

# Precipitation and Evaporation Trends in Texas

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# Study Area

- Texas occupies about 7% of the area of the US.
- Second largest state at 692,000 sq. km.
- Lat Range: 25.83N – 36.50N (1289 km)
- Lon Range: 93.52W – 106.63W (1255 km)
- Elev Range: sea level – 2667 m
- Physical Regions: Gulf Coastal Plains, Interior Lowlands, Great Plains, Basin and Range Province.
- Climate Types: Cfa, BS, BW

# Data Sources

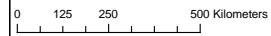
- Temperature and Precipitation: 1932 – 2002.
- US Historical Climatology Network
- 43 stations with long-term records.
- Corrected for time of observation and identified inhomogeneities.
- Not fully homogenous spatially.

# Data Sources

- Bulk Evaporation: 1954 – 2007
- Texas Water Development Board
- Blend of pan measurements and modified Penman formula computations.
- Gridded to 1 x 1 lat/lon

### Texas HCN Stations

0 125 250 500 Kilometers

A horizontal scale bar with four major tick marks labeled 0, 125, 250, and 500 Kilometers. The bar is divided into four equal segments by these tick marks.

# Data Processing

- Less than 1% missing in temperature and precipitation estimated by neighbor regression.
- Evaporation 100% complete.
- Monthly data also aggregated to seasonal and annual values.
- Winter (D,J,F) Spring (M,A,M) Summer (J,J,A) Fall (S,O,N).

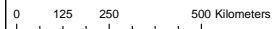
Annual Temperature Trend (C Deg / Year)  
(Various POR 1932 - 2002)

0 125 250 500 Kilometers

A horizontal scale bar with tick marks at 0, 125, 250, and 500 kilometers.

Annual Precipitation Trend (mm / Year)  
(POR 1932 - 2002)

0 125 250 500 Kilometers

A horizontal scale bar with tick marks at 0, 125, 250, and 500 kilometers.

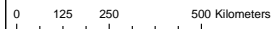
Spring Temperature Trend (C Deg / Year)  
(Various POR 1932 - 2002)

0 125 250 500 Kilometers



Spring Precipitation Trend (mm / Year)  
(POR 1932 - 2002)

0 125 250 500 Kilometers






Summer Temperature Trend (C Deg / Year)  
(Various POR 1932 - 2002)

0 125 250 500 Kilometers



Summer Precipitation Trend (mm / Year)  
(POR 1932 - 2002)

0 125 250 500 Kilometers



Fall Temperature Trend (C Deg / Year)  
(Various POR 1932 - 2002)

0 125 250 500 Kilometers

Fall Precipitation Trend (mm / Year)  
(POR 1932 - 2002)

0 125 250 500 Kilometers

Winter Temperature Trend (C Deg / Year)  
(Various POR 1932 - 2002)

0 125 250 500 Kilometers

Winter Precipitation Trend (mm / Year)  
(POR 1932 - 2002)

0 125 250 500 Kilometers

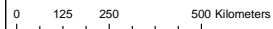
January Temperature Trend (C Deg / Year)  
(Various POR 1932 - 2002)

0 125 250 500 Kilometers



January Precipitation Trend (mm / Year)  
(POR 1932 - 2002)

0 125 250 500 Kilometers



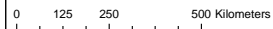
August Temperature Trend (C Deg / Year)  
(Various POR 1932 - 2002)

0 125 250 500 Kilometers



August Precipitation Trend (mm / Year)  
(POR 1932 - 2002)

0 125 250 500 Kilometers



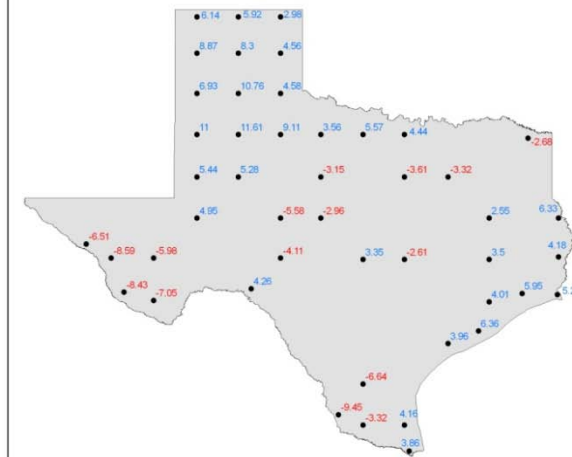
# Comments on Precipitation Trends

- Mixed signal in temperature.
- Eastern areas cooling in summer and fall
- Western areas show greatest rates of warming in spring. Large warming trend in Rio Grande Valley winter.
- Annual trend more cooling than warming but distinct spatial pattern.

# Comments on Precipitation Trends

- Only seasonal trend identified is in fall with increase in pcp. in eastern and central area.
- No other seasons show trends.
- Annual trend mirrors fall season trend
- October positive trends dominate.
- Only two stations show month with negative trend.

