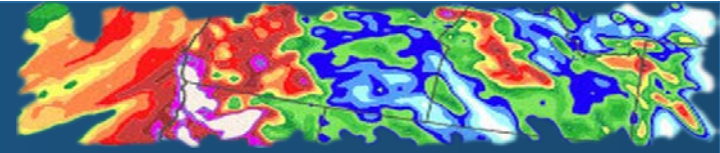


Data Innovations for Efficient Water Conservation

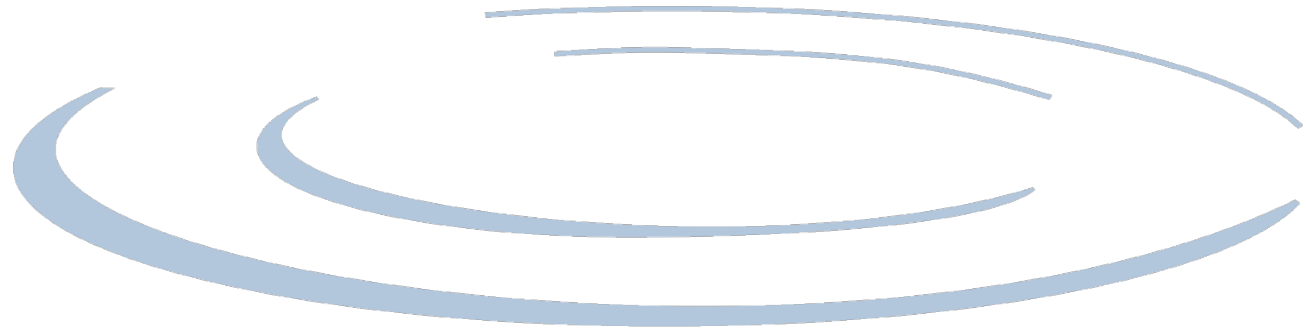


February 22, 2018

Charles Yost

Meteorologist

charles.yost@onerain.com

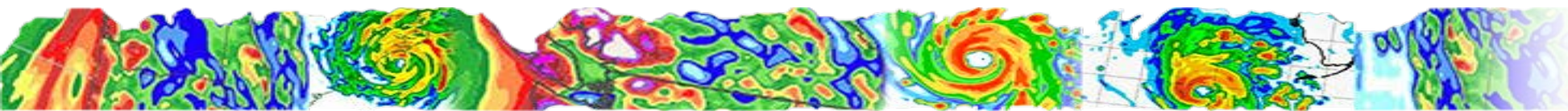


Experts measuring rainfall and its consequences™

OneRain, Inc.

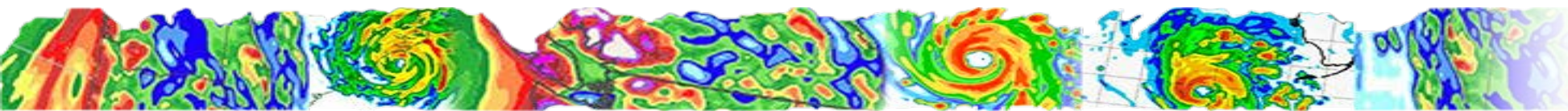
“Experts Measuring and Understanding Water”

- Founded in 1992
- End-to-end solution provider
 - Design of water monitoring networks
 - Software & Data Analysis
 - Field integration solutions (monitoring, telemetry, training, maintenance)
 - Rainfall data (historical, real-time)



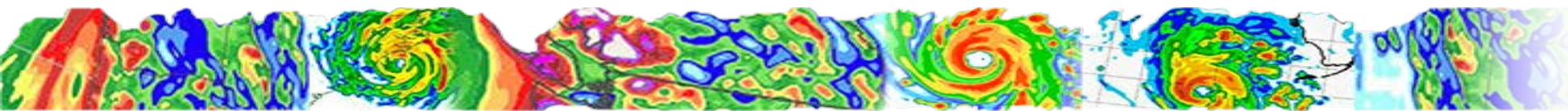
We support our customers' critical missions in...

- Flood Early Warning and Emergency Management
- Dam Safety and Reservoir Operations
- Water Resource Management
- Post Wild-Fire Flash Flood Monitoring & Warning
- Floodplain Management
- Urban Water Management
- Stormwater Management
- Wastewater Management (I/I Studies, NDPES)



My Background

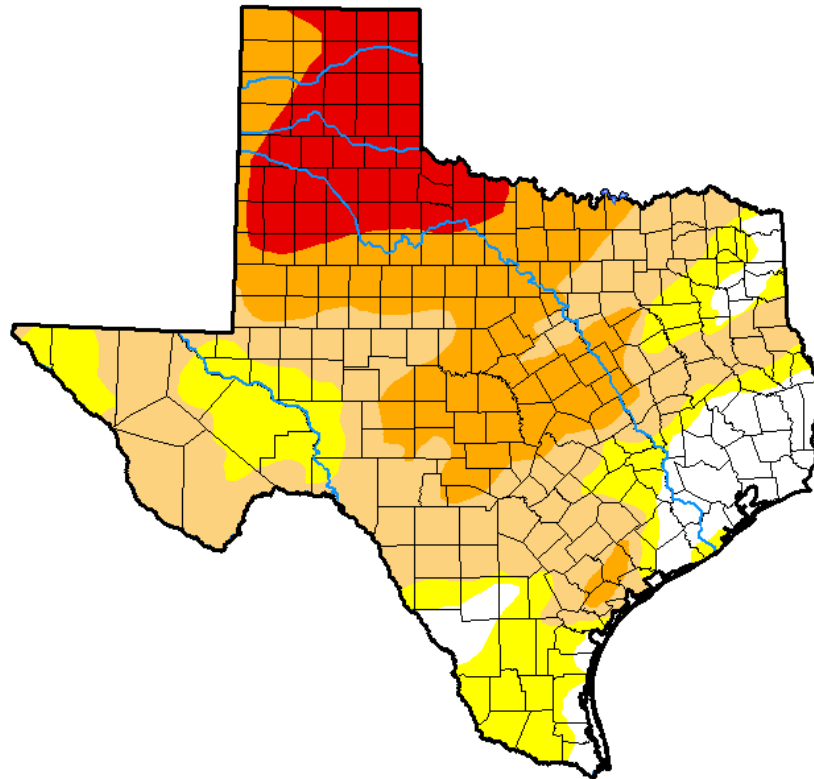
- (Hydro)Meteorologist
- Studied extreme rainfall
- Also concentrated on social issues and where it rained
- Design and implement flood warning networks
- Expert in understanding where it rains



Current Weather

U.S. Drought Monitor Texas

February 13, 2018
(Released Thursday, Feb. 15, 2018)
Valid 7 a.m. EST



Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

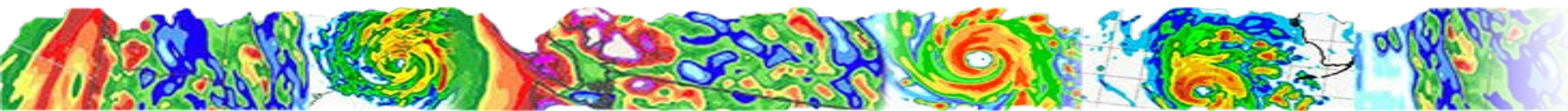
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

