

# Snow Depth and Temperature in the Midwestern United States

## Plan for HW3 – Team 4

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### Primary Question

Has the Northern Plains of the United States, experienced a significant increase in snowfall while the Southern Plains has experienced a significant decrease in snowfall during the years 1970-2010, as claimed in the article<sup>1</sup>? Do we also observe shortening snow seasons as well as an increase in temperature over this time period, as described by the article?<sup>1</sup>

### Experimental Design

The Northern Plains consist of the following states: North Dakota, South Dakota, Minnesota, Iowa, and Nebraska, while the Southern Plains consist of the following states: Texas, Oklahoma, and Kansas. The dependent variables for these models will consist of the first 3-4 eigenvalues resulting from a principal component analysis (PCA) calculated over in either region over the time period from 1970-2010. We consider only stations that regularly report snowfall in the winter.

Figure 1 (A) Reproducible unsupervised method of identifying weather stations that report outlier weather data. (B) Mean Observed Snowfall depth for a state in the Northern Plains - South Dakota. (top) the mean observed snowfall (inches) in North Dakota from 1970-2019 and (bottom) the first three eigenvectors that result from the corresponding principal component analysis (PCA). (C) A summary of our proposed workflow for HW3. (D) Mean Observed Snowfall depth for a state in the Northern Plains - North Dakota. (top) the mean observed snowfall (inches) in North Dakota from 1970-2019 and (bottom) the first three eigenvectors that result from the corresponding principal component analysis.

Discontinuities in the second and third PCA eigenvectors suggests the presence of significant noise from some stations in the mid-winter. (E) Mean Observed Temperatures for a state in the Northern Plains - North Dakota. (top) the mean observed temperature (degrees Fahrenheit) in North Dakota from 1970-2019 and (bottom) the first three eigenvectors that result from the corresponding PCA. The y-axis units of the top figure may be incorrect.

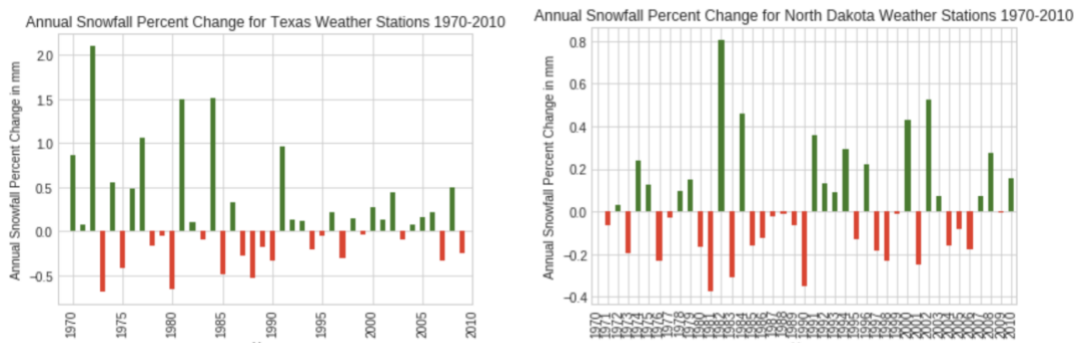
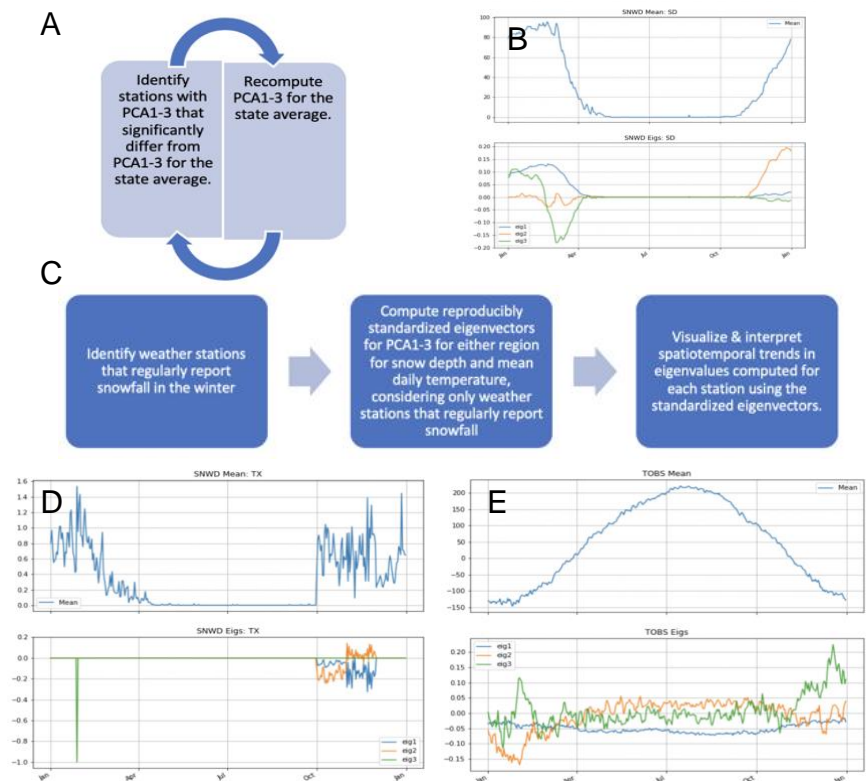


Figure 2 Annual percent change in snowfall for a state located in the Southern Plains (left) and the Northern Plains (right).

<sup>1</sup> <https://weather.com/safety/winter/news/2020-02-05-snow-season-shorter-us-climate-central-study>