UNBC GIS LAB
GIS & Remote Sensing

Climatic Variances from 1975-1990

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Abstract

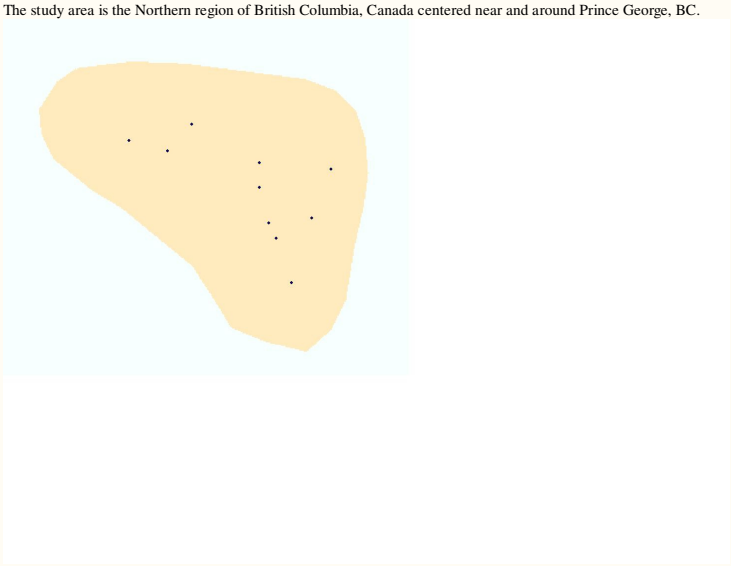
This report will show rainfall, snowfall, and precipitation changes from 1975-1990. It will also include an overview of the overall snowfall, rainfall, and precipitation totals for 1975-1990.

Introduction

- The Problem: The data I worked with did not show a trend in climatic variances over the years 1975-1990
- The Study Area: The area that is highlighted in this project is the Northern British Columbia region near and around Prince George, BC.
- The Objective: I wanted to create maps to see if there was a trend in general declination or increase in snowfall, rainfall, and precipitation over the course of 1975-1990.

Study Area and Data Source

- The study area is the Northern region of British Columbia, Canada centered near and around Prince George, BC.



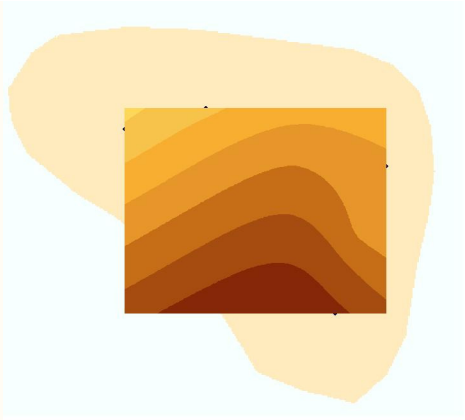
- The region above includes towns and cities such as Barkerville, Quesnel, Prince George, and Fort St. James. The blue dots represent the weather station points where the data I worked with were created.
- The data supplied to me was from the Geography 413 GIS Lab course on Spatial Analysis. In that lab we worked with the same data that I used here. For my project I used advanced GIS techniques to create my final outputs.

Data Manipulation

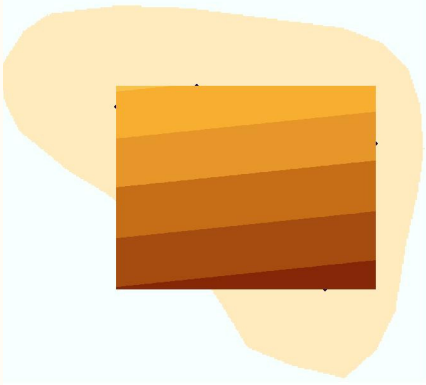
- I re-opened the data that we used in our lab class and ran the Spline function on all the data sets I had to make sure that any cells surrounding the station points would take the cell value from the station and apply it to surrounding cells. Using the Tension option I ensured that the surface output would conform more closely to the station points than to other areas of the surface. This would give me a smoother surface to work with and one that generally is better for analyzing weather data.