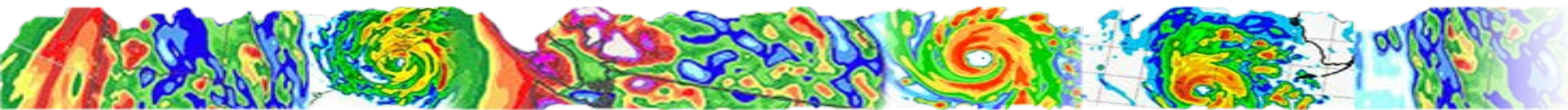
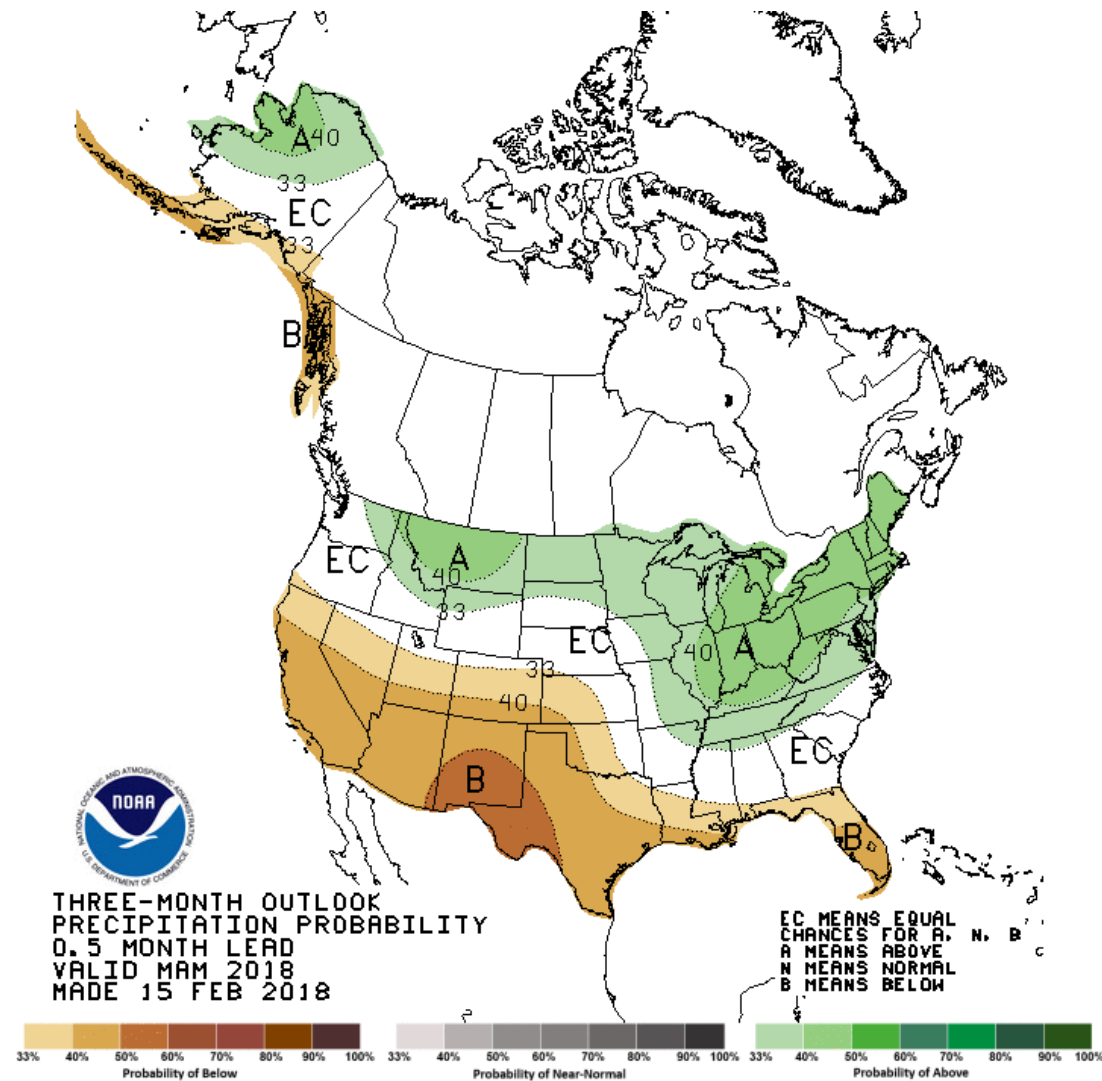
Eric Luebehusen
U.S. Department of Agriculture



<http://droughtmonitor.unl.edu/>



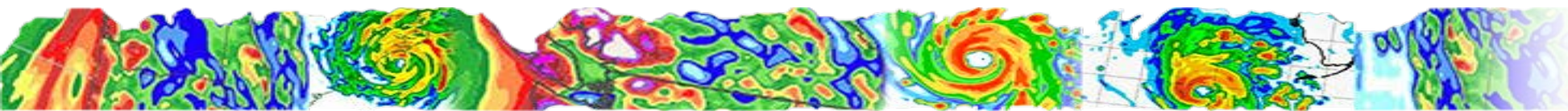
Current Weather



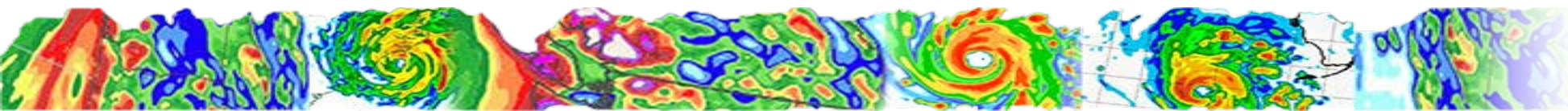
Water Conservation



- Water conservation extremely important
- Susceptible to drought and water supply issues
- Complicated water rights

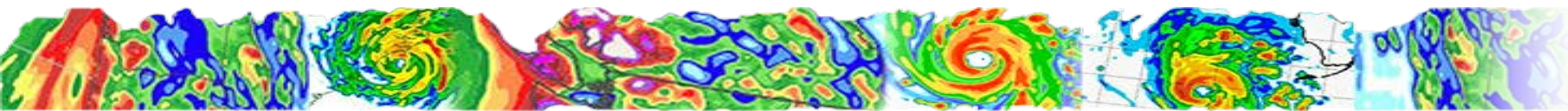


WHAT ARE SOME DATA INNOVATIONS THAT CAN HELP?



