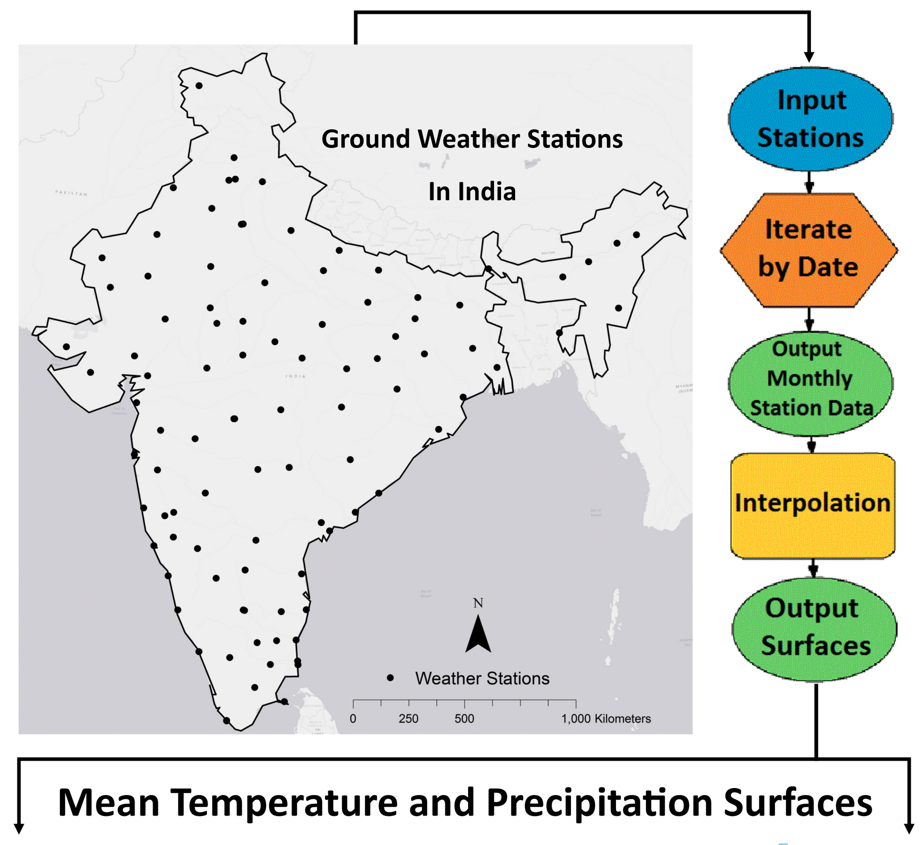
Climate Classification of India,

Based on Surfaces Generated from Ground Weather Stations

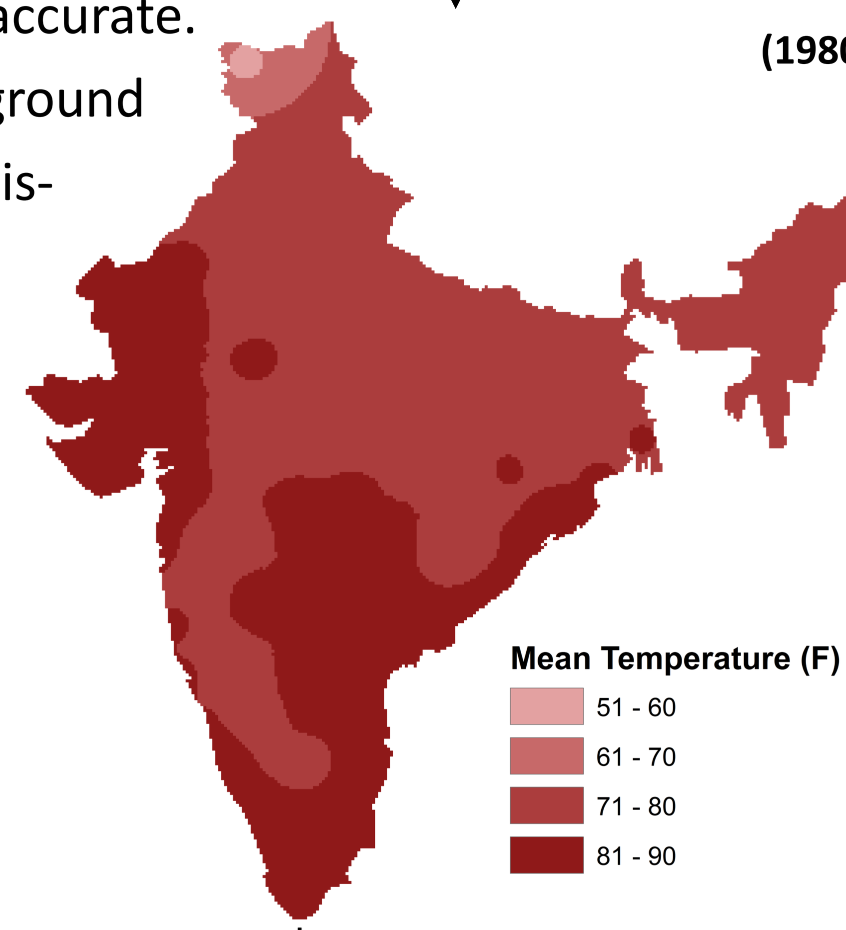
Introduction

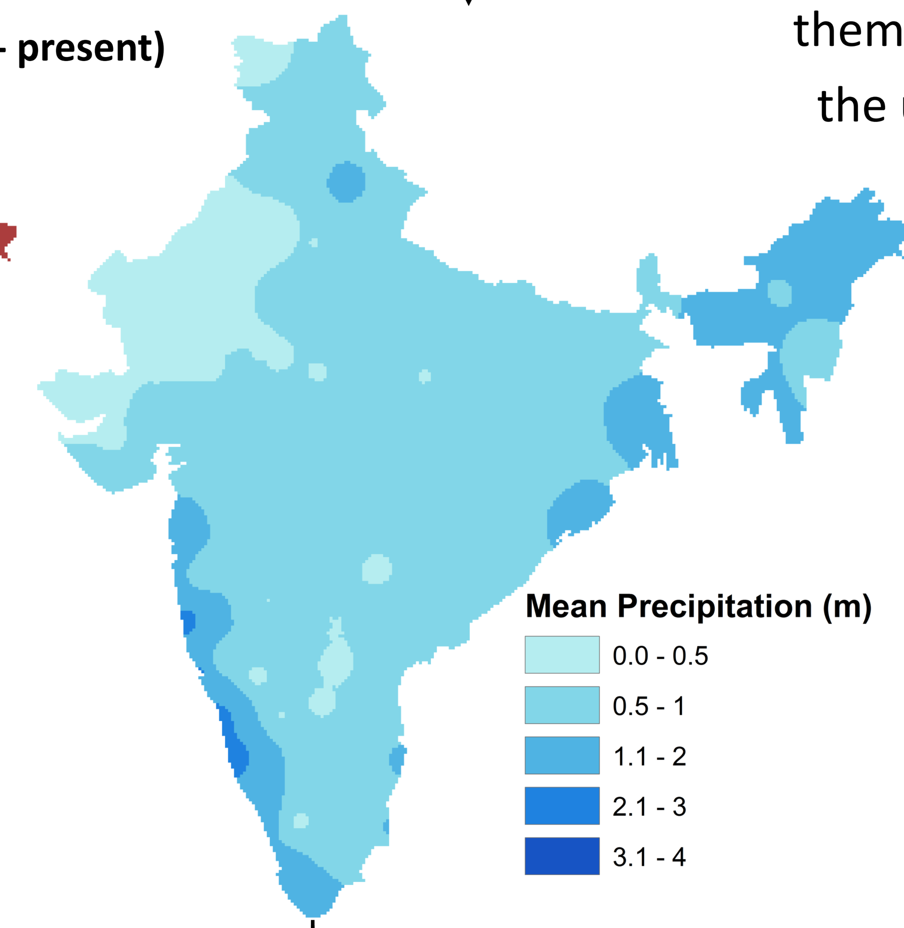
India's current climate classification method is almost a century old. This Koppen system is founded on the principle that vegetation is a proxy for temperature and precipitation, which are proxies for climate. Ideally satellites could be used to gather temperature and precipitation over large spatial and temporal scales. Unfortunately, India's monsoon season causes much of the country to be covered in clouds making remote sensing inaccurate. Interpolation of weather variables from ground stations offer a way to circumvent these issues, providing current, accurate, and continuous data for climate classification. While remote sensing is still preferable, this method could be used for reciprocity year round or as a fill in during the monsoon season.