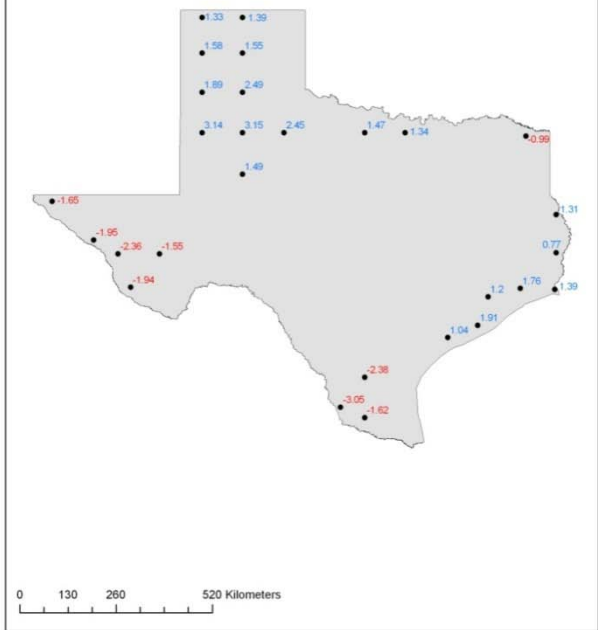
### Annual Evaporation Trend (mm/Year) 1954 - 2007



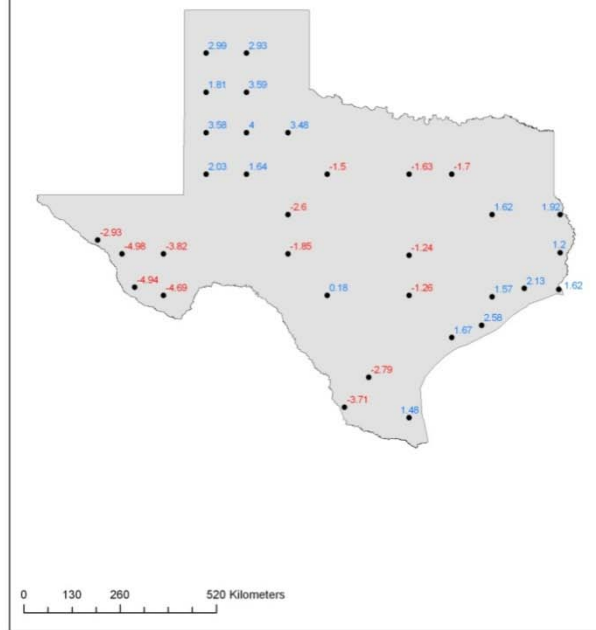
0 125 250 500 Kilometers



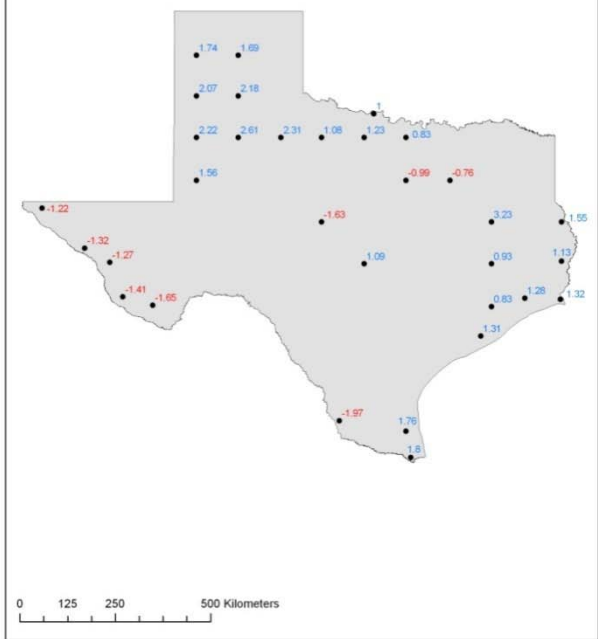
Spring Evaporation Trend (mm/Year)  
1954 - 2007



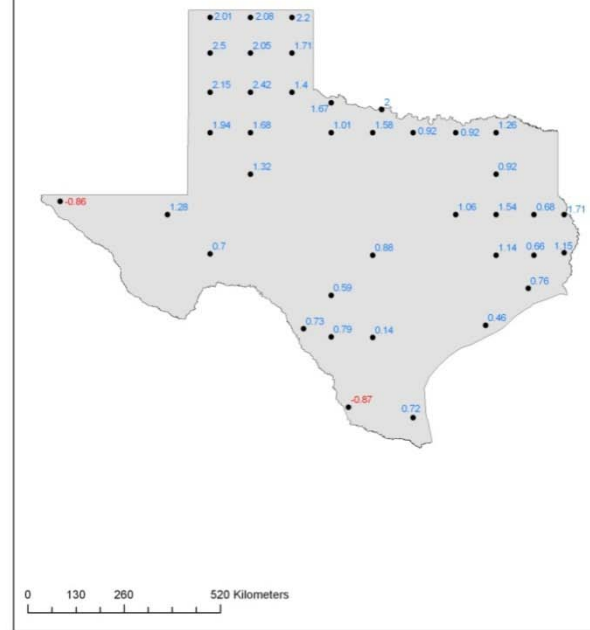
Summer Evaporation Trend (mm/Year)  
1954 - 2007