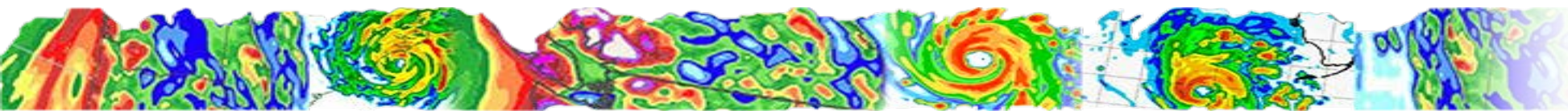
Two Examples

1. Sterling Ranch, CO – better planned communities
2. Gauge-Adjusted Radar Rainfall better watering recommendations



Two Examples

1. Sterling Ranch, CO – better planned communities
2. Gauge-Adjusted Radar Rainfall better watering recommendations

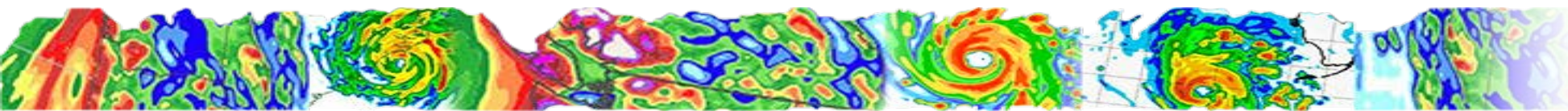


Colorado Issues

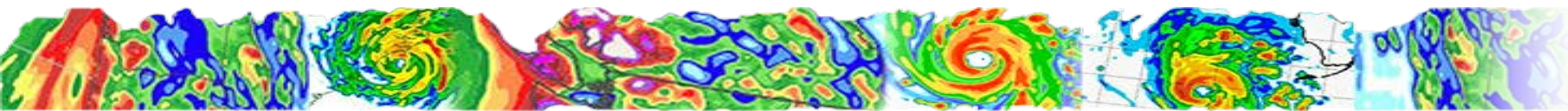


1. Water
2. Housing

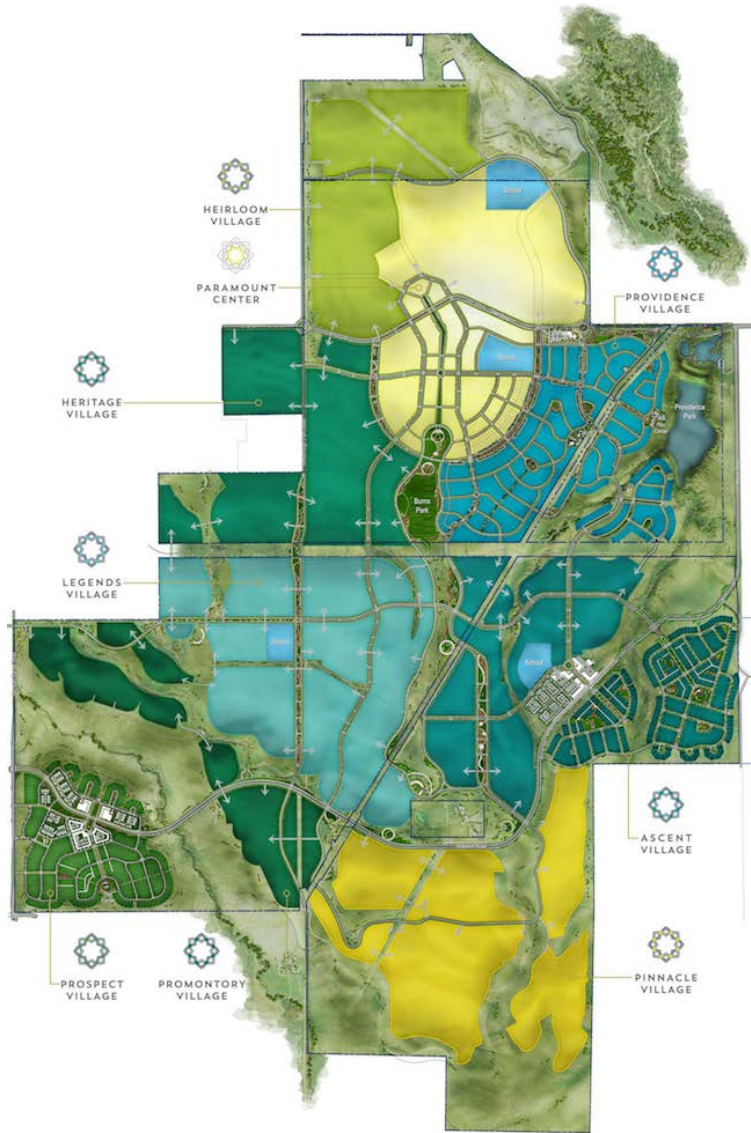
Sound like Montgomery County?



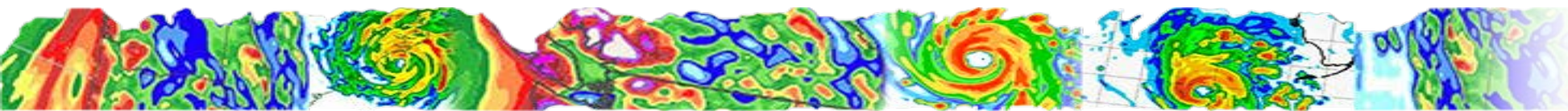
Douglas County, CO



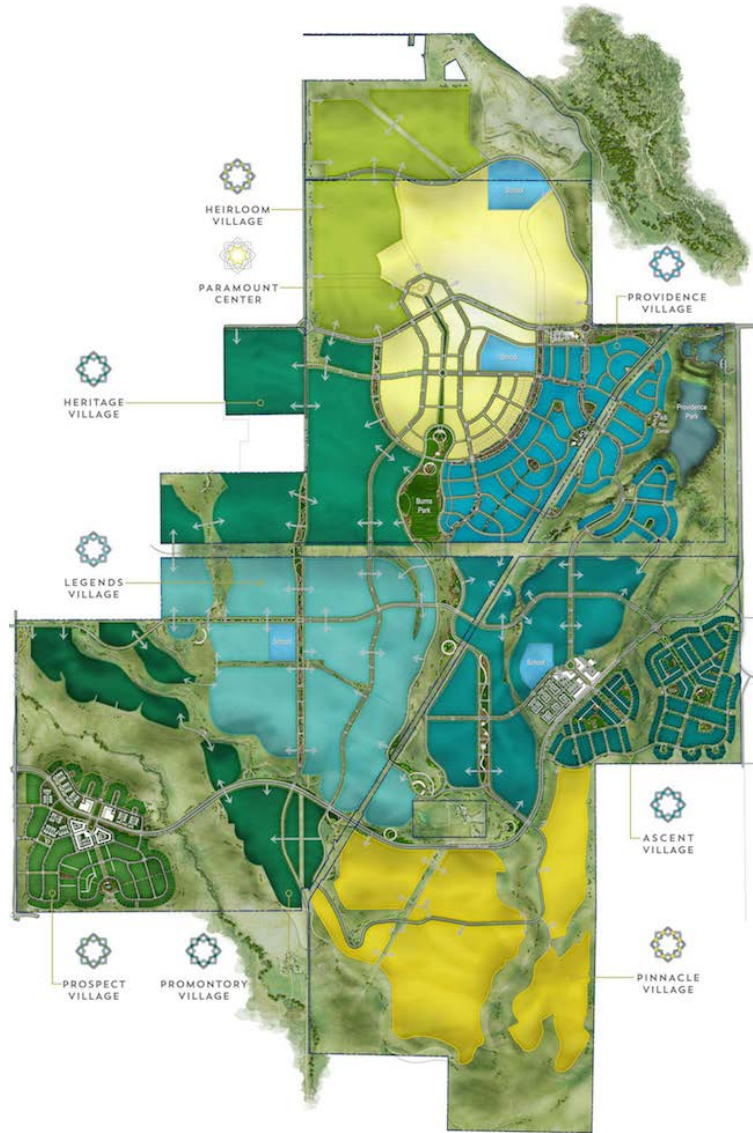
Sterling Ranch, CO



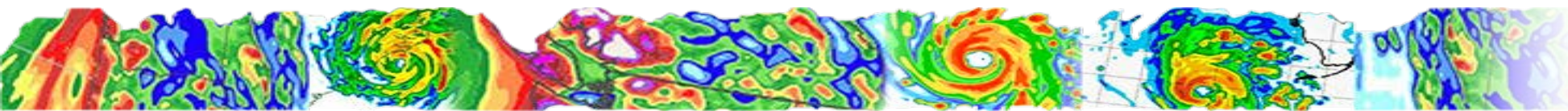
- New model for development
- 12,000+ new homes
- 3,400 acres
- Multi-year plan