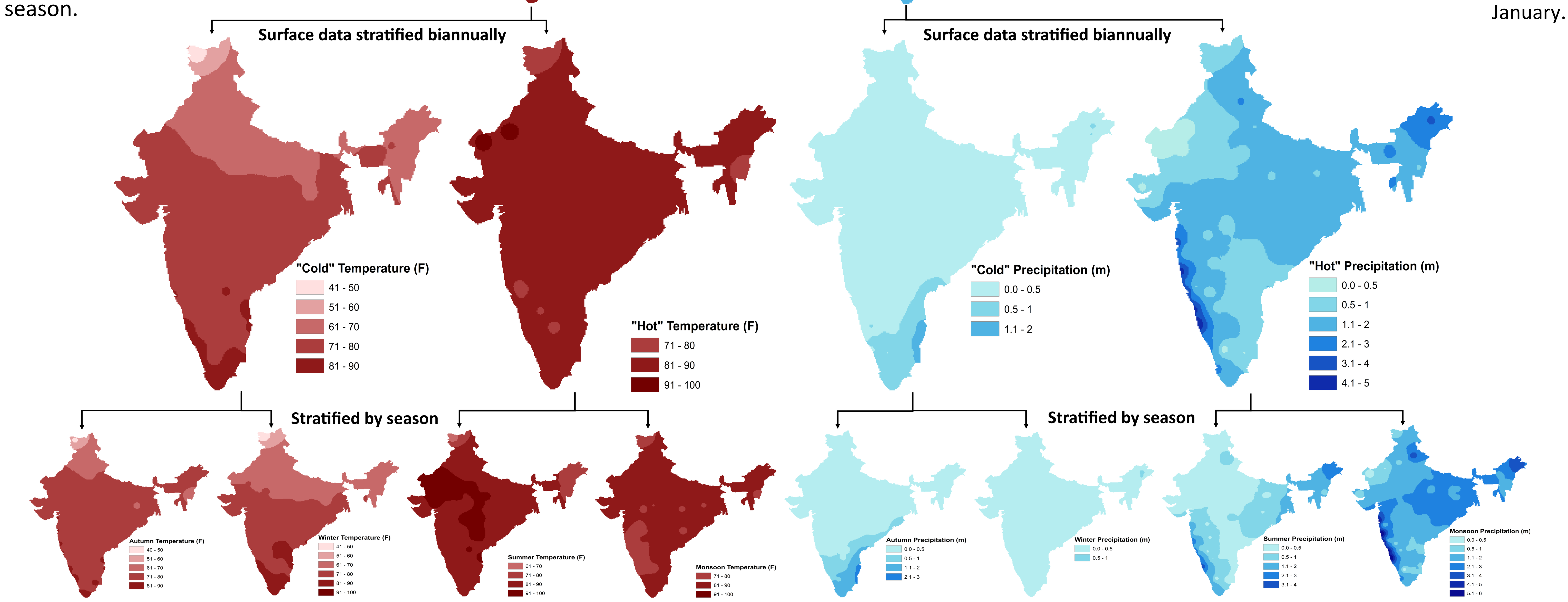


Methods

Monthly weather station data from 1980 to present was downloaded as .csv's from NOAA's: National Climate Data Center (NCDC) and scrubbed for errors in Excel. The data was imported into ArcMap and geolocated. The stations were then fed into a tool created with Model Builder, that iterated the data grouping by date (month) before feeding it into IDW interpolation (basic method based off distances), and outputting mean raster surfaces. These surfaces could then have cell statistics run on them for different monthly groupings depending on the user's needs. I began with running statistics on all the rasters to create a "30 year normal", which is considered in the literature the required amount of time to obtain long term trends from. Surfaces were then generated from hot vs. cold (Apr-Aug vs. Sep-Mar) months, and seasons were made from every three months starting from January.