Methods / Procedure

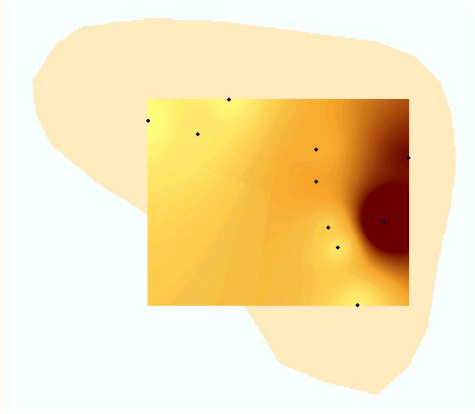
- Once I ran the Spline function I then went ahead and created layers called "overall_mean, overall_max, overallrangemeantemp" from the pre-existing weather data using the Spatial Analyst Raster Calculator function. This created outputs based on the overall average values for snowfall, rainfall, and precipitation from '75-'90. Since I wanted to show precipitation variances over the years I created layers called "overall_meanRain, overall_meanSnow, overall_meanPrecipitation" to give me averages for those years.
- Once I created those outputs listed above I struggled to find a way to make it all come together in a manner that would be visually appealing and easily understood. I tried to run interpolation techniques such as Local Polynomial Interpolation, Global Polynomial Interpolation, and Inverse Distance Weighting to see what the outcomes would be. The LPI I created gave me a map that looked like this:



- This output was extremely difficult for me to understand. Once I understood that the LPI forces the program to run right through the weather station points and then using those cell values applies them to other pixels farther from the station, I could read the map. However it did not convey my results well enough for me to accurately present so I decided to try the GPI. When I ran the GPI I came out with an output that looked like this:



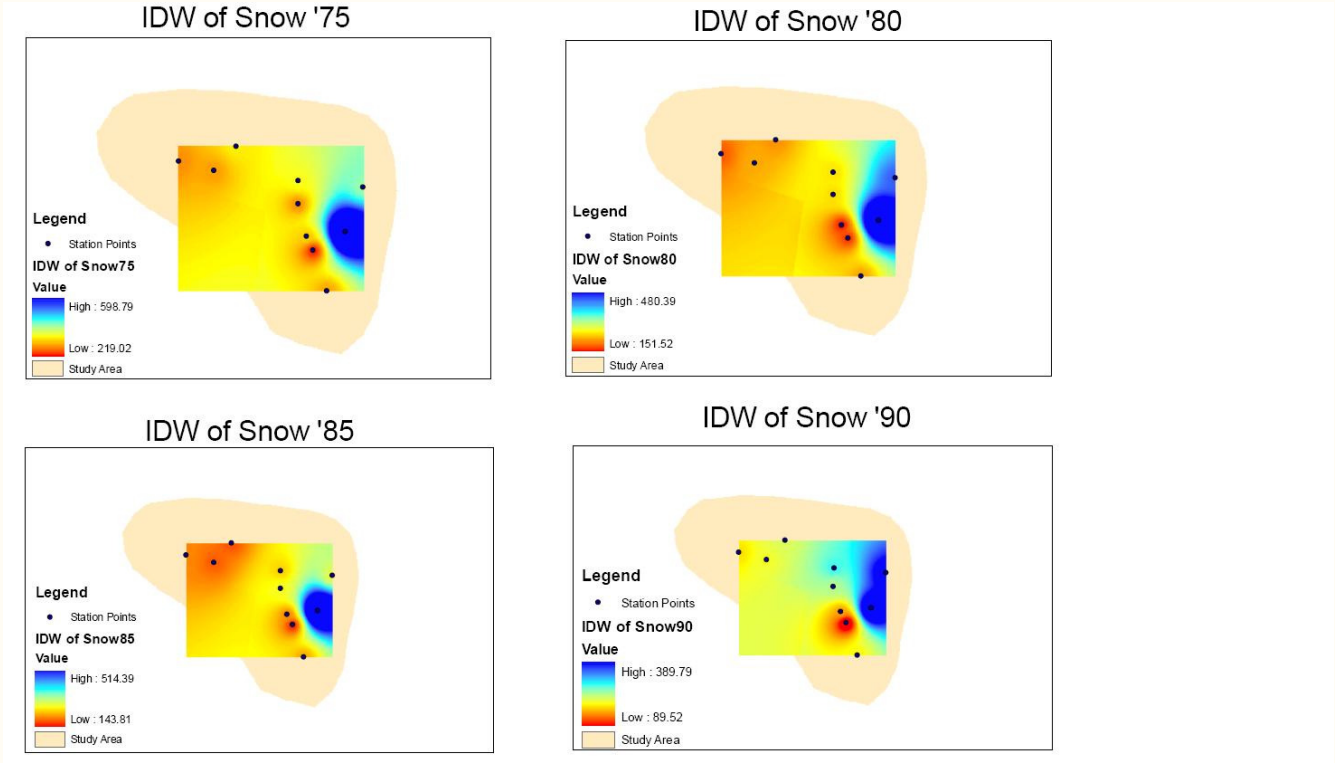
- This result of the GPI made less sense to me than the LPI. I did some research and found that the GPI takes lines and bends them to fit almost perfectly with the weather station points. However it is not an exact fit through the points so the data has a wider margin for error. The GPI works by taking points from stations and applying them all over the general map to other cells close by. This means that cells near a specific station may not contain the same cell value for the point they are nearest to but one that the program deems best. I was unsatisfied with the output that I generated and so I moved on to the Inverse Distance Weighting.
- Inverse Distance weighting takes a line and applies it directly through the points that are on the map. By fitting a line perfectly through the points the cells near those points take on the characteristics of the point cell itself. In simpler terms it is assuming that things that are close to one another are more alike than those that are farther apart. Thus when you run an IDW the result will be closer to the intended outcome than the other interpolation techniques. The IDW outcome looks like this:



- The result of running an IDW with the data I have makes much more sense. This is a smoother outcome than the others and much more readable and user-friendly. It also gives the reader a better idea of the topography of the land, aiding in understanding climatic data.

Results

- Once I had established an idea of how the different interpolations looked when I ran them I ran an IDW on the data layers of snowfall, rainfall, and precipitation. By creating separate IDW outputs for each year ('75, '80, '85, '90) I was able to see a general trend in snowfall, rainfall, and precipitation.

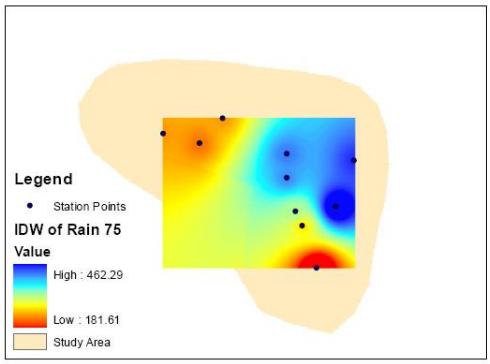


- The figure above is the IDW I performed on the snowfall data. The blue represents areas high in snowfall and areas of red represent low amounts of snowfall. There is a consistent pattern in the right portion of the map which

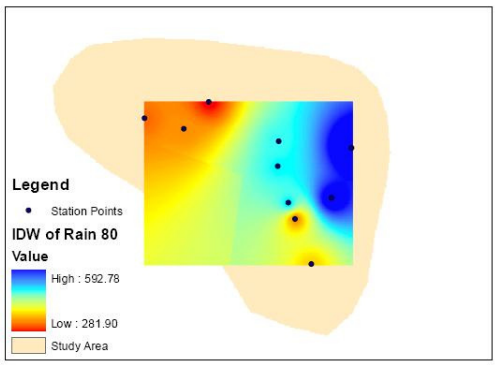
is highlighted in blue. This shows that from '75-'90 this region of the landscape received higher amounts of snowfall than other portions. As a digital elevation map was unavailable to me I can only guess that the blue area represents the Eastern part of a mountain while the red portion represents the Western part of the mountain. This assumption is further supported by the data themselves. There is a narrow area of green running between the blue and the red portions, telling me that it is part of a mountain range.

- Over the course of these years the most amount of snowfall seems to be concentrated in the blue areas and not inclined to spread outward. However, the red portions of the map vary though the years, sometimes being prevelent over almost the entire map and sometimes being more centrally located.
- As I examine this map I see a medium amount of declination in the amount of high snowfall totals throughout the years. In contrast the amount of low snowfall seems to have gotten smaller, perhaps indicating that more snow is falling over the region than in previous years. To accurately support this assumption more analysis would need to be done.

