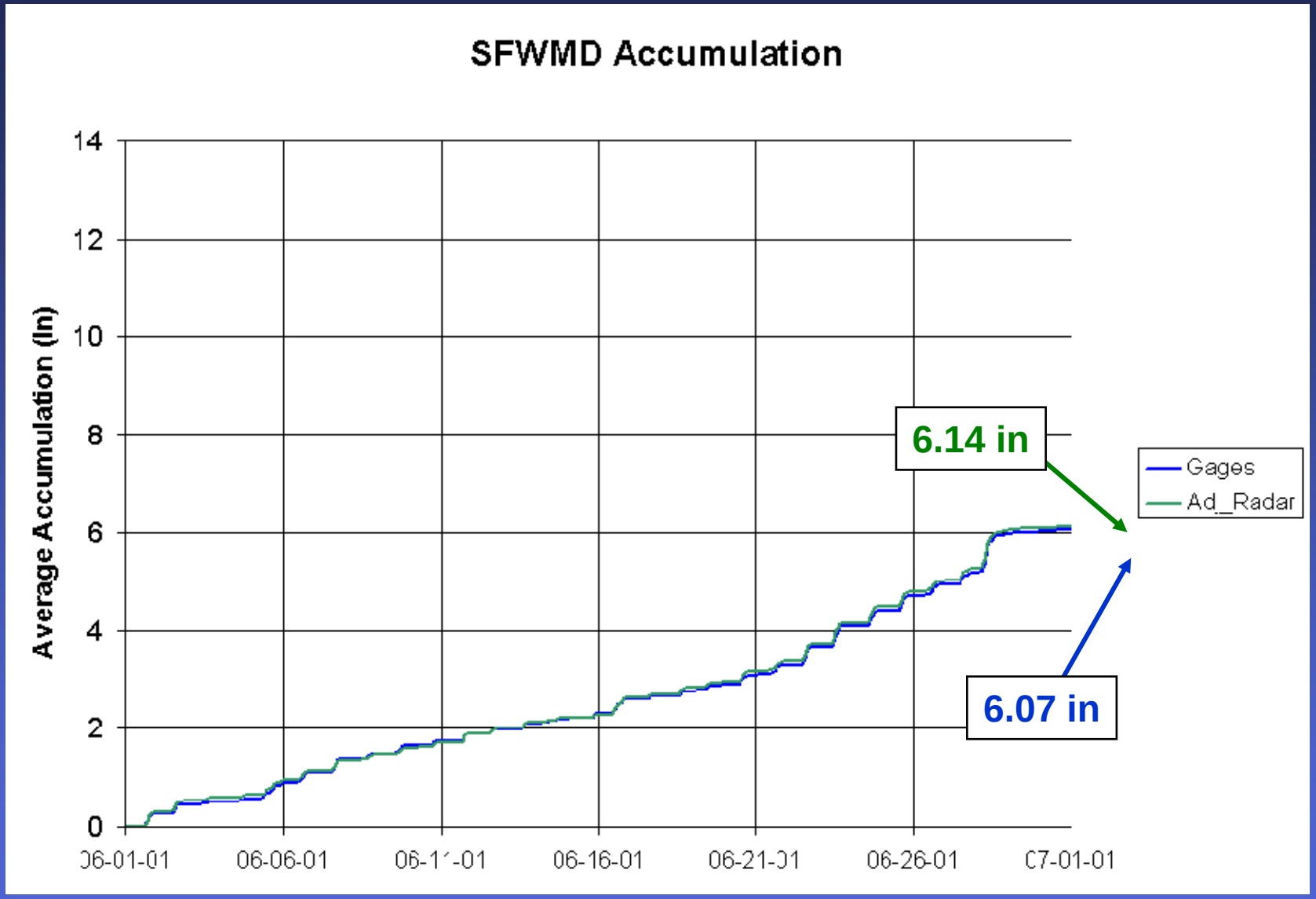
Preliminary analysis

QA/QC results

Final analysis

Reformat data

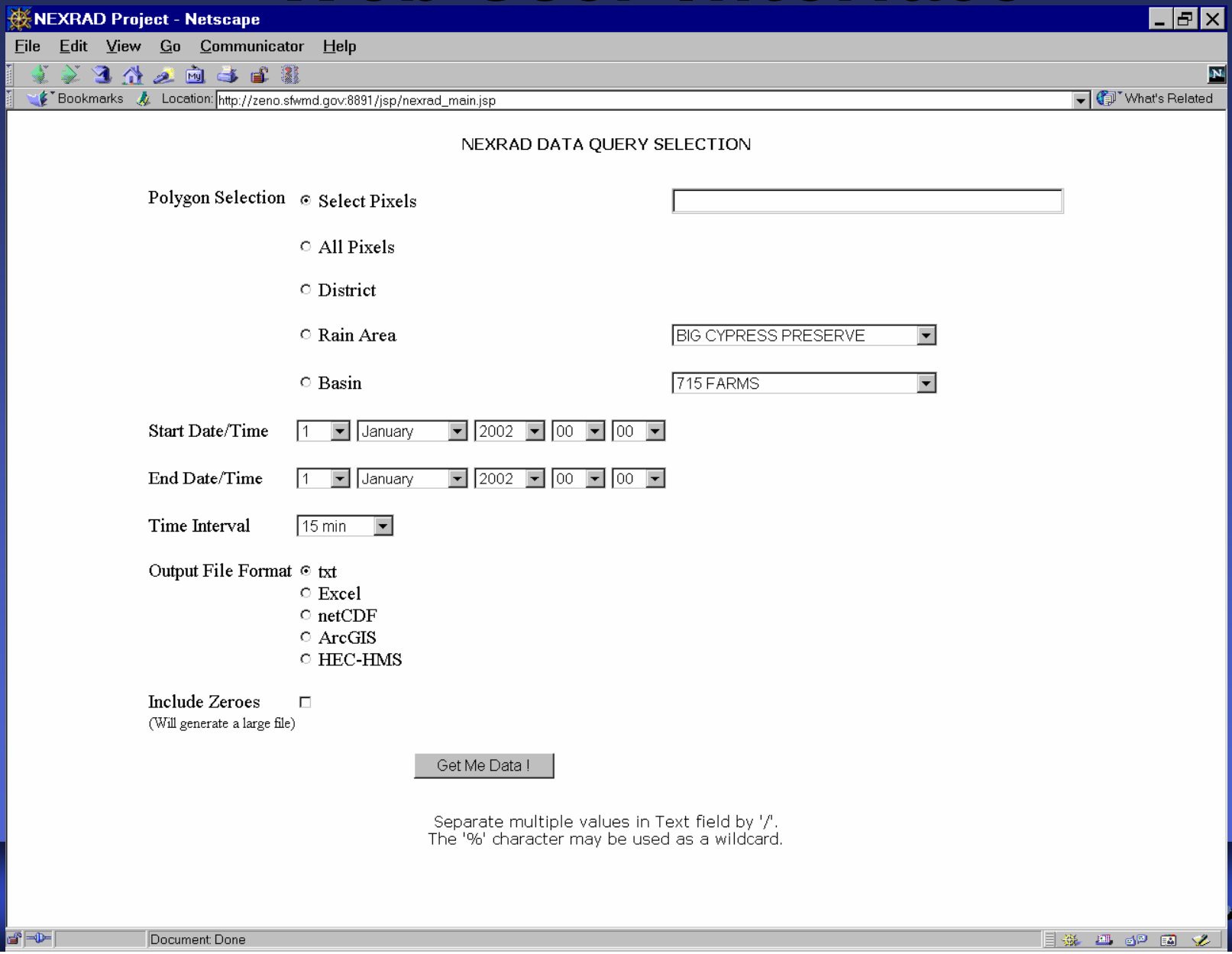
Repeat if necessary


SFWMD Accumulation
Average Accumulation (In)
14
12
10
8
6
4
2
0
06-01-01
06-06-01
06-16-01
06-21-01
06-26-01
07-01-01
6.14 in
6.07 in
Gages
Ad_Radar

NEXRAD Data Retrieval

- Corporate Database (DBHYDRO) incorporation and data access
- Web accessibility
- Data aggregation (hourly, daily, event time-frames)
- ArcGIS and other (needed data) format compatibility