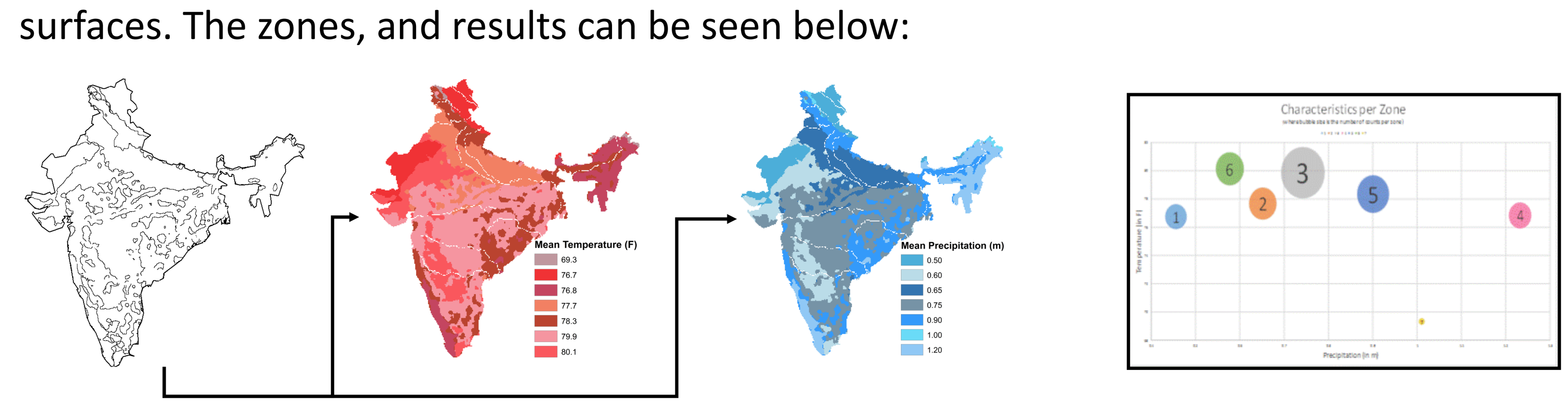


Conclusions

Beginning with the two "30 year normals" for temperature and precipitation, you can see that India's usually pretty hot (mostly between 70 and 80°F) and gets a reasonable amount of total rain per month (between 0.5 and 1m). When each of these are stratified into hot vs. cold months you can begin to understand the variability in climate per time of year. The cold portion sees less heat (70-80°F) and very little rain (0-0.5m). Note: snow was not included in this analysis. The hot portion of the year is usually 10° warmer and has more rain (0.5-2m). When these are further stratified by season, additional information can be drawn out. Notice how as the year progresses the climate changes, when reading from left to right (Note: autumn was placed at the front so as to held keep "cold" months grouped together). Summer is the hottest, followed closely by the monsoon season, while there is practically no rain in the winter as compared to the monsoon season. The stratification capability by user preference is the importance of this work, and it was only for the sake of easy interpretation that the legend scales were chosen. This data is available in as much detail as supplied by the source. The main limitation was the use of IDW interpolation and temporal scale, which were only used so as to limit computational time.

Future Work

Additional work was done, that for the sake of presentation was not included on this poster. This used Alex Liss's the creation of zones based off of vegetation spectral signature which were mosaicked, water masked, PCA analyzed, classified, and smoothed via the remote sensing software ENVI before being imported into GIS where zonal statistics were performed on the raster surfaces. The zones, and results can be seen below:



These could be summarized in a table or placed into a bubble plot, where color represents zone, each variable is an axis, and the size of the bubble is related to cell counts. This would shows that each zone is indeed a separate cluster indicating unique climate. Climate could then be related to population and health outcomes per zone, such as heat exposure in India.

Data: NOAA NCDC GSOD

Projection: World Geodetic System 1984 UTM Zone 44

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Madeline Wrable

UEP232—Introduction to GIS