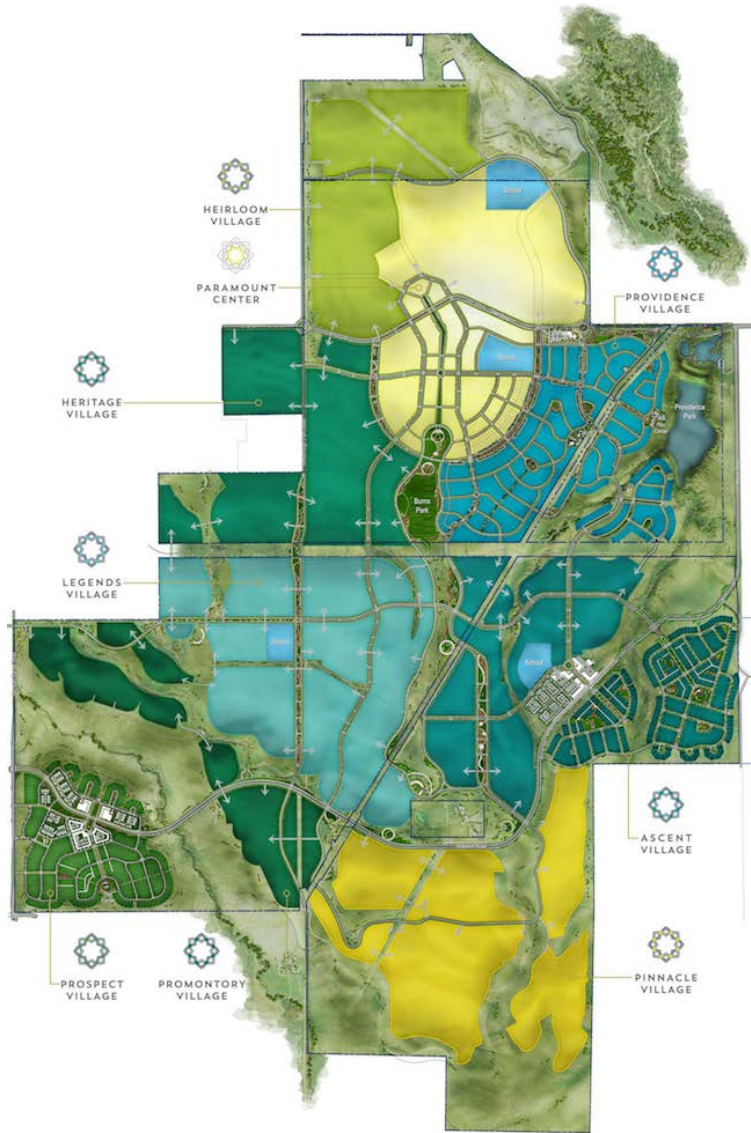
Sterling Ranch, CO



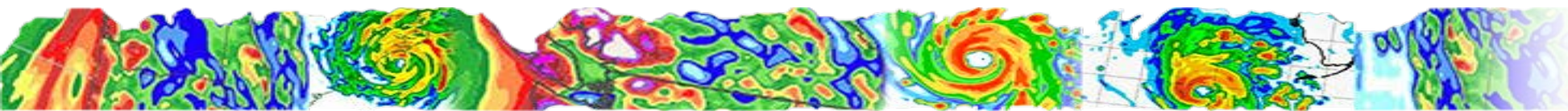
- Only owns 230 acre feet
- Colorado law:
 - No new development without knowing water sources
- Committed to renewable sources



Sterling Ranch, CO



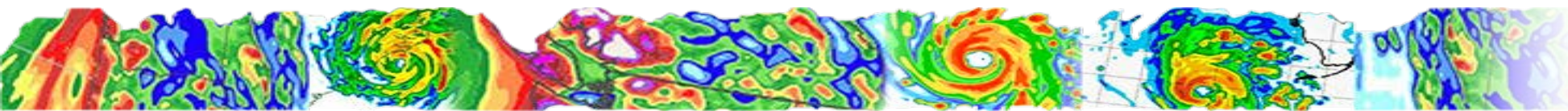
- CO legislature call for unique solution
- New water usage plan
 - Development keeps all runoff
- Major rainwater pilot project
- Goal: 0.286 acre-feet / household



Gauging Site for Planning



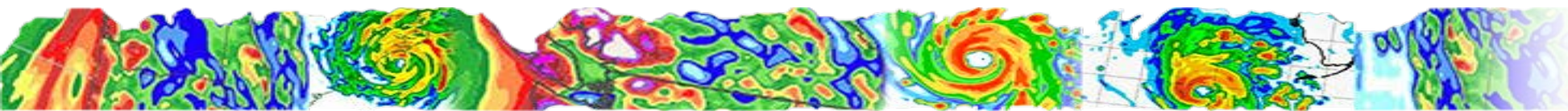
- Development keeps all runoff
- Look at different type storms
- How much leads to runoff
- Back out how much goes to ground water recharge and vegetation
- Development keeps the rest



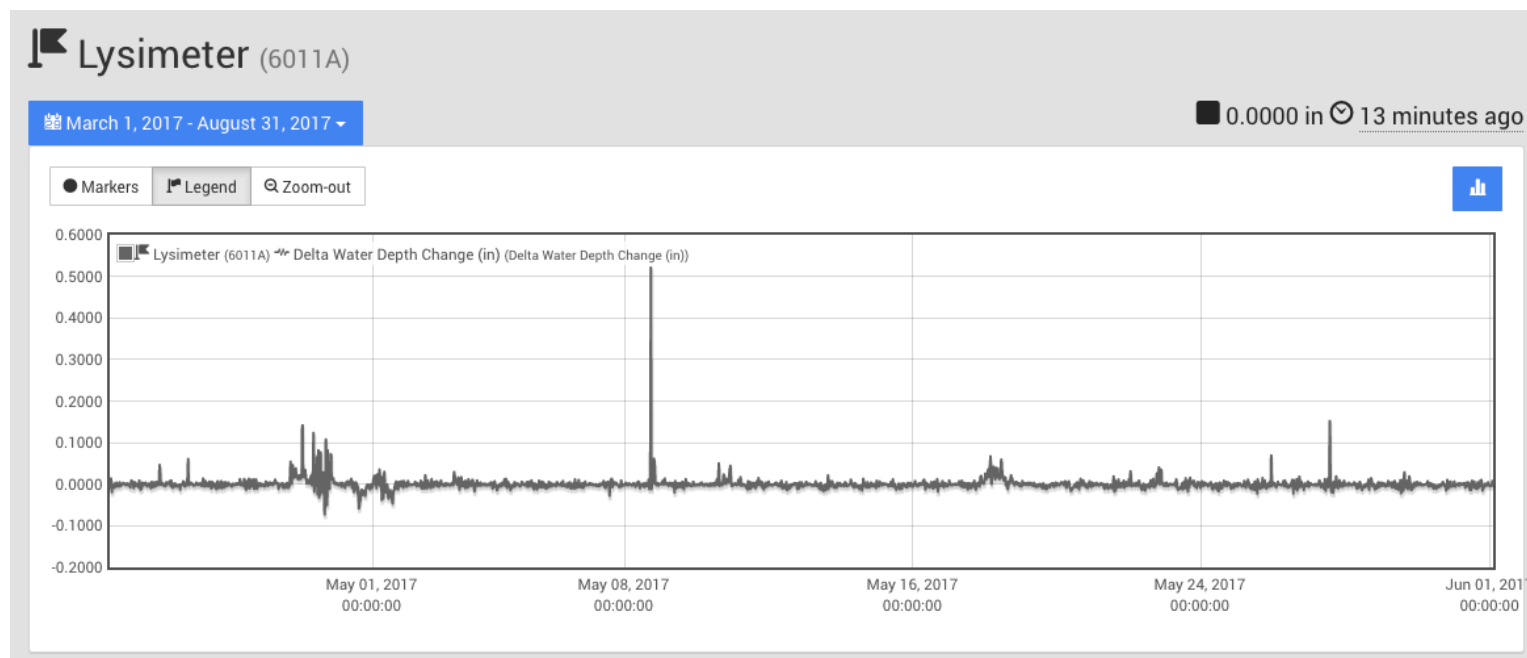
Gauging Site for Planning



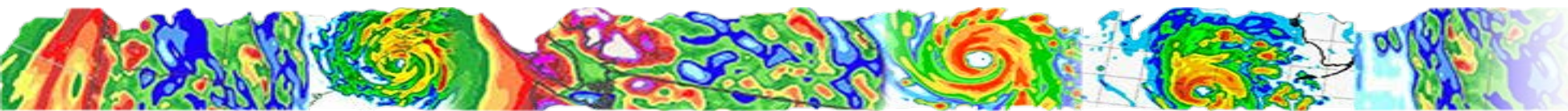
- Installed years in advance
- Complete weather station
- Lysimeter
- Cellular reporting back to Contrail
 - Diagnose issues
 - Easily run reports frequently



Sterling Ranch, CO

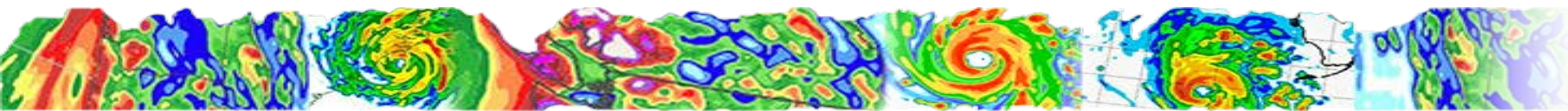


- Delta water depth change
- Directly measure evapotranspiration
- Measure how much ground water recharge



