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Your Name = [Ankila Kumari] *GIS 5555 Basic Spatial Analysis*

internet_id = [kuma0389]

Time_Spent = [70 mins] (after-class)

[Windows+Shift+S for screenshot of your analysis]

[Fill the above-listed info and then submit the completed document in Canvas (try to include all analysis results that can help reflect your workflow and thoughts, i.e., images, information about data, your statements, etc.)]

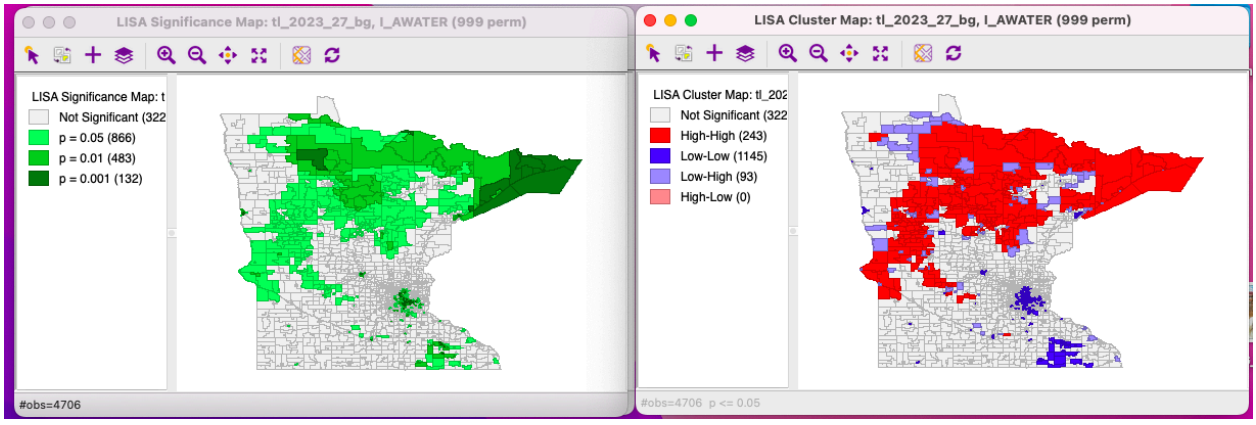
Assignment for Lab 3c

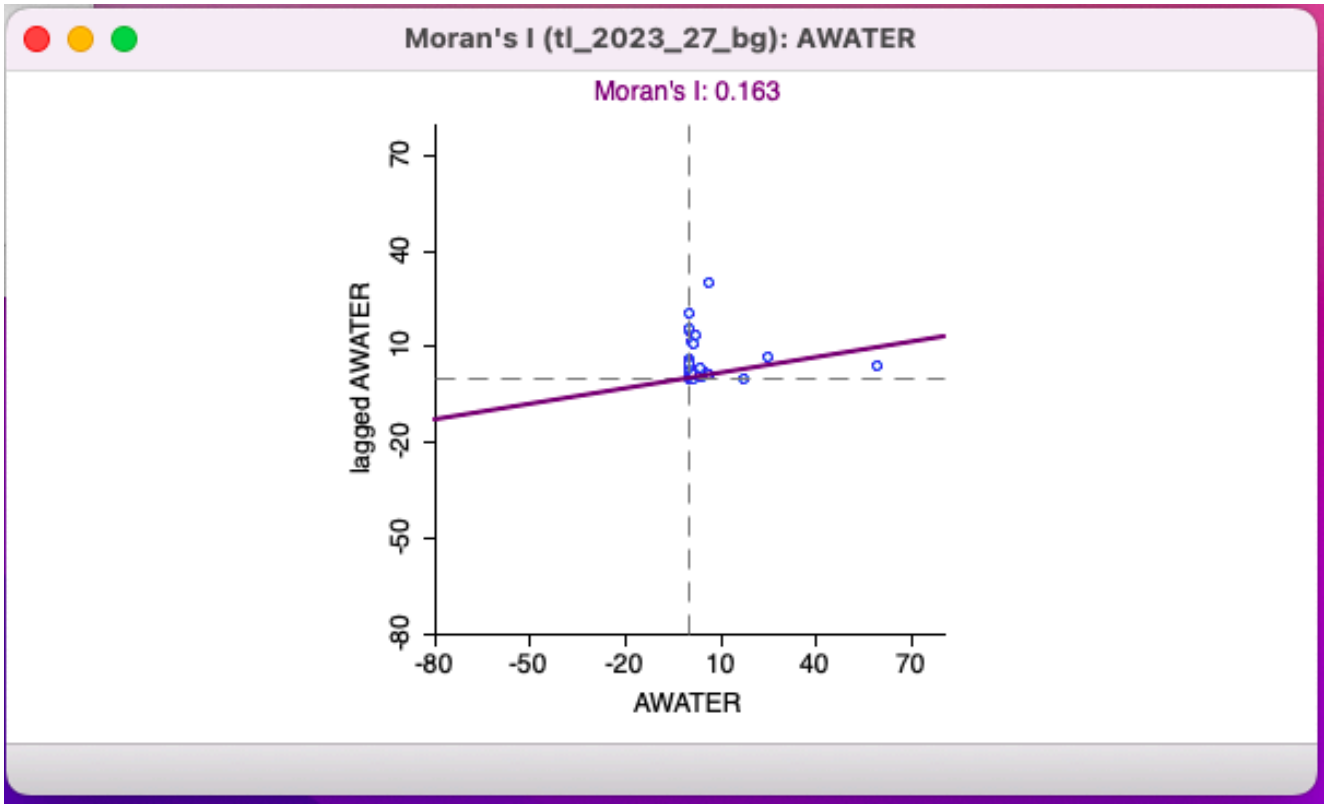
"Local Indicator of Spatial Associations (LISA)"

Please choose carefully on your target variable. Conduct EDA mapping if necessary as we hope the selected target variable to exhibit spatial autocorrelation to highlight the purpose of this lab exercice.

- ***Task 1 LISA mapping***
  - *Create a spatial weights for your data*
  - *Create the LISA significance map (p<0.05) and LISA cluster map*
  - *How many observations are there in each significance level? Where are they?*
  - *How many observations are there in each type of local spatial association? Where are they?*

Ans- I created a spatial weights matrix for the data and generated a LISA significance map (p < 0.05) and a LISA cluster map and Moran Scatter plot. The significance map showed how many observations were significant at different levels (e.g., p < 0.05, p < 0.01), while the cluster map identified high-high, low-low, high-low, and low-high clusters. This helped me understand where spatial patterns were strongest and what type of clusters existed.