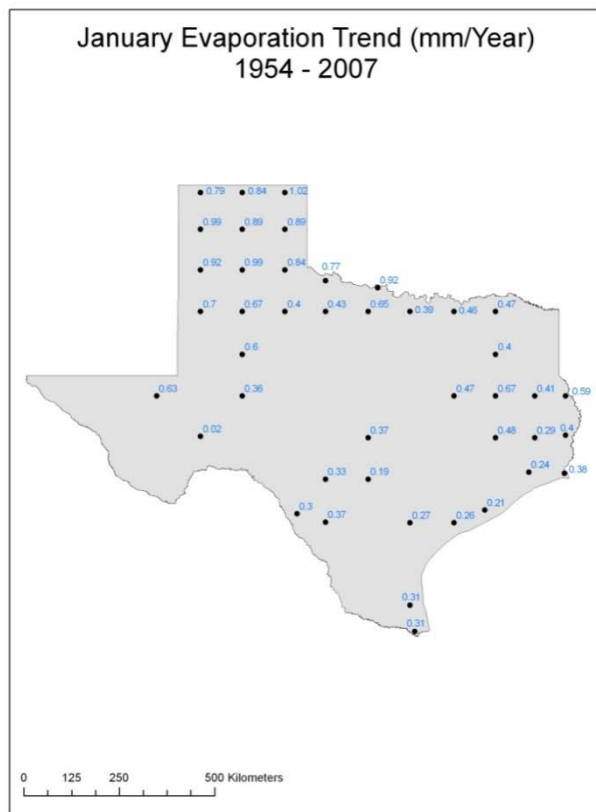
Fall Evaporation Trend (mm/Year)  
1954 - 2007



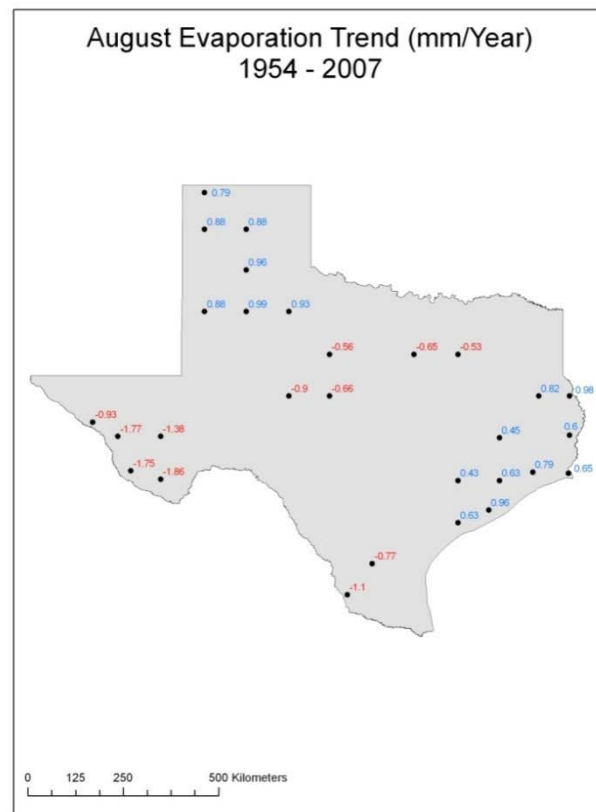
Winter Evaporation Trend (mm/Year)  
1954 - 2007



January Evaporation Trend (mm/Year)  
1954 - 2007



August Evaporation Trend (mm/Year)  
1954 - 2007



# Comments on Evaporation Trends

- Panhandle region dominated by increased evaporation in all seasons.
- Far west and Rio Grande Valley shows decreasing trend.
- Winters show more evaporation spatially while summer pattern more mixed.

# Conclusions

- Results (kind of) track with NAST report of 2001.
- Some warming is occurring but most likely at low-end of early model scenarios. Eastern cooling trend anomaly.
- Precipitation more problematic and drying not shown in panhandle.
- Evaporation matches well with model ppt.

# Future Work

- Examine trends and changes in rain days and rainfall intensity.
- Examine trends in humidity (mixing ratio).
- Correct evaporation data for land use/irrigation use?
- Potential sea surface temperature contribution?

# Acknowledgements

- US Environmental Protection Agency for grant funding.
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- Texas Water Development Board
- NOAA/National Climatic Data Center
- Legions of weather observers!

# Questions?