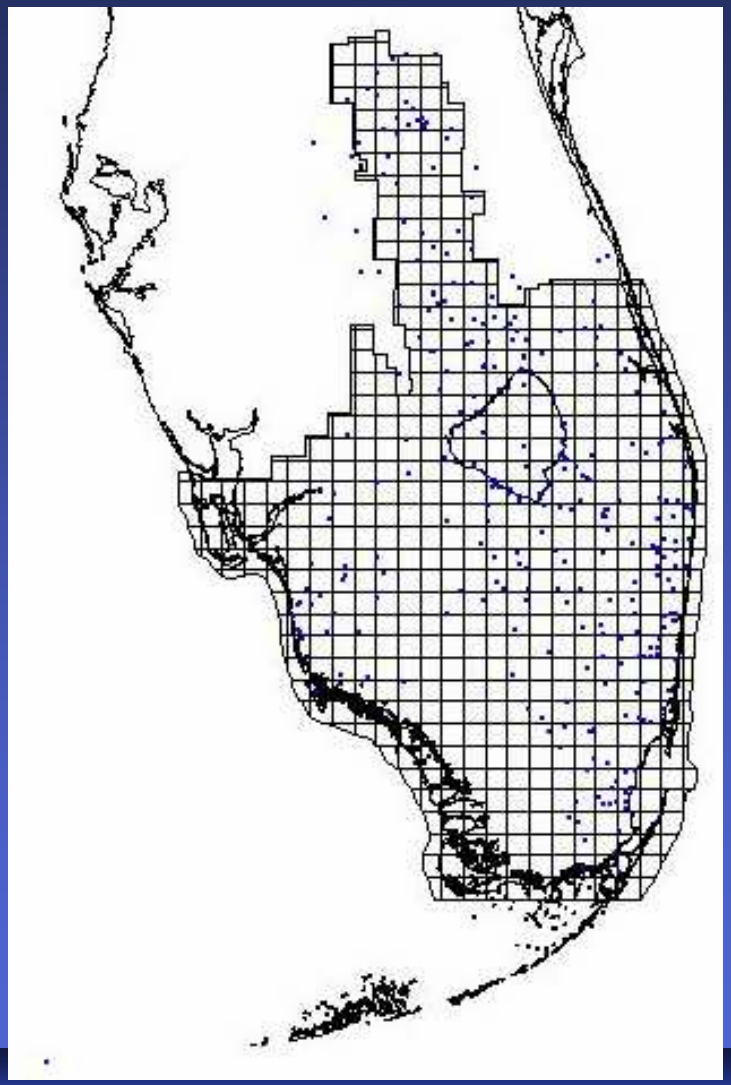
Web User Interface



Data Uses at SFWMD

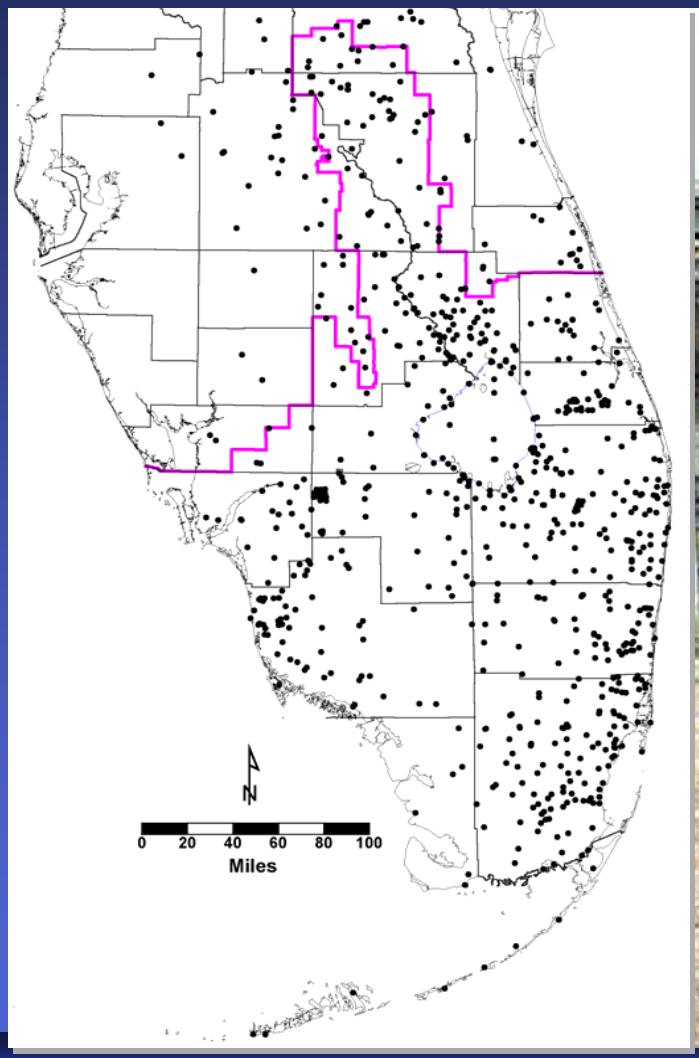
- historical record
- operations/EM
- modeling
- regulation
- reporting
- network optimization

Rain-gage Network Optimization



- Optimize the gage network by relocating some gages to obtain best possible spatial correlation
- Use NEXRAD data set for spatial analysis
- Recommend gages, which require relocation and their respective new site locations

District Rain-gage Network



- District has ~300 rain-gages
- District has ~210 rain-gages that are equipped to provide break-point (1, 3 or 5 - minute interval) rainfall data
- DBHYDRO receives rainfall data from external agencies

Summary

- NEXRAD data are **good quality** and compare well with the rain-gage data.
- NEXRAD data provide **superior spatial distribution of rainfall** within the District without increasing number of rain-gages. However, **spatial distribution of the gages could be improved** for better NEXARD rainfall estimates.
- NEXRAD data are **available at 15-minute intervals for ~ 12,000 pixels.** One pixel area is ~1,000 acres.

Questions?

THANK YOU