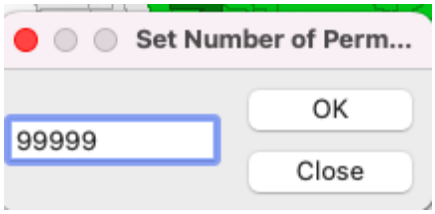


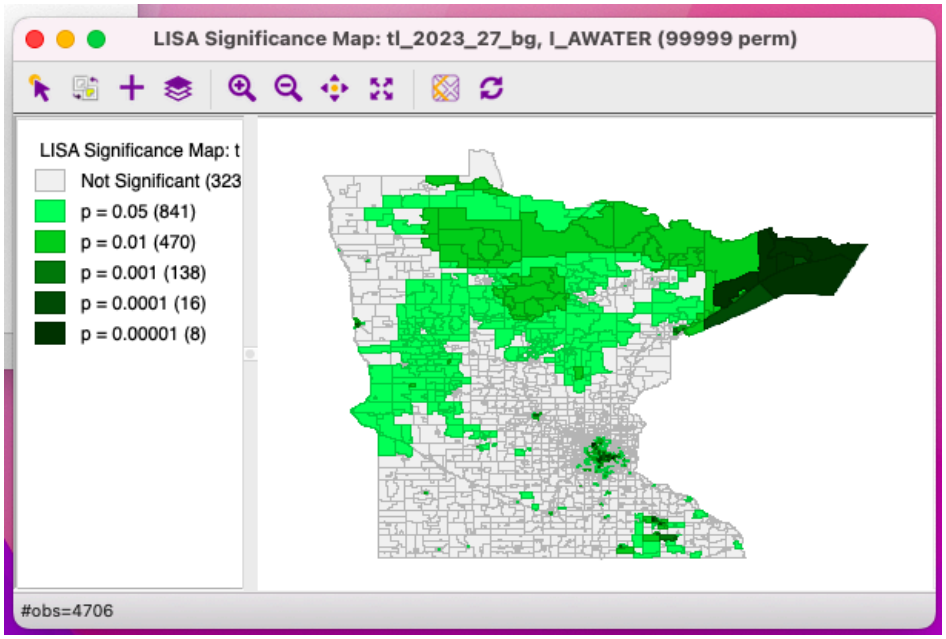


➢ ***Task 2 Local permutation and local statistics***

- *Change your permutation number up to 9999 or 99999, does any observation remain significant under p-value 0.0001 or 0.00001? Any change of those observations under p-value 0.01 found in task 1?*
- *Save the local Moran statistics into your data table, then*
  - *Create a choropleth map of your exported p-value*
  - *Create a choropleth map of your local moran's I*

Ans- I increased the permutation number to 99999 to check if any observations remained significant at stricter p-values (0.0001 or 0.00001) and yes there is some observation value. I also saved the local Moran statistics and created choropleth maps for the p-values and local Moran's I. This allowed me to visualize the spatial distribution of significance and the strength of local spatial autocorrelation.


Set Number of Perm...
99999
OK
Close


LISA Significance Map: tl_2023_27_bg, l_AWATER (99999 perm)
LISA Significance Map: t
Not Significant (323
p = 0.05 (841)
p = 0.01 (470)
p = 0.001 (138)
p = 0.0001 (16)
p = 0.00001 (8)
#obs=4706

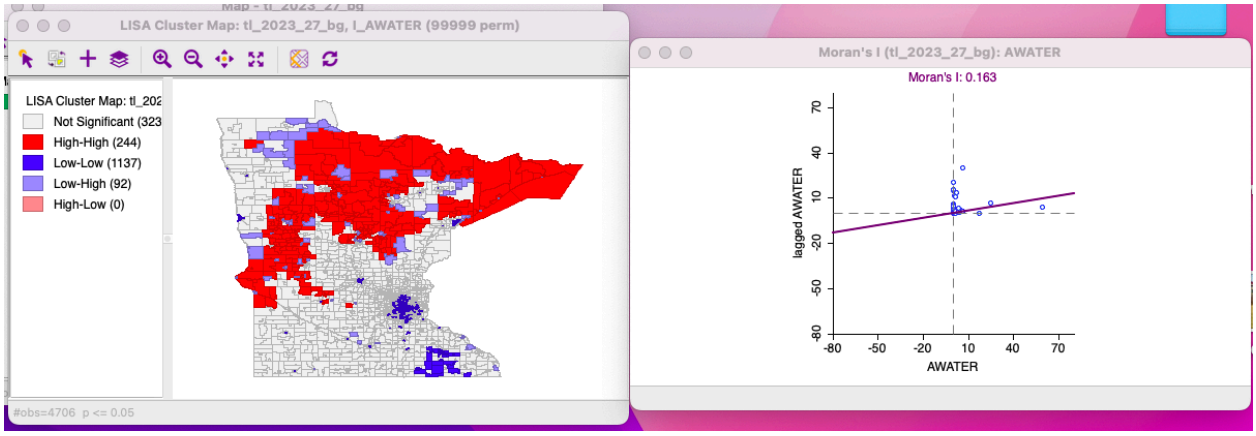
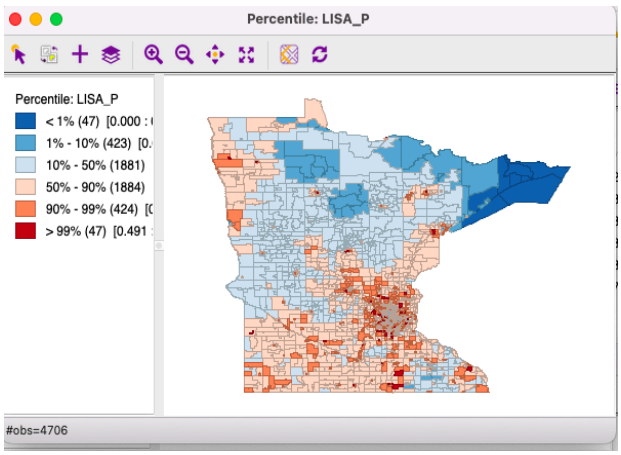
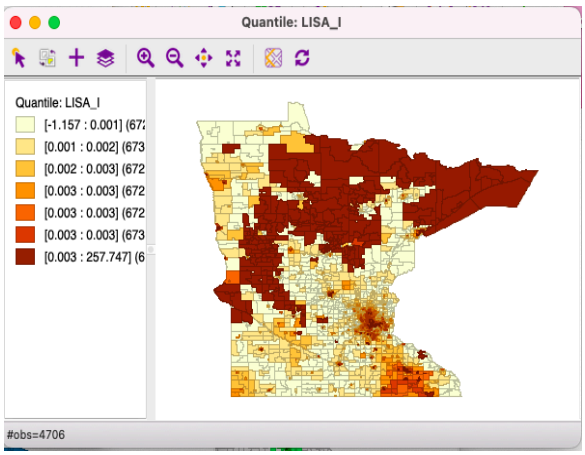

LISA Cluster Map: tl_2023_27_bg, l_AWATER (99999 perm)
LISA Cluster Map: tl_202
Not Significant (323
High-High (244)
Low-Low (1137)
Low-High (92)
High-Low (0)
#obs=4706 p <= 0.05
Moran's I (tl_2023_27_bg): AWATER
Moran's I: 0.163
lagged AWATER
AWATER
70
40
10
-20
-50
-80
-80
-50
-20
10
40
70