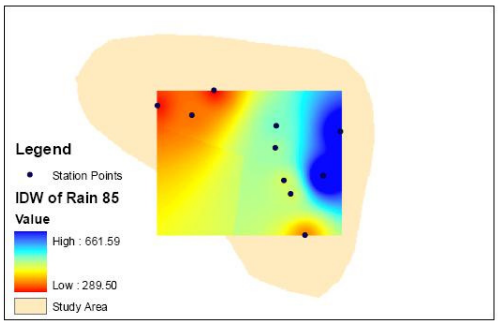
IDW of Rain '75



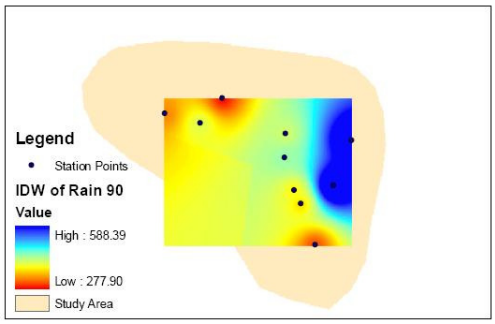
IDW of Rain '80



IDW of Rain '85

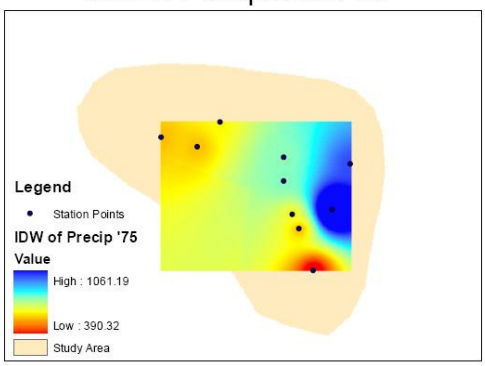


IDW of Rain '90

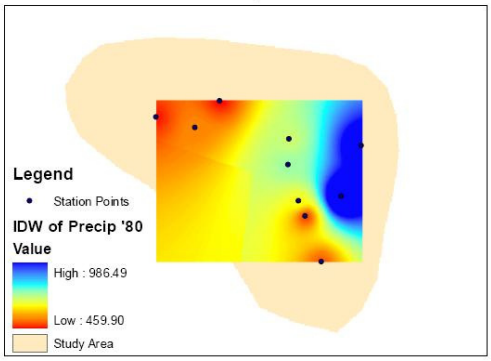


- This figure above represents the IDW of rain for the years '75-'90. Again one can see that the blue areas represent high amounts of rainfall and red represents low amounts of rainfall.
- The trend that I see here is a slight increase in the amount of rainfall over the region. The rainfall is again concentrated more to the Eastern portion of the map and the lesser amounts towards the North-Western part. In contrast I see a trend towards evening out when speaking of the lesser amounts of rainfall. From '75 to '85 there seems to be an increase in the lesser amounts of rain; however '90 there seems to be less rainfall than '85 and less dryness than '85 as well. Further analyses of these trends needs to be conducted for to determine why.

