Kansas Heat Wave Trends

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Introduction:

Heat waves in Kansas have not been quantified or analyzed. People as a whole are becoming more environmentally aware and climate change is at the forefront. This study used mean daily temperatures from data collected throughout 23 weather stations in Kansas in combination with modern statistical methods and data analysis to find trends in heat wave behavior.

Methods:

Definition:

This study uses three different heat wave indicators (HI) to define a heat wave.

- HI01- a period of two or more consecutive days in which the mean daily temperature meets or exceeds the 90th percentile threshold temperature.
- HI02- criteria is the same as HI01 but for the 95th percentile threshold temperature
- HI04- criteria is the same as HI01and HI02 but for the 99th percentile threshold temperature

We would like to thank Aavudai Anandhi, (our instructor for this project) and other instructors of the NRES Capstone course (James Steichen, Ben Champion) and Shawn Hutchinson, director of NRES

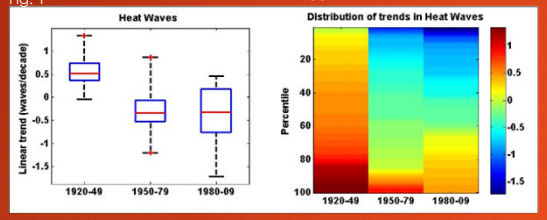
Statistical Analysis:

- Daily Mean Temperature Average, 5 year average, 30 year average
- Linear Regression Modeling
- Box and whisker plots

Collect Data & Select Indicators → Implement Descriptive and inferential Statistics → Automate Data Analysis

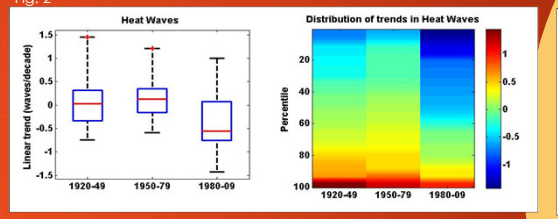
HI01 T_{thresh}=24°C

Fig. 1



HI02 T_{thresh}=26°C

Fig. 2



HI04 T_{thresh}=28°C

Fig. 3

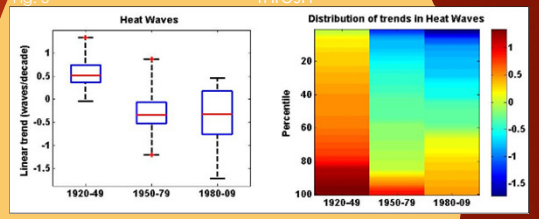


Fig. 4

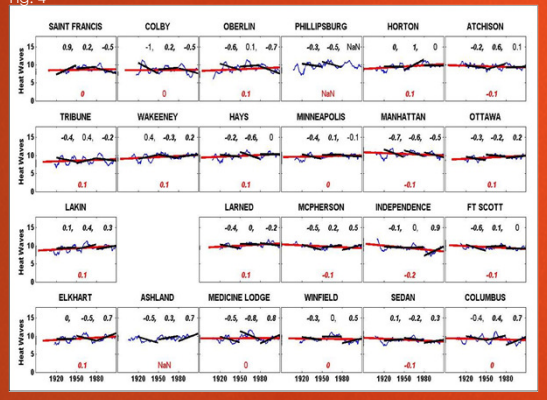


Fig. 5

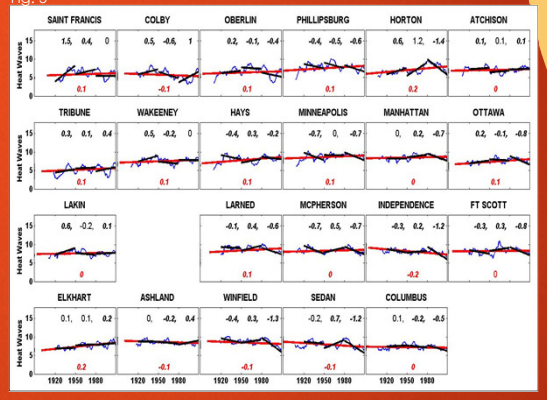
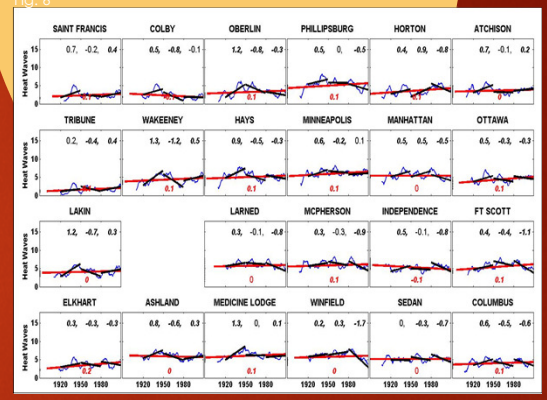


Fig. 6



Bottom: Figures 4, 5, and 6 show trends in heat wave behavior by location in Kansas. The blue line represents the 5 year moving average, black line 30 year average, and the red line represents the overall average over all data years. Top: Figures 1, 2, and 3 are box and whisker plots showing distribution of trends for each of the three thirty year periods.

Impacts:

Cattle

- Heat waves in 1995 & 1999 5,000 feedlot cattle died each year in Midwestern states
- Estimated loss of $4,000-$5,000 per cattle death

Humans

- Extreme heat in Europe during the summer of 2003 caused over 70,000 deaths
- In 1954 from mid June to mid July 137 deaths caused by a heat wave
- Summer of 1954 12%-15% of energy use went to cool city residents

Results:

- 90th Percentile (24°C thresh.)—Captures greatest amount of data
  - On average, about 10 heat waves per year
  - General trend is INCREASING number of heat waves per year
  - .025 heat wave increase per year
    - By the year 2114 we will see 2.5 **more** heat waves every year.
    - By the year 3014 we will see 25 **more** heat waves every year
- 95th Percentile (26°C thresh.)
  - On average, about 7 heat waves per year
  - No significant increase in the number of heat waves per year
- 99th Percentile (28°C thresh.)
  - On average, about 3 heat waves per year
  - General trend is DECREASING number of heat waves per year
  - .05 heat wave decrease per year

Conclusions:

- Heat waves are increasing in frequency
  - + trend in 90th percentile, more heat waves at lower threshold
  - 0 trend in 95th percentile, same heat waves at medium threshold
  - - trend in 99th percentile, less heat waves at higher threshold
- Climatic changes include increases in number of extreme weather events including HEAT WAVES.
- SIGNIFICANT increases in Frequency of heat waves over the long term will have DEVASTATING effects on human livelihood and well-being of the planet..

Future Work

- While this study focuses on the frequency of heat waves, other aspects such as severity and duration of heat waves may play crucial roles and need further research.
- Increases in the frequency of heat waves will play a great role in Kansas's future. This increase in frequency of heat waves will call for further research and cost analysis will continue to be needed in order to best understand the situation at hand.