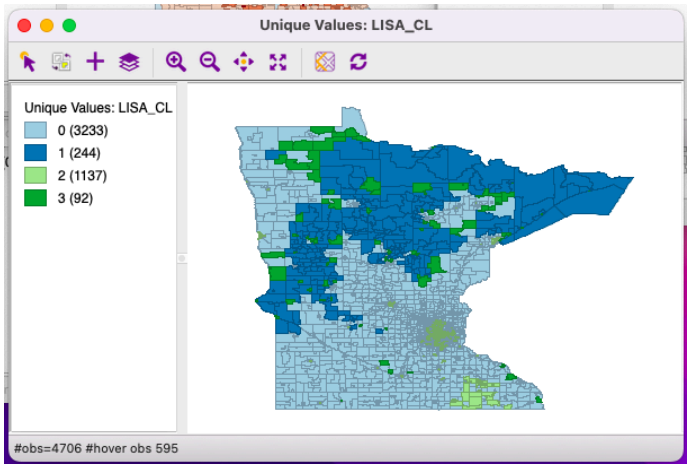
Table - tl_2023_27_bg

	COORD_Y	Z	Z_LAG	Z_LAG_arch	LISA_I	LISA_CL	LISA_P
1	44.052162	-0.056991	-3805.303710	-0.056399	0.003214	0	0.072440
2	44.047084	-0.056991	-7268.692077	-0.056991	0.003248	0	0.053010
3	45.554205	-0.055571	-4519.813380	-0.054927	0.003052	0	0.143220
4	46.073511	0.041077	-2.404113	-0.023842	-0.000979	0	0.253440
5	45.935257	-0.032180	-39.221158	-0.019430	0.000625	0	0.214690
6	45.015772	-0.056990	-11414.540192	-0.056068	0.003195	0	0.173860
7	44.946848	-0.056991	-57846.516858	-0.056866	0.003241	0	0.082610
8	44.944403	-0.056489	-38058.791033	-0.056152	0.003172	0	0.054630
9	45.139514	-0.056613	-7220.412533	-0.056971	0.003225	2	0.000010
10	45.116458	-0.056897	-9393.672150	-0.056929	0.003239	2	0.003100
11	44.866550	-0.056901	-7881.138803	-0.054974	0.003128	0	0.140560
12	44.888316	-0.056081	-8303.989325	-0.054283	0.003044	0	0.247980
13	44.882755	-0.056697	-8520.117437	-0.053774	0.003049	0	0.313590
14	44.866164	-0.056902	-7266.526701	-0.052177	0.002969	0	0.376300
15	45.126367	-0.056991	-10124.320871	-0.056875	0.003241	2	0.027860
16	45.145425	-0.056991	-10148.901921	-0.056475	0.003219	0	0.089110
17	45.130676	-0.055866	-7356.452893	-0.056027	0.003130	2	0.047170
18	45.153078	-0.056156	-12102.882070	-0.056833	0.003192	2	0.023240
19	45.151842	-0.036634	-3478.430255	-0.037872	0.001387	0	0.348720
20	45.183888	-0.056975	-8935.224270	-0.054410	0.003100	0	0.285900
21	45.179830	-0.056991	-8377.718930	-0.055286	0.003151	0	0.152080