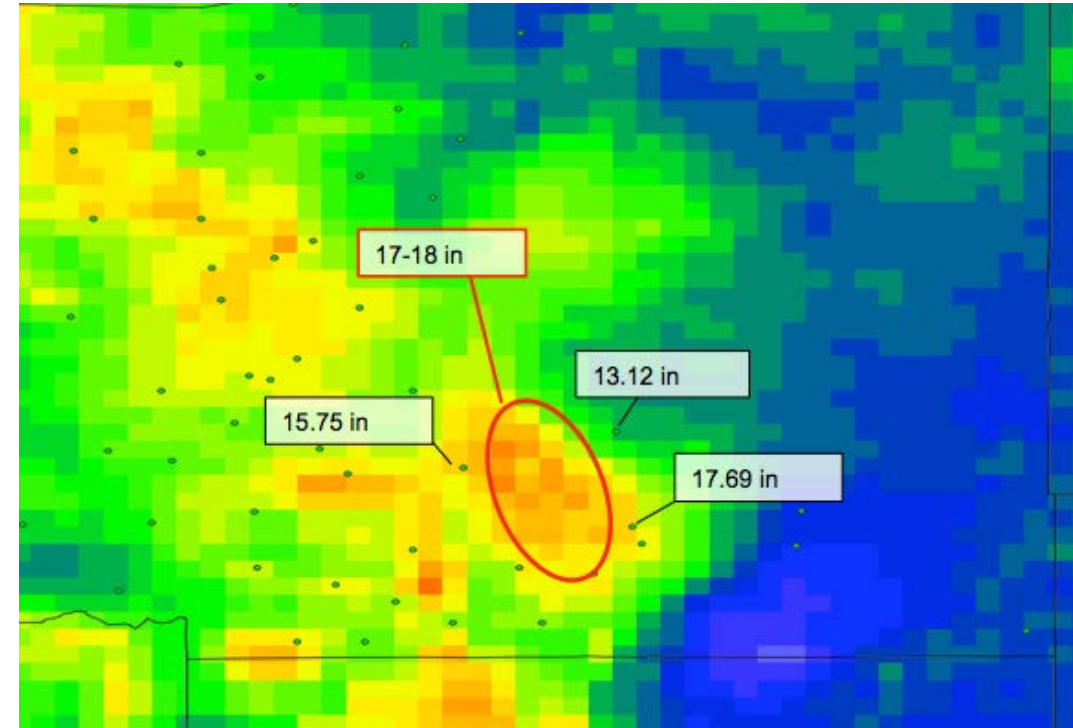
Two Examples

1. Sterling Ranch, CO – better planned communities
2. Gauge-Adjusted Radar Rainfall better watering recommendations

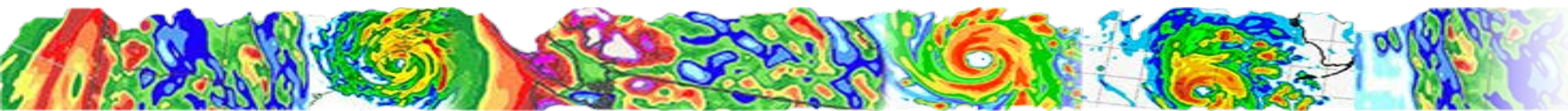


Traditional Watering Recommendations

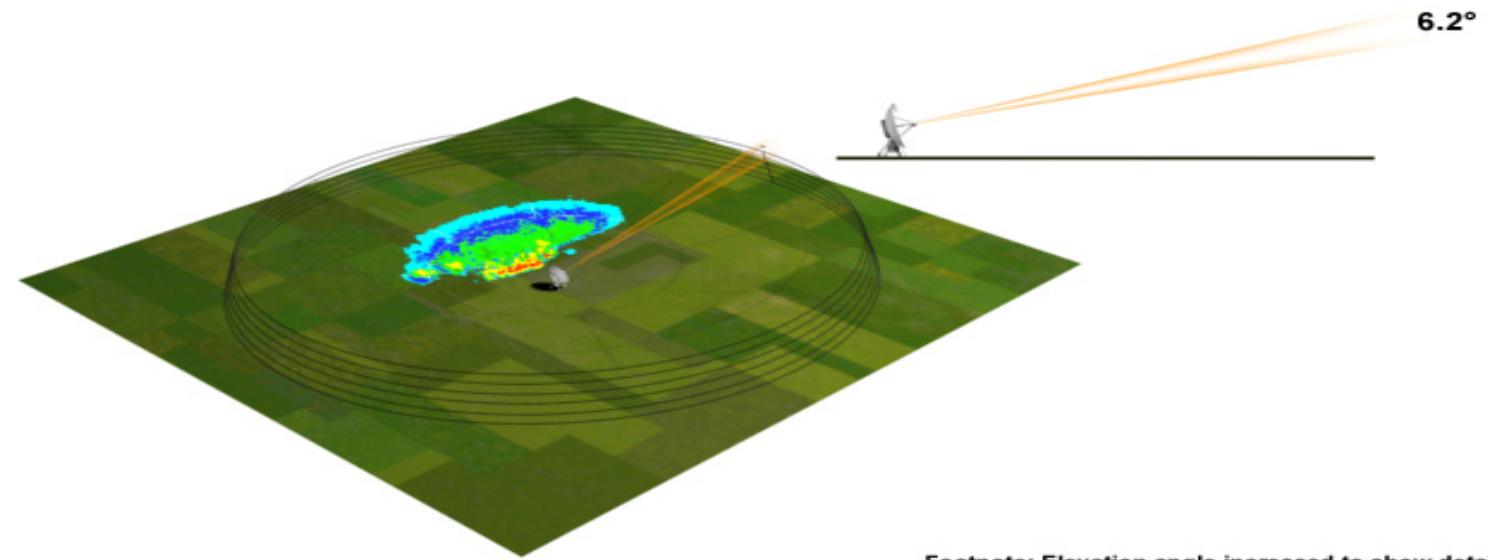
- Typical watering recommendations
- Are we over-recommending based on:
 - Temporal frequency
 - Spatial resolution



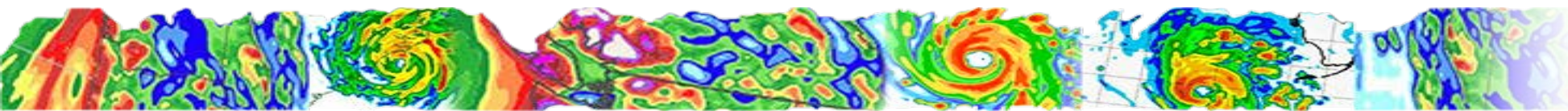
Example from September 2013 Event in Boulder County



