



# First Freeze Date Trends across Southern New England

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## Abstract

This study examines the first freeze dates in Massachusetts, Connecticut, and Rhode Island from 1964 through 2014. Daily temperature data were obtained from the U.S. Historical Climatology Network, and the first freeze date was determined as the first air temperature equal to or less than 32°F. Trend lines were calculated to determine the direction and magnitude of change and tested for significance. Results showed that the first freeze date has been coming later.

## Results and Discussion

Statistical analyses of first freeze dates for the period of record from 1964 to 2014 years at five USHCN stations across southern New England are shown in Figure one below. Overall, the linear trends in the first freeze dates across the region indicate that the onset of freezing is occurring later in the year. All of the stations exceeded the expected natural variation approximated as  $\pm$  one standard deviation from the mean. The  $R^2$  values indicate a gradual, rather than abrupt, change toward a later frost onset over time for southern New England.

1. Falls Village, CT had an mean first freeze date of September 30<sup>th</sup> (Julian date 273  $\pm$ 14) with a linear trend of 19 days later.
2. Amherst, MA had an mean freeze date of October 1<sup>st</sup> (Julian date 274  $\pm$ 11) with a linear trend of 19 days later.
3. Plymouth-Kingston, MA had a mean freeze date of October 19<sup>th</sup> (Julian date 292  $\pm$ 12) with a linear trend of 16 days later.
4. Providence TF Green Airport, RI had October 23<sup>rd</sup> (Julian date 296  $\pm$ 11) as its mean first freeze date with a linear trend of 14 days later.
5. Kingston, RI had a mean first freeze date of October 5<sup>th</sup> (Julian date 278  $\pm$ 9) with a linear trend of 16 days later.

## Data and Methods

Early farmers began keeping track of the first freeze dates in order to maximize their growing season, and now we continue to do so in a similar way. First freeze dates can be beneficial if they come later by extending the growing season, producing more or better quality yield. They can also be destructive if they come too early by killing or damaging crops (Baron 1996).

Reports indicate that the onset of the first freeze has changed over recent years (Cooter and Leduc (1995). This study looked at the date of freeze season onset at five weather stations in southern New England (Menne et al. 2015). Each station was chosen for completeness (> 90 %) and analyzed to identify the change in the onset of the freeze season from years 1964 through 2014. The stations evaluated include:

1. Falls Village, CT
2. Amherst, MA
3. Plymouth-Kingston, MA
4. Providence TF Green Airport, RI
5. Kingston, RI

Trend lines were calculated with  $R^2$  values, as well as the standard deviations to determine the magnitude of the change compared to the natural variability in freeze onset. Dates were converted to the Julian calendar and it was assumed there were no leap years. First freeze dates ranged from August 29<sup>th</sup> (Julian date 241) to November 11<sup>th</sup> (Julian date 315).

## Acknowledgements

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## References

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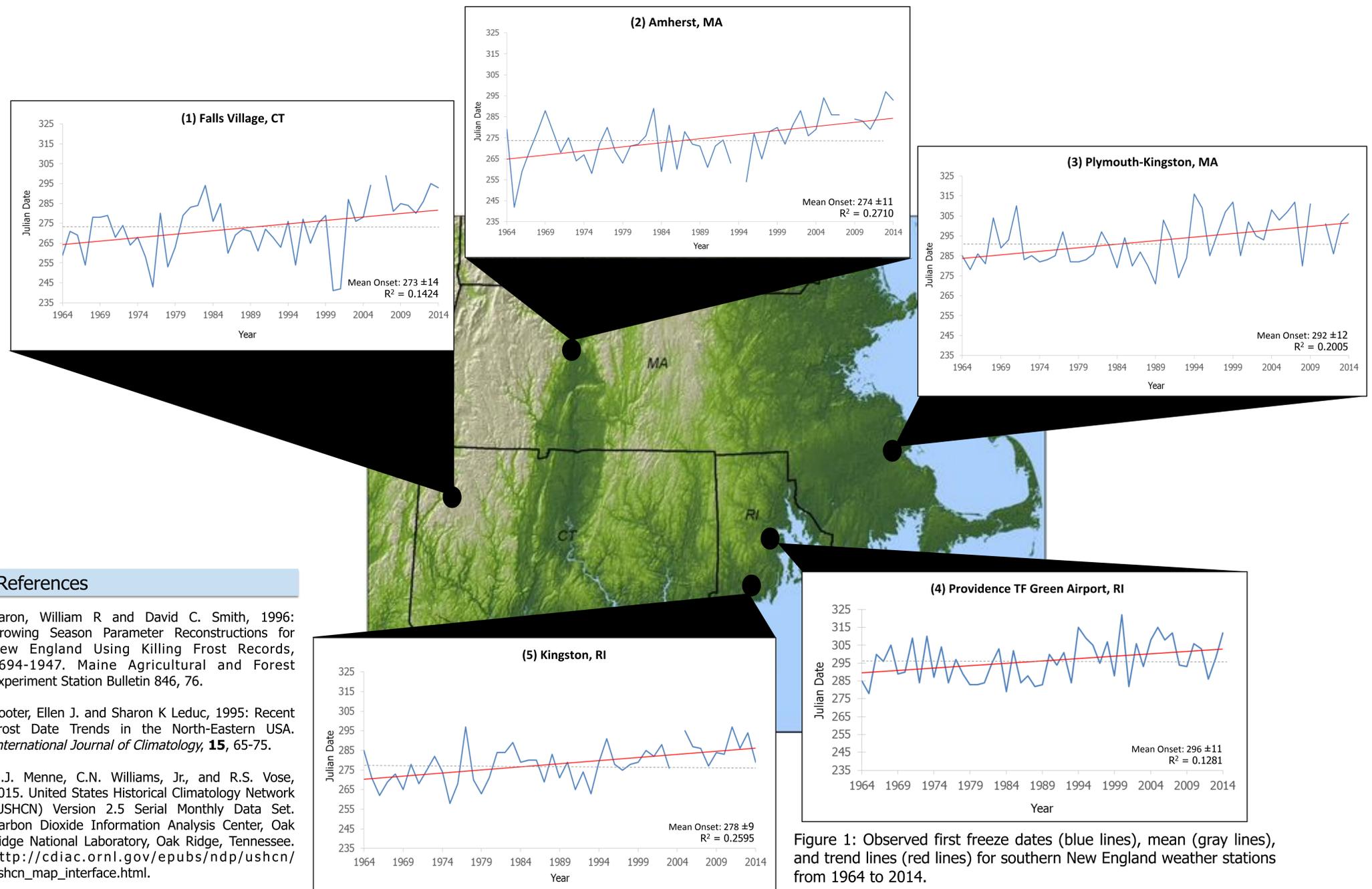


Figure 1: Observed first freeze dates (blue lines), mean (gray lines), and trend lines (red lines) for southern New England weather stations from 1964 to 2014.