#row=4706

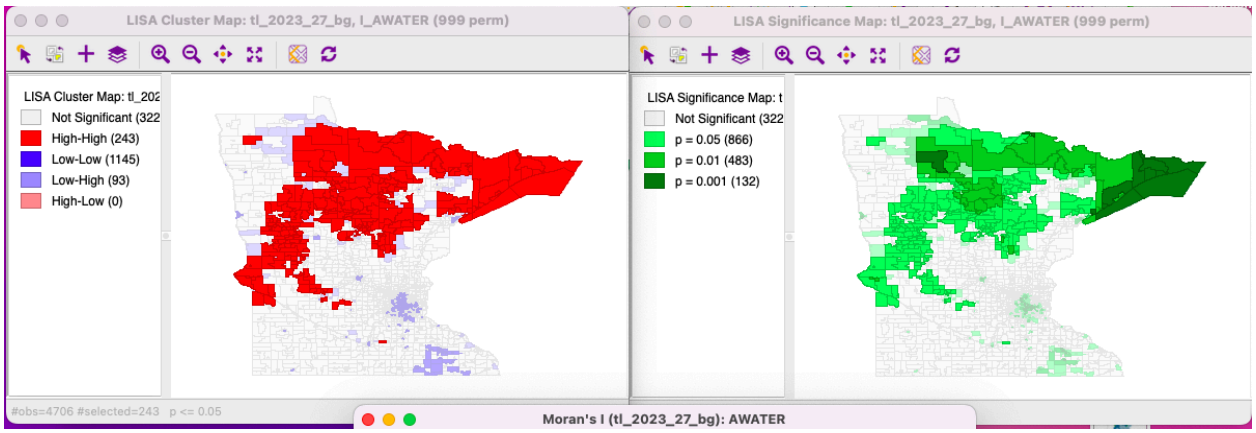


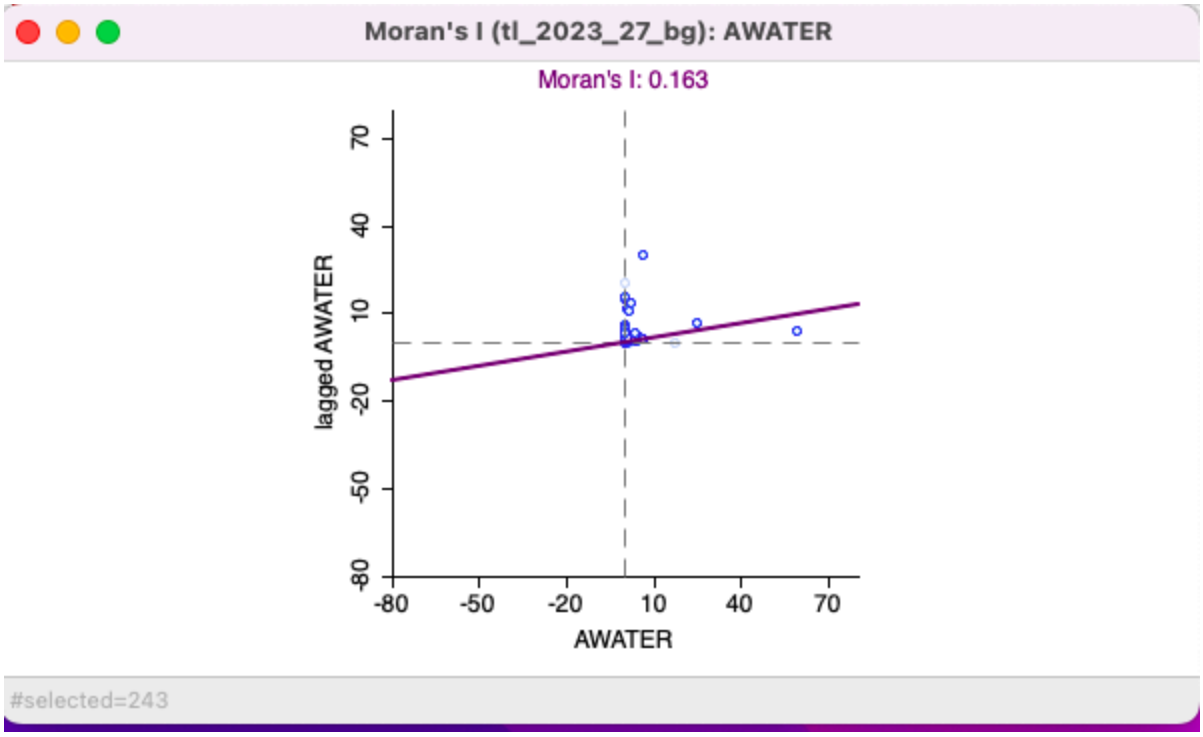


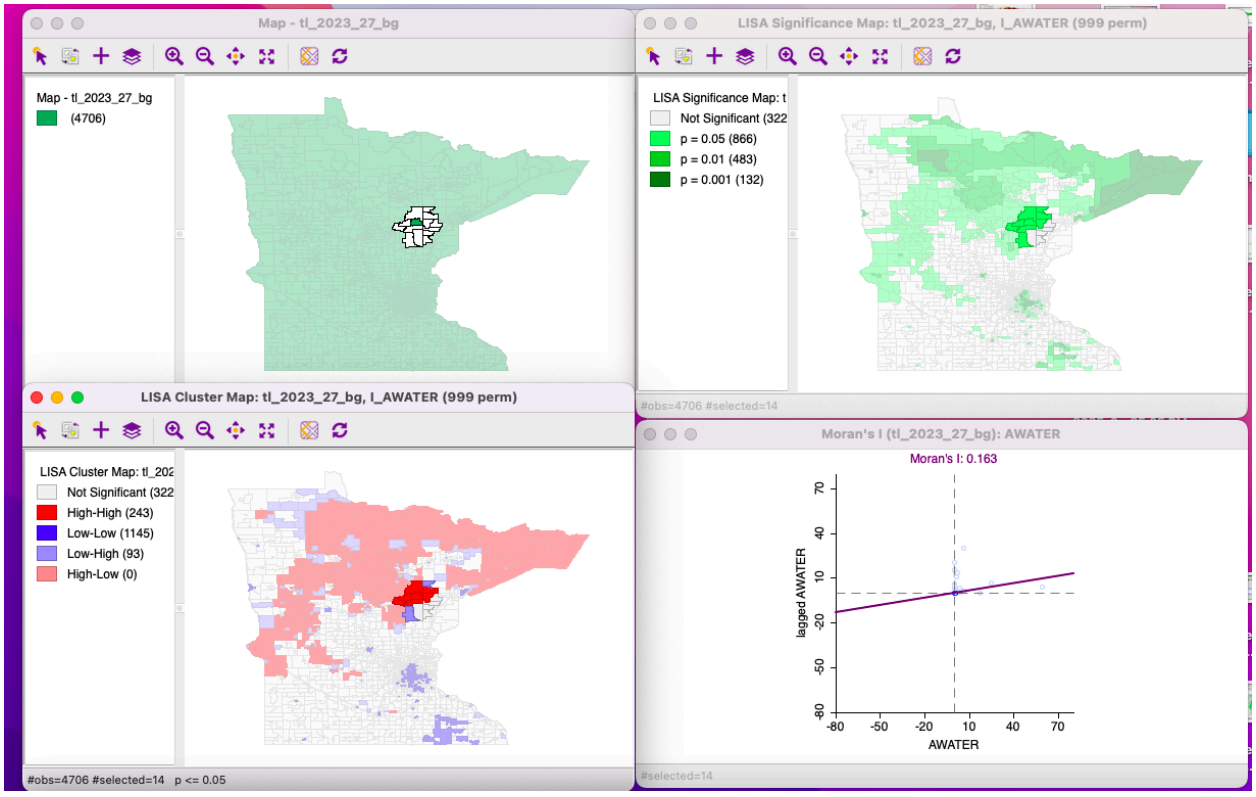


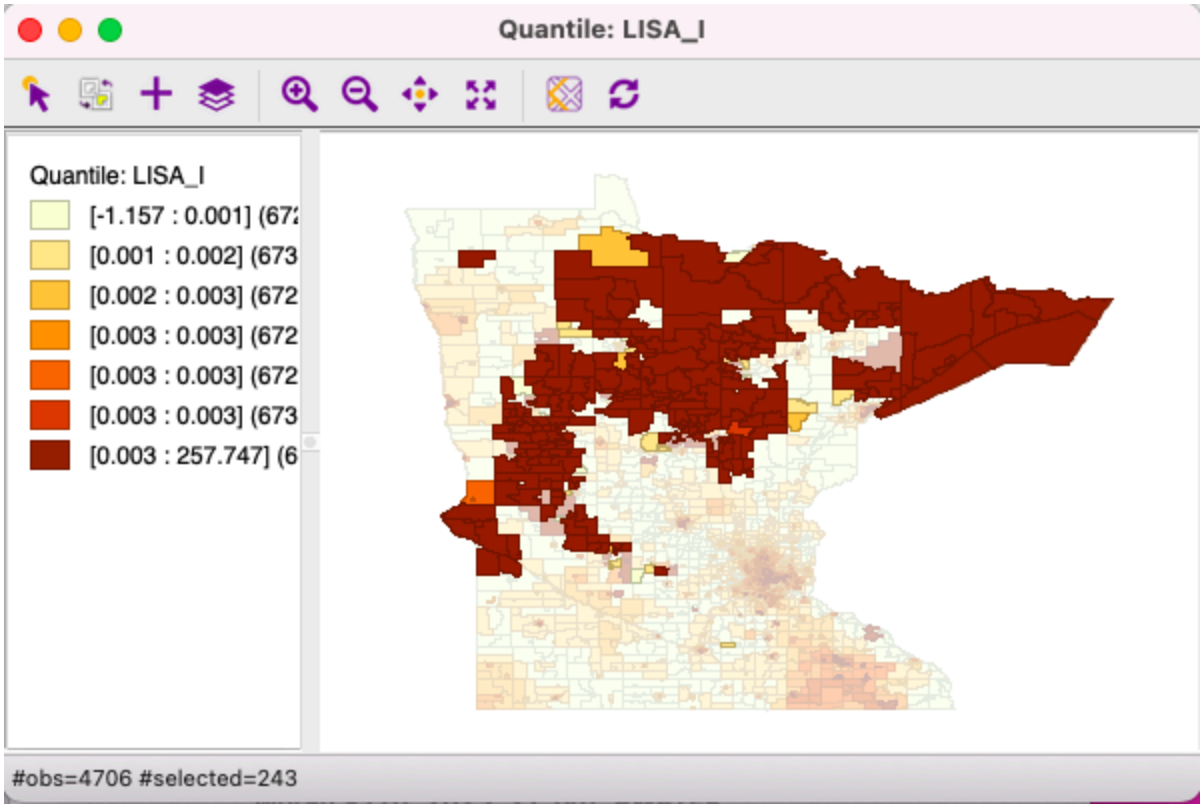
- ***Task 3 Moran scatter plot and LISA maps***
  - *Highlight the high-high clusters and high-low spatial outliers in your LISA cluster map by brushing the corresponding moran scatterplot*
  - *Create a choropleth map of your target variable with a certain map classification.*
  - *Highlight the high-high clusters and their neighbors in the choropleth map of your target variable.*