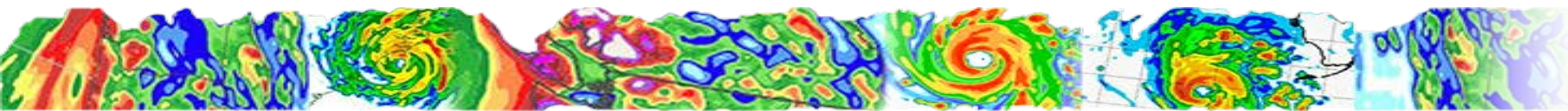
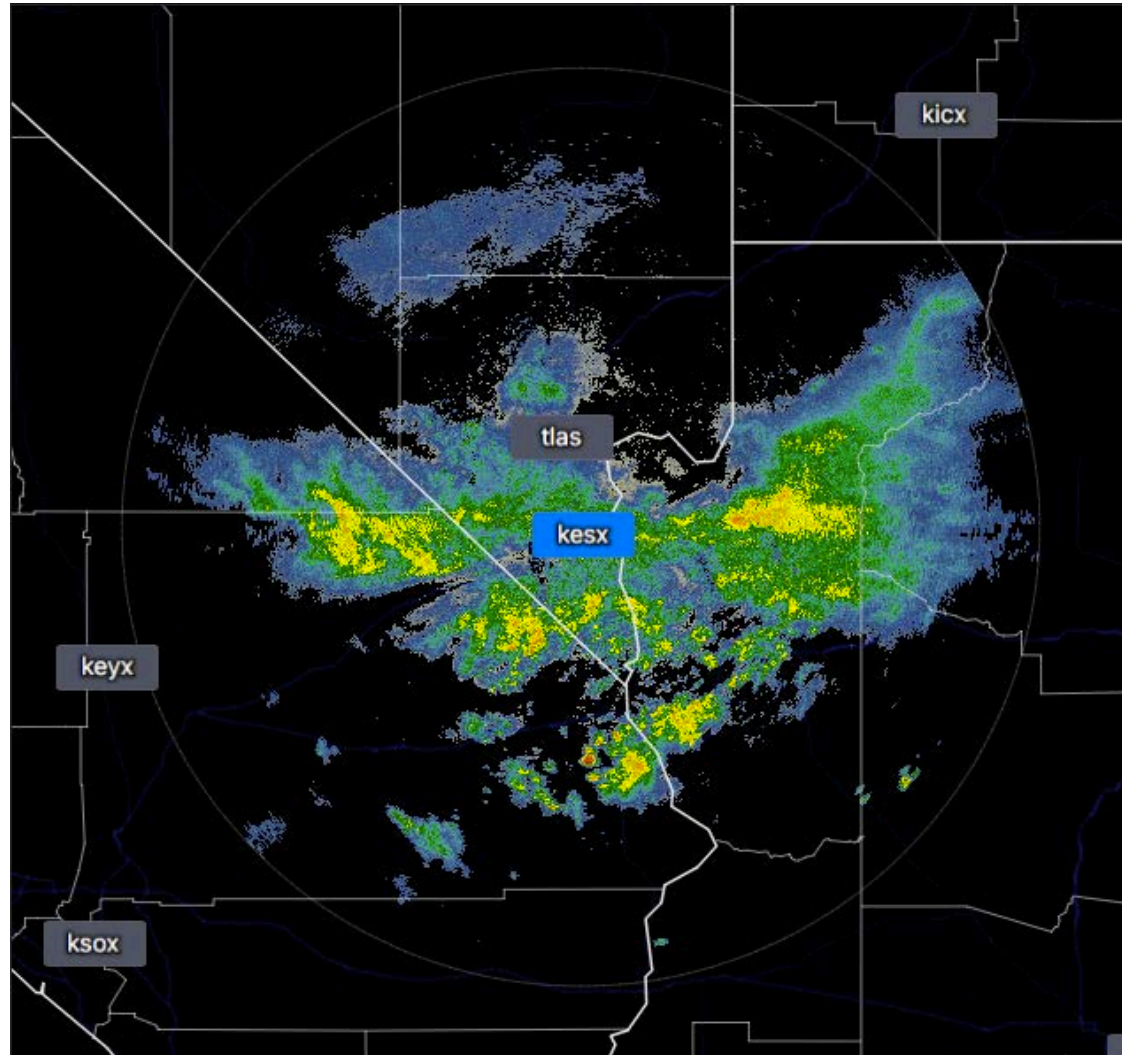
Radar Basics



Footnote: Elevation angle increased to show detail
NOAA / The COMET Program



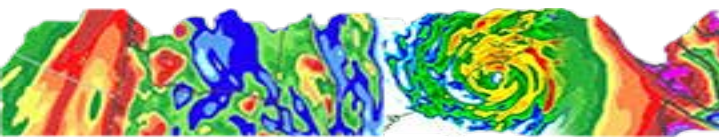
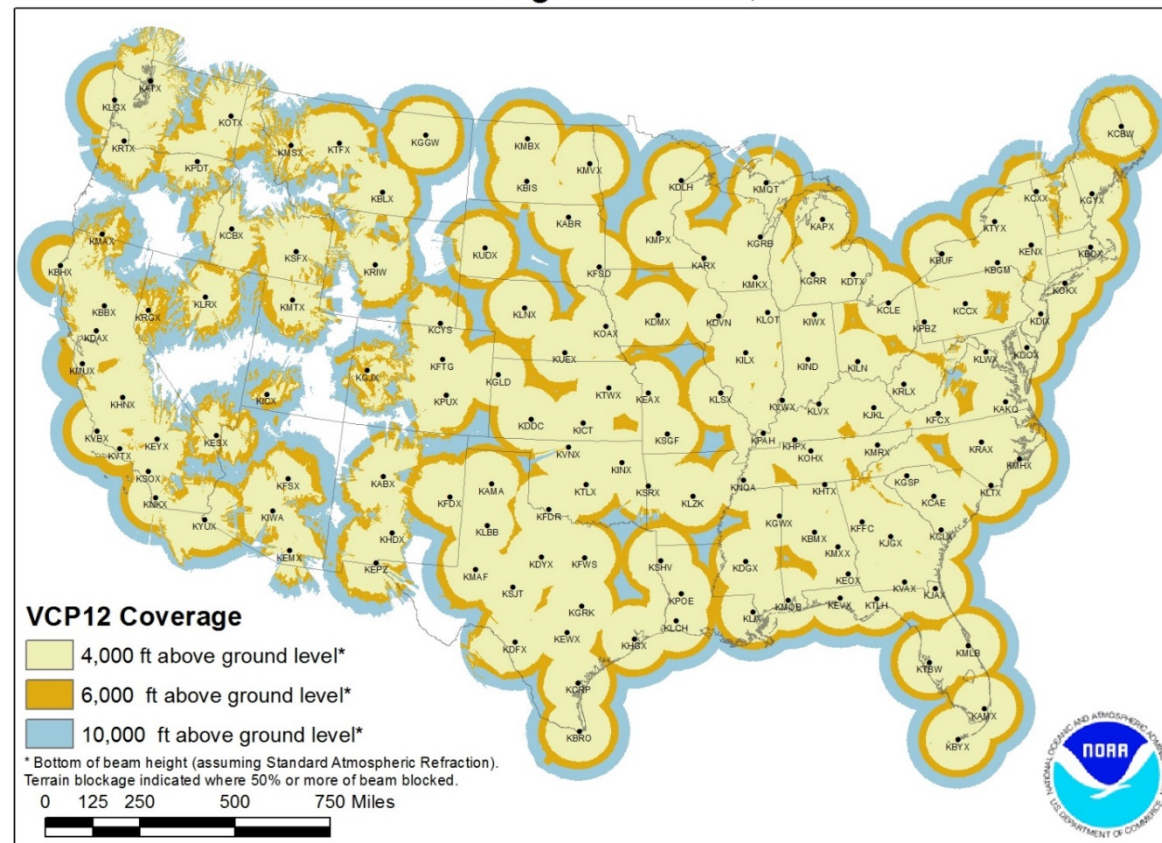
Individual Radar Coverage



Radar Mosaic

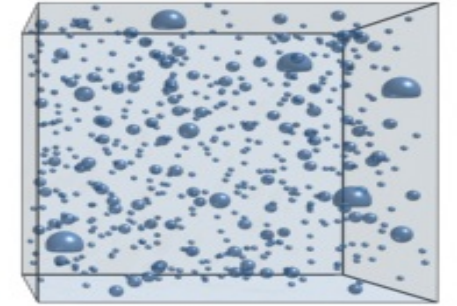
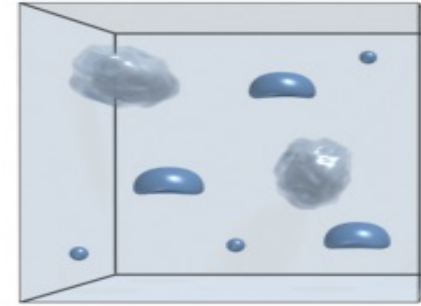
Combined picture of reflectivity that is better than any individual radar can provide