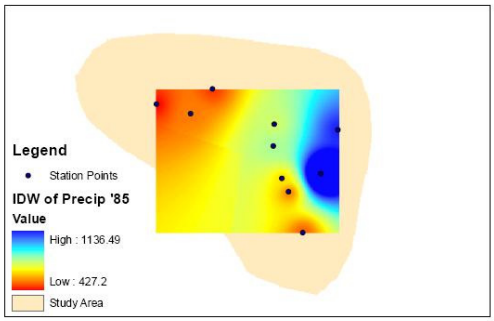
IDW of Precipitation '75



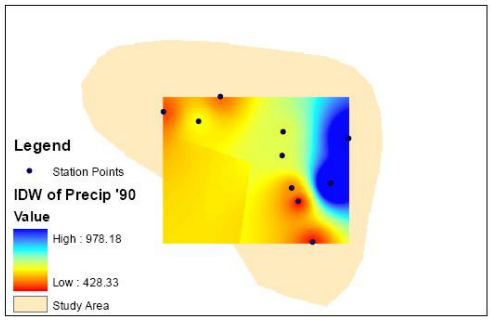
IDW of Precipitation '80



IDW of Precipitation '85



IDW of Precipitation '90



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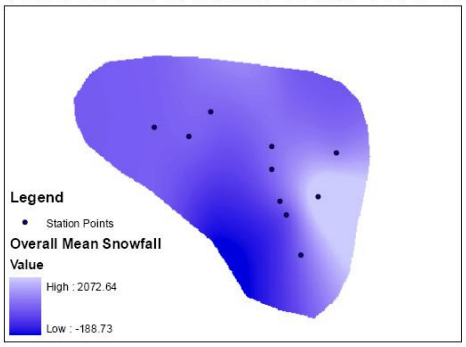
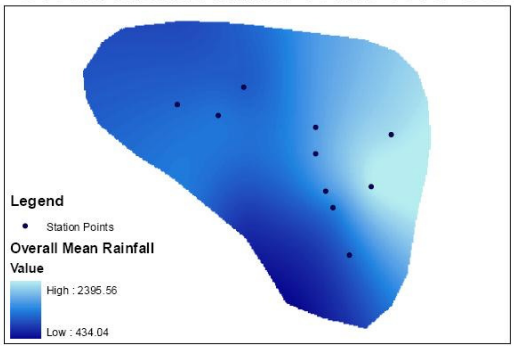
- This figure above represents the amounts of precipitation that fell from '75-'90. In the years '80-'90 I see a genereal increase in the lesser amounts of precipitation and a fluxuation in the high amounts of precipitation.
- In between the blue and red areas in '75-'85 there is a large swatch of green representing the middle average between the two extremes. However, that green patch is virtually gone in '90 to be replaced by more red, indicating that the area of lesser precipitation is enlarging. In contrast, the areas of high precipitation seem to fluxuate a bit but remain more constant than the lower precipitation values. This too needs further study to ascertain the reasons behind this general increase and decrease.

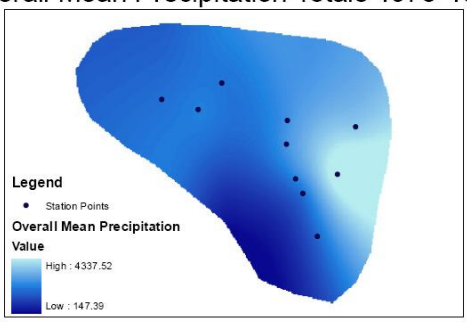
Overall Mean Snowfall Totals 1975-1990



Overall Mean Rainfall Totals 1975-1990



Overall Mean Precipitation Totals 1975-1990



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- Above is my final set of analyses. Represented above are the overall mean snowfall, rainfall, and precipitation totals for the years 1975-1990. The color in the snowfall totals varies from the other two because I wanted to show a difference between rainfall, precipitation, and snowfall so there would be no confusion between the three.
- In viewing the overall totals for snowfall we can see an interesting difference between the IDW of snowfall: the lighter blue areas--representing the areas of high snowfall--seem to be concentrated towards the South-Eastern part of the study area. Previously the IDW showed that the concentration was towards the Northern part of the study area. General fluxuations over the years would help explain this but further study is needed to fully understand the reasons why.

Conclusions / Discussion

- I will summarize what we see in the figures above in this section.
- The study area is an area encompassing towns such as Prince George, Quesnel, Fort St. James, and Hixon.
- The station points are weather stations in these towns from which the data were gathered from.
- The Spline function was used to create new layers from previously existing layers of snowfall, rainfall, and precipitation.
- Functions such as Inverse Distance Weighting, Global Polynomial Interpolation, and Local Polynomial Interpolation were used to examine the results and determine which technique to use in further analysis.
- I created maps using the IDW functions for snowfall, rainfall, and precipitation from the years 1975-1990 to track climatic trends over these years.
- As a general trend in the data seems to show, rainfall and snowfall seem to have shrunk from previously larger areas and now have leveled out from '75-'90 while the areas not receiving rainfall have increased.

Future Works / Developments

- The work currently being done on this is now complete. If someone were inclined to pull up the data and progress with further research then perhaps more concrete results could be drawn.
- I have no intention of continuing to work on this data.
- I would suggest that the next researcher gather more information from the weather stations and perhaps update the data to reflect a time period from 1975-2007. This would generate an interesting trend map and let a person show whether or not there has been a drastic difference in the amount of precipitation, snowfall, and rainfall from the time the data was first collected until now.

References

- all materials, idea referenced in this project
  - Geography 413 GIS Lab 8 Spatial Analyst
  - Metadata on layers IDW: Rain, Snow, Precipitation 1975-1990

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