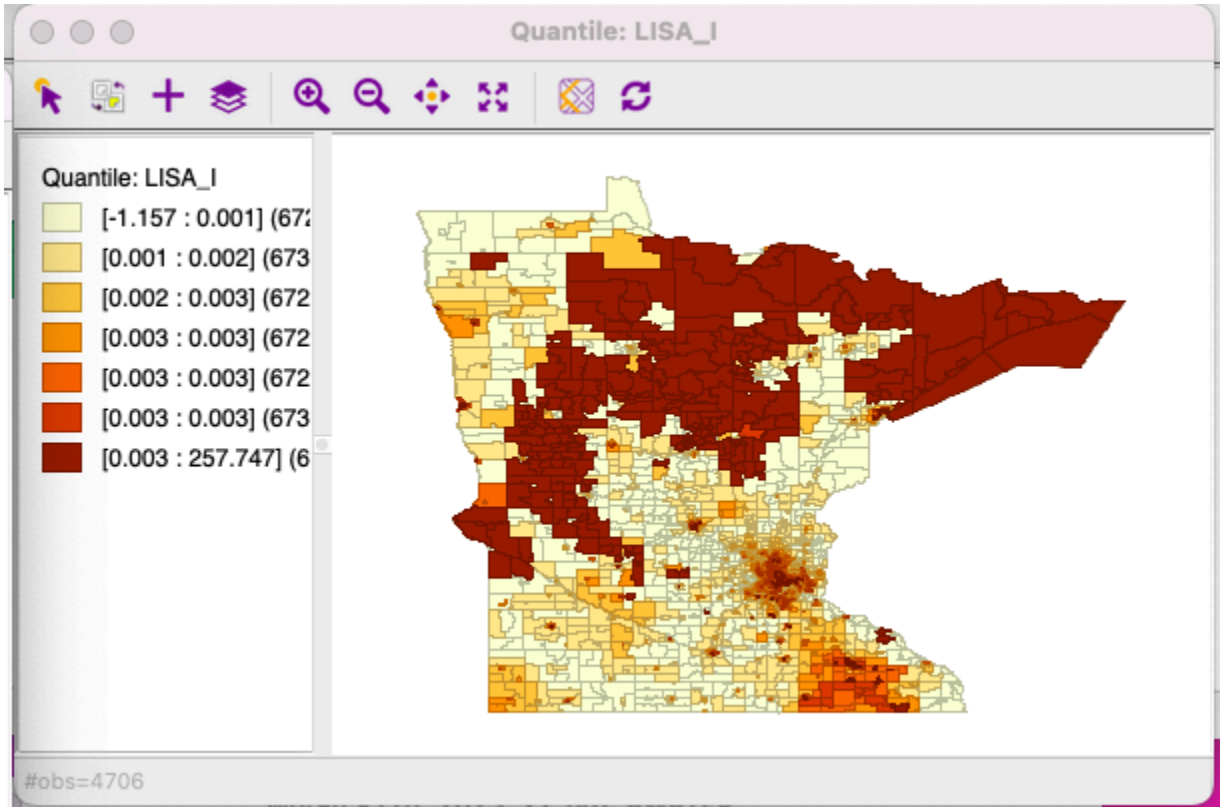
Ans- I highlighted high-high clusters and i don't have high-low outliers in the LISA cluster map. Then, I created a choropleth map of the target variable and highlighted the high-high clusters and their neighbors. This helped me see how clusters and outliers were distributed across the map.




Moran's I (tl_2023_27_bg): AWATER
Moran's I: 0.163
lagged AWATER
AWATER
-80
-50
-20
10
40
70
#selected=243


Map - tl_2023_27_bg
Map - tl_2023_27_bg
(4706)
LISA Significance Map: tl_2023_27_bg, l_AWATER (999 perm)
LISA Significance Map: t
Not Significant (322
p = 0.05 (866)
p = 0.01 (483)
p = 0.001 (132)
#obs=4706 #selected=14
LISA Cluster Map: tl_2023_27_bg, l_AWATER (999 perm)
LISA Cluster Map: tl_202
Not Significant (322
High-High (243)
Low-Low (1145)
Low-High (93)
High-Low (0)
#obs=4706 #selected=14 p <= 0.05
Moran's I (tl_2023_27_bg): AWATER
Moran's I: 0.163
lagged AWATER
AWATER
#selected=14

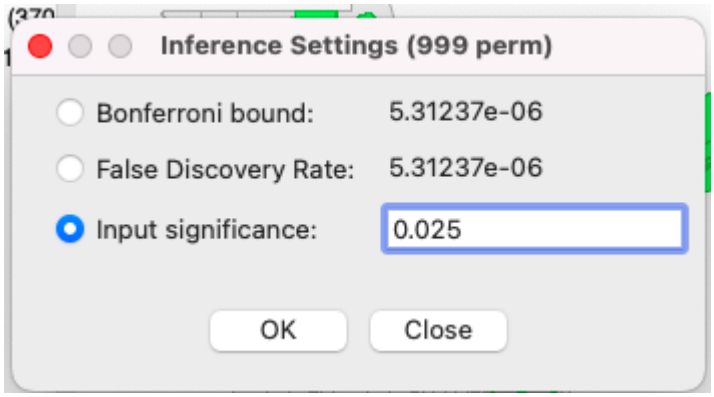

Quantile: LISA_I
Quantile: LISA_I
[-1.157 : 0.001] (67
[0.001 : 0.002] (673
[0.002 : 0.003] (672
[0.003 : 0.003] (672
[0.003 : 0.003] (672
[0.003 : 0.003] (673
[0.003 : 257.747] (6
#obs=4706 #selected=243