NEXRAD Coverage Below 10,000 Feet AGL

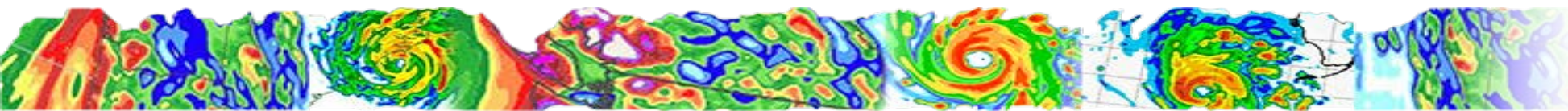


Gauge-Adjusted Radar Rainfall

- Radar detects amount of water
- Does NOT detect rain directly



COMET Program - UCAR



Gauge-Adjusted Radar Rainfall

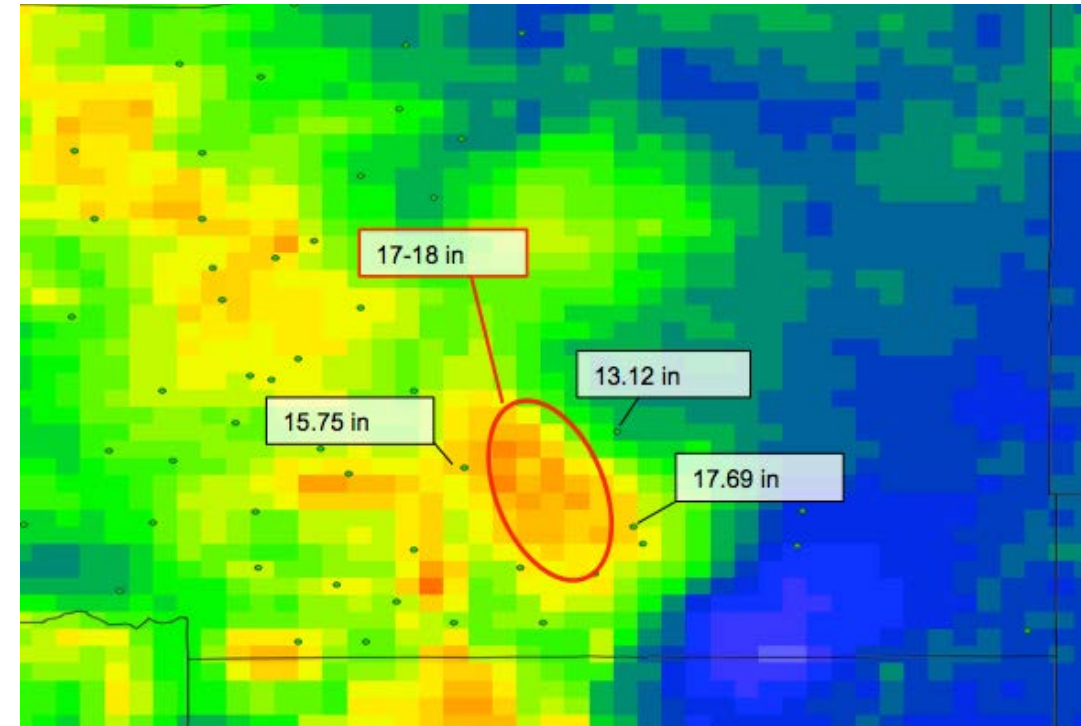
Calibrate radar using gauges for the best rainfall estimate

GAUGES

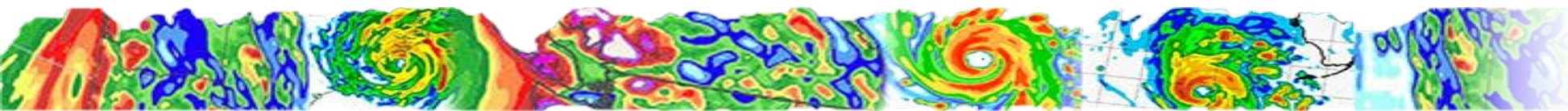
Accurate measurements at point locations

RADAR

Spatial information for coverage between gauges

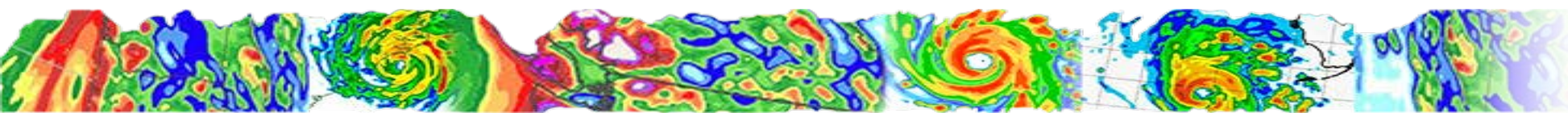
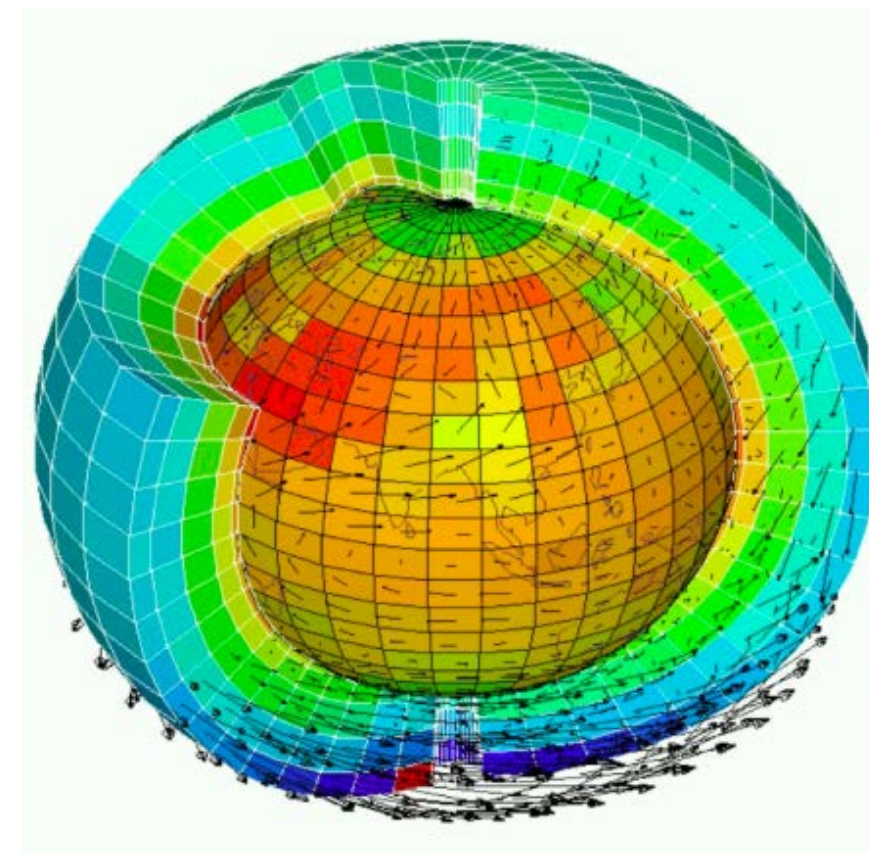