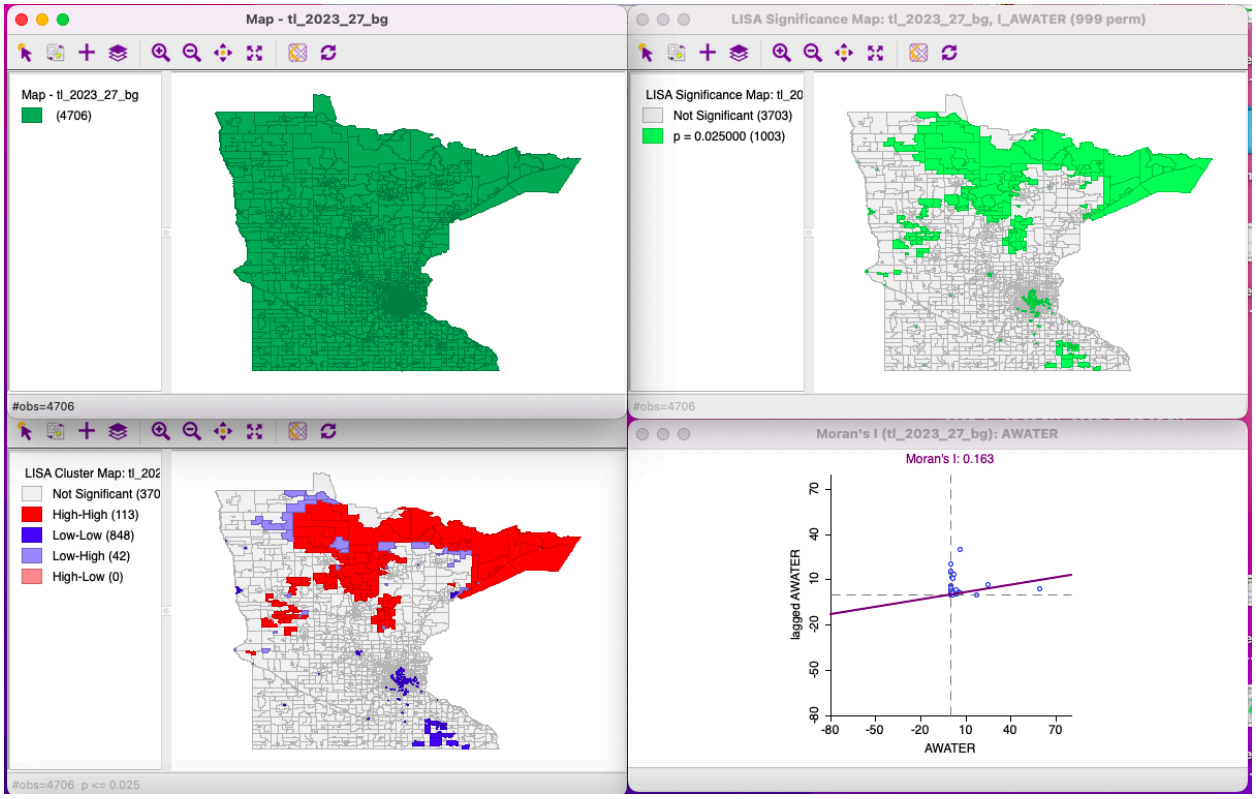

Quantile: LISA_I
Quantile: LISA_I
[-1.157 : 0.001] (67
[0.001 : 0.002] (673
[0.002 : 0.003] (672
[0.003 : 0.003] (672
[0.003 : 0.003] (672
[0.003 : 0.003] (673
[0.003 : 257.747] (6
#obs=4706

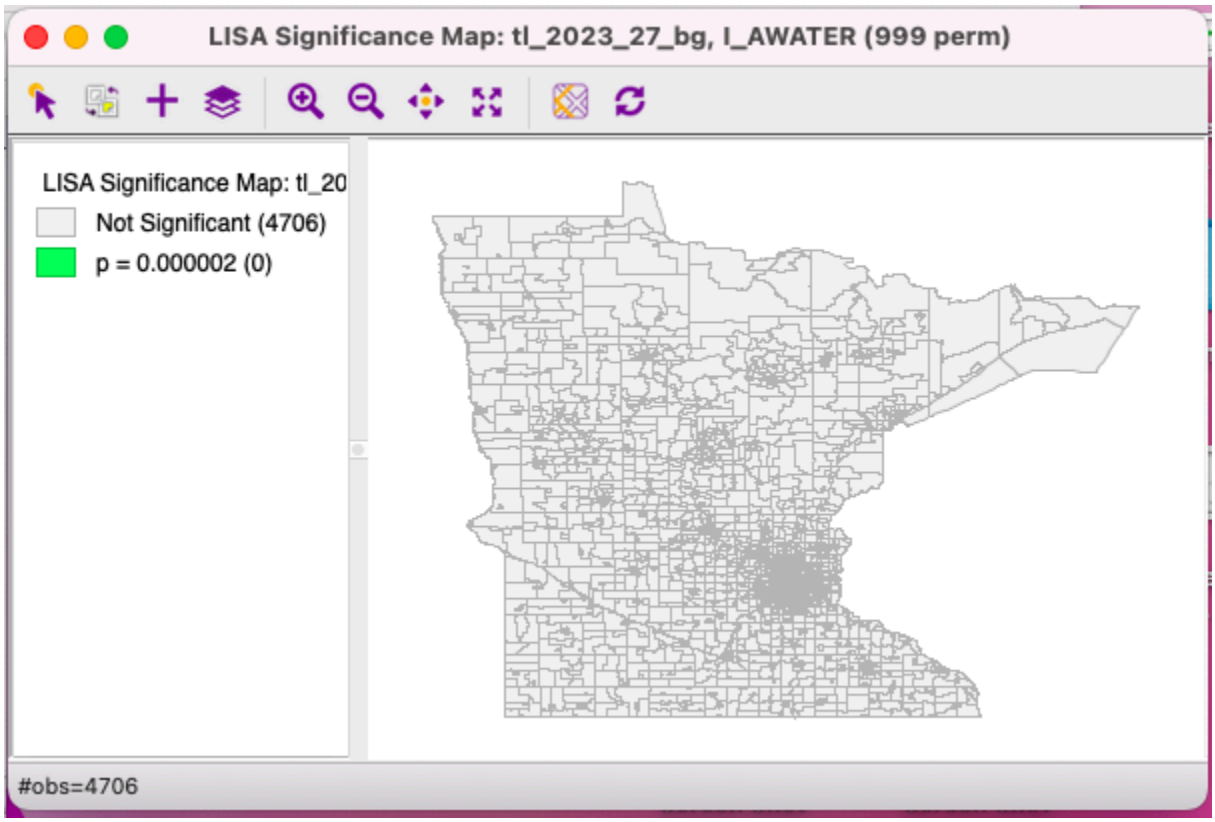
➢ ***Task 4 Significance filter and Interpretation***

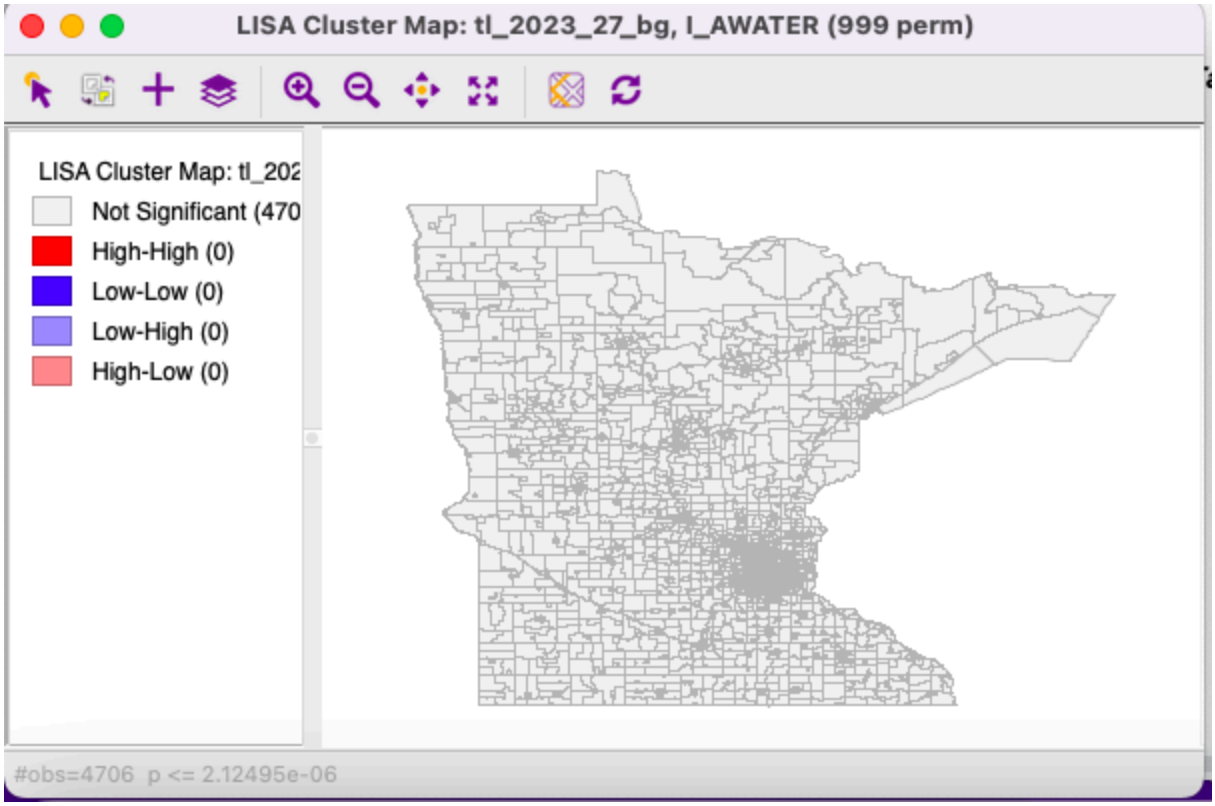
- *Customize your input significance with a p-value = 0.025, how many of the observations are considered significant under 0.025?*
- *Use Bonferroni bound as the cut-off p-value (change the input significance if necessary), make sure there is at least one significant observation left. Let us know what's the input significance and the corresponding Bonferroni bound. What is(are) the type(s) of LISA for the significant observation(s)? "Zero obs"*
- *How many observations left if we use the FDR under the same setting of the previous question?*

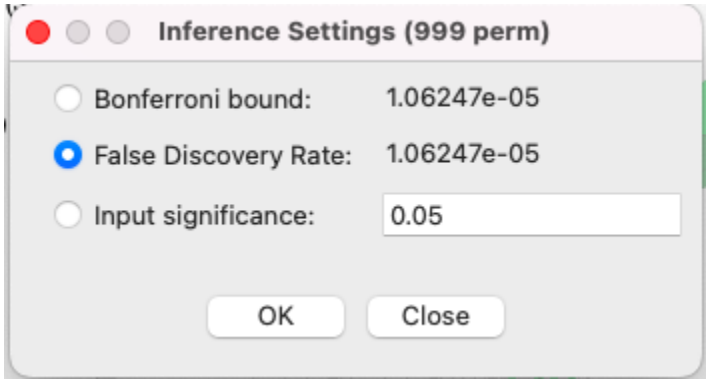
Ans- I customized the significance filter to use a p-value of 0.025 and checked significant observations. Using the Bonferroni bound, I adjusted the significance level to ensure at least one significant observation remained but, there was zero p value observation . I also applied the False Discovery Rate (FDR) to compare the number of significant observations under different criteria and got zero p value observation.