Example from September 2013 Event in Boulder County



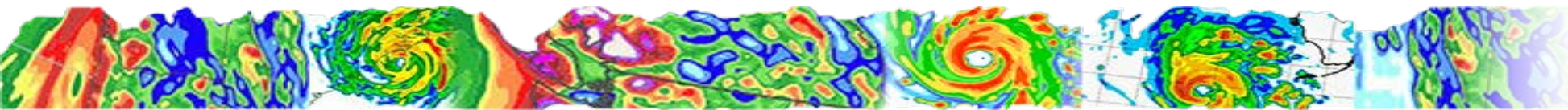
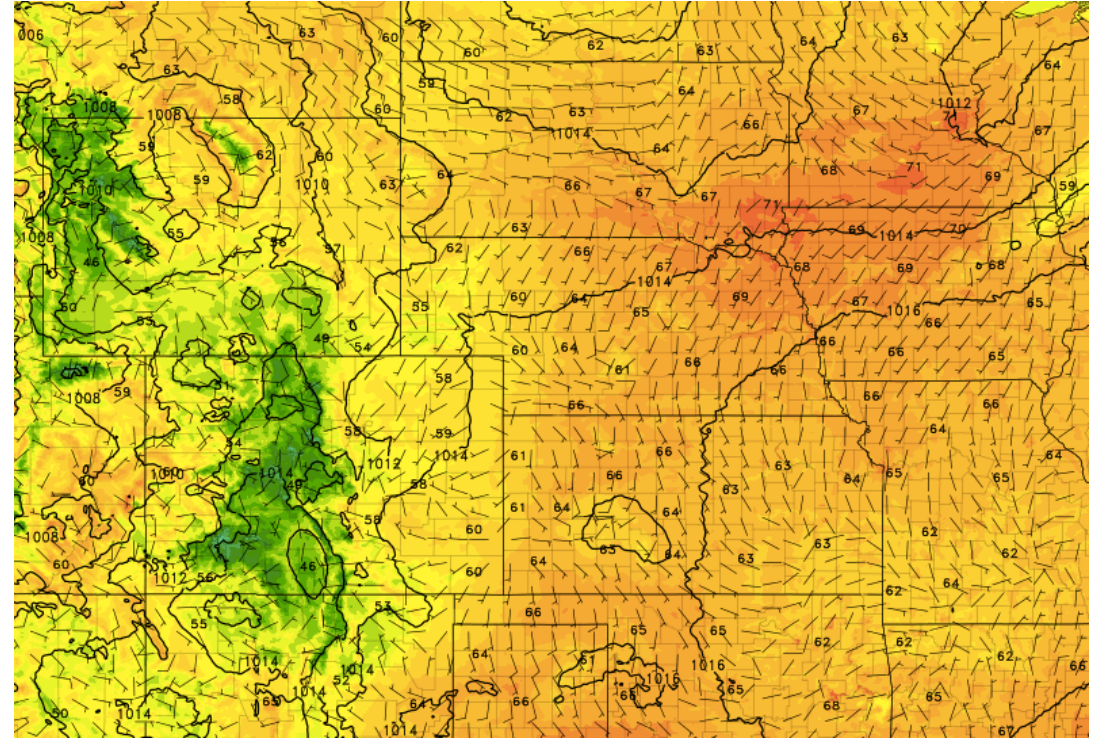
New Watering Recommendations?

- Instead of single rain gauge:
 - Utilize GARR spatial data
- Instead of single ET point calc:
 - Spatial ET from model
 - Same correction as GARR



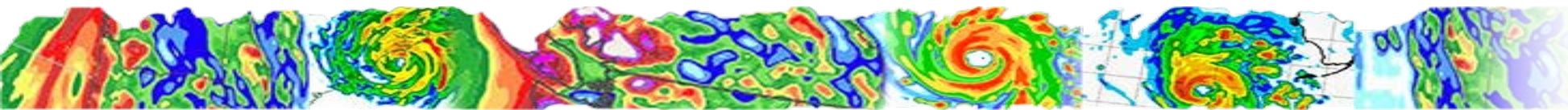
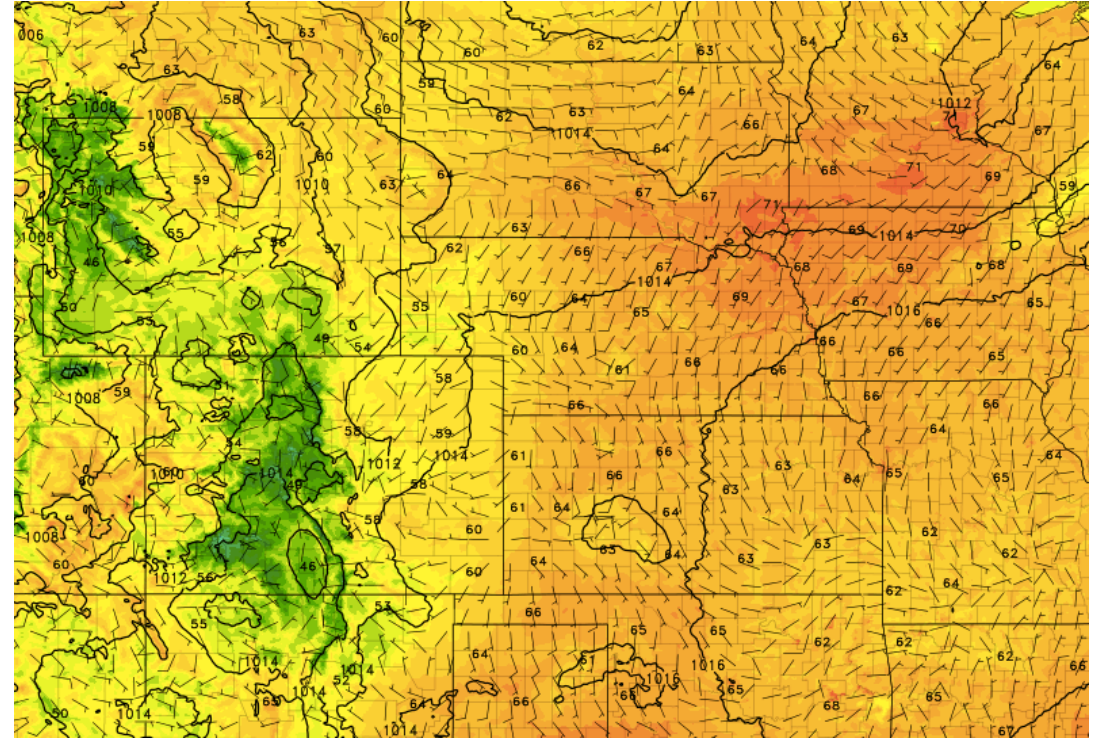
New Watering Recommendations?

- Calculations are done spatially
 - Derived spatial calc from two spatial datasets
- Thousands of recommendations
- API to GIS or website access

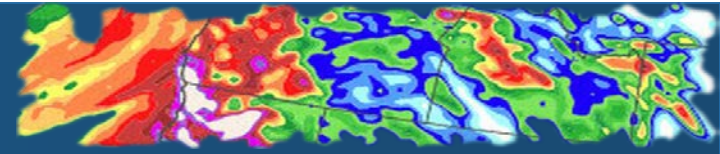


New Watering Recommendations?

- Delivery:
 - Email based on address
 - Google Maps
 - GIS Query
 - Neighborhood websites
- Can be updated in realtime



Questions?

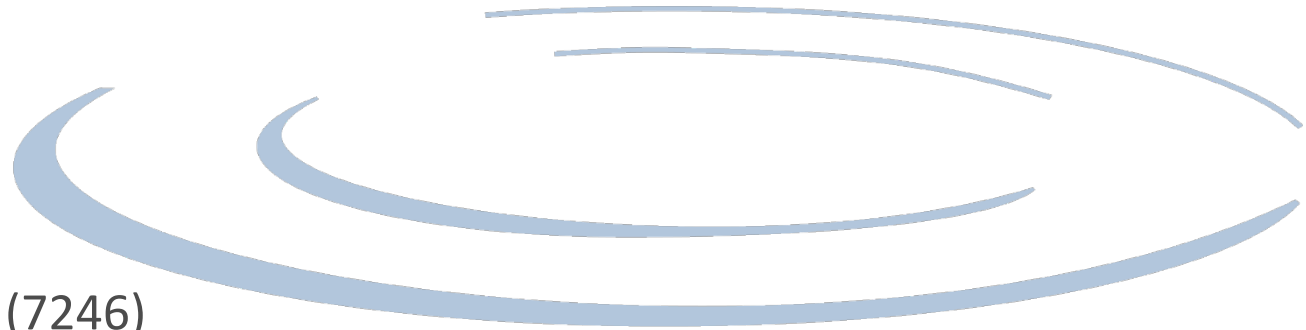


Contact Us

OneRain Incorporated
1531 Skyway Drive, Unit D
Longmont, CO 80504

Phone: 303-774-2033 or Toll Free: 1-800-758-RAIN (7246)

www.onerain.com



Experts measuring rainfall and its consequences™