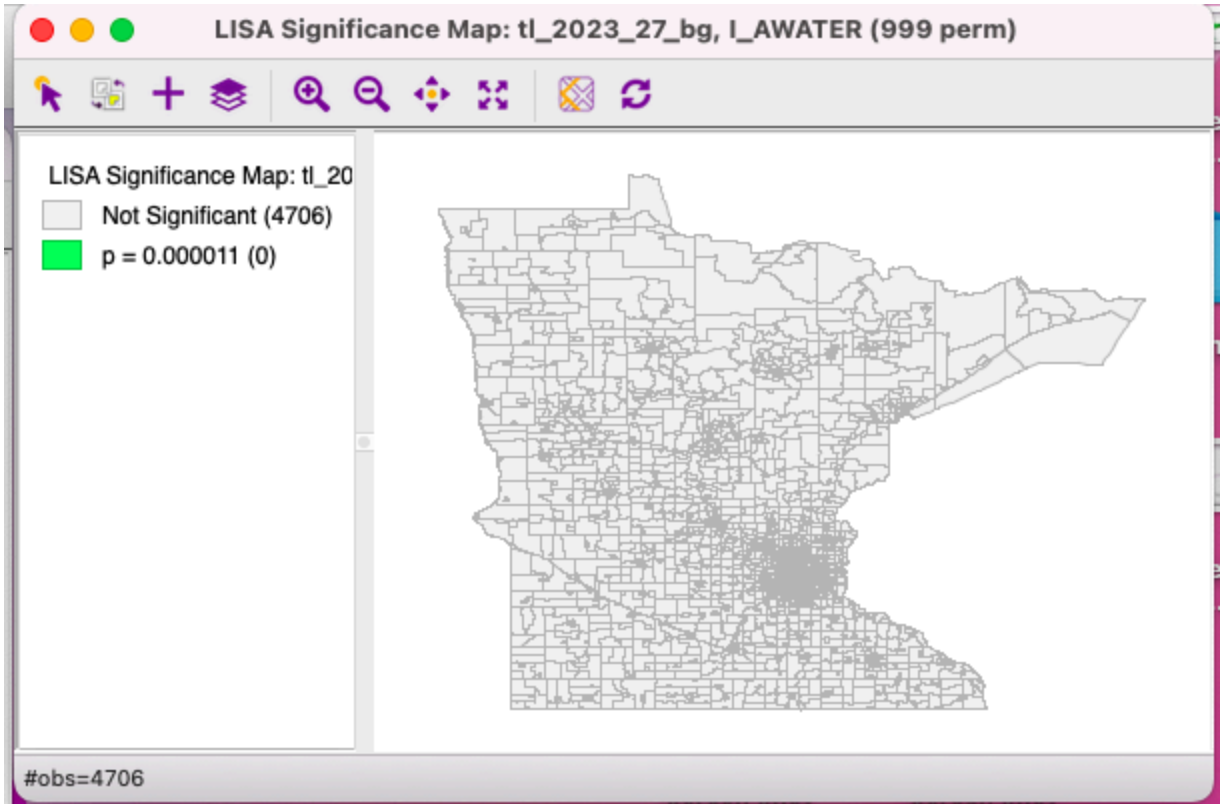


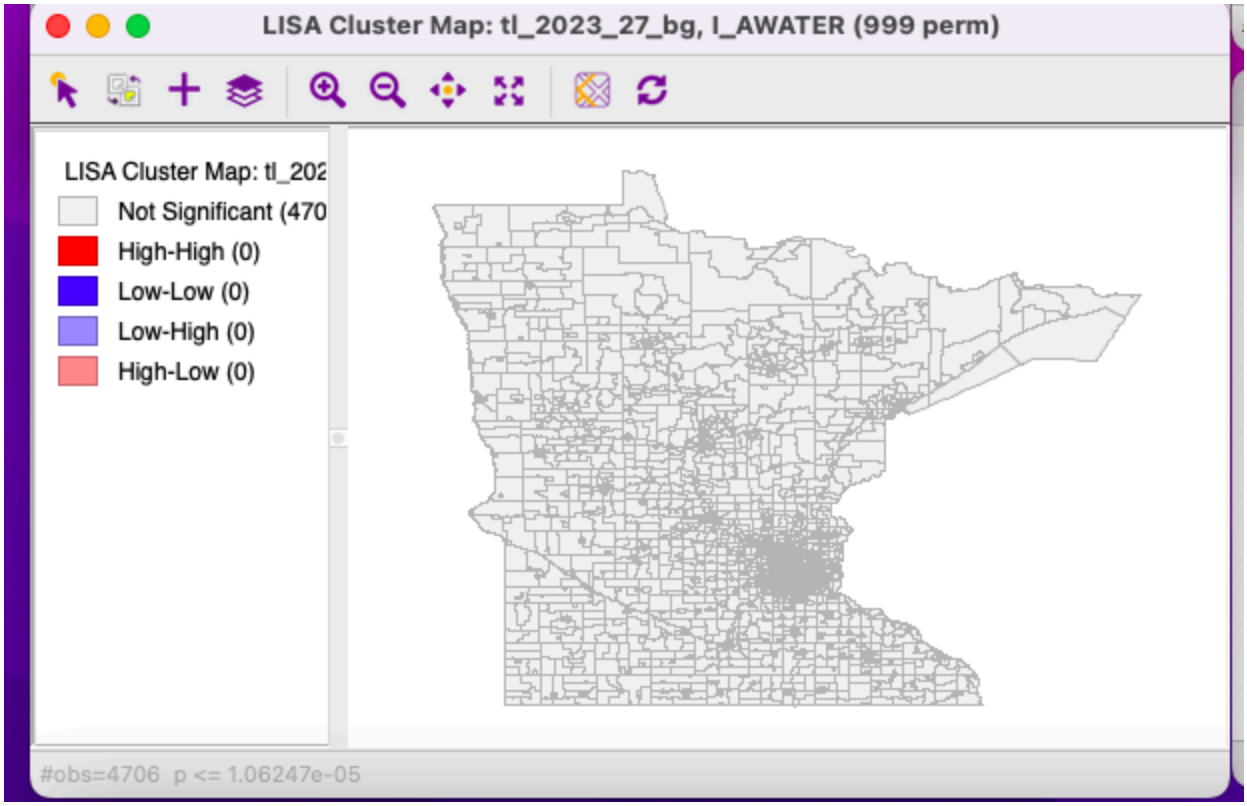

Map - tl_2023_27_bg
Map - tl_2023_27_bg
(4706)
#obs=4706
LISA Significance Map: tl_2023_27_bg, l_AWATER (999 perm)
LISA Significance Map: tl_20
Not Significant (3703)
p = 0.025000 (1003)
#obs=4706
LISA Cluster Map: tl_202
Not Significant (370
High-High (113)
Low-Low (848)
Low-High (42)
High-Low (0)
#obs=4706 p <= 0.025
Moran's I (tl_2023_27_bg): AWATER
Moran's I: 0.163
lagged AWATER
AWATER
70
40
10
-20
-50
-80
-80
-50
-20
10
40
70


LISA Significance Map: tl_2023_27_bg, l_AWATER (999 perm)
LISA Significance Map: tl_20
Not Significant (4706)
p = 0.000002 (0)
#obs=4706


LISA Cluster Map: tl_2023_27_bg, I_AWATER (999 perm)
LISA Cluster Map: tl_202
Not Significant (470
High-High (0)
Low-Low (0)
Low-High (0)
High-Low (0)
#obs=4706 p <= 2.12495e-06

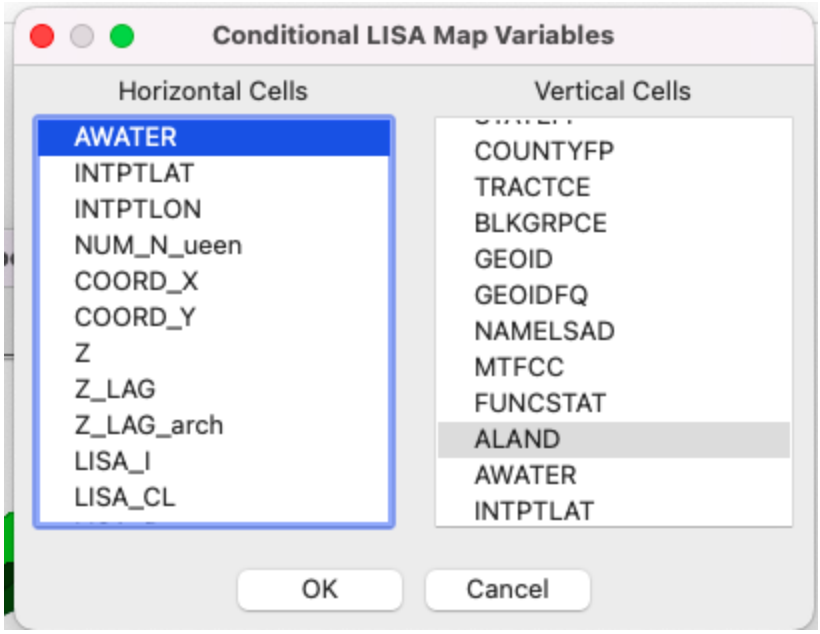

Inference Settings (999 perm)
Bonferroni bound: 1.06247e-05
False Discovery Rate: 1.06247e-05
Input significance: 0.05
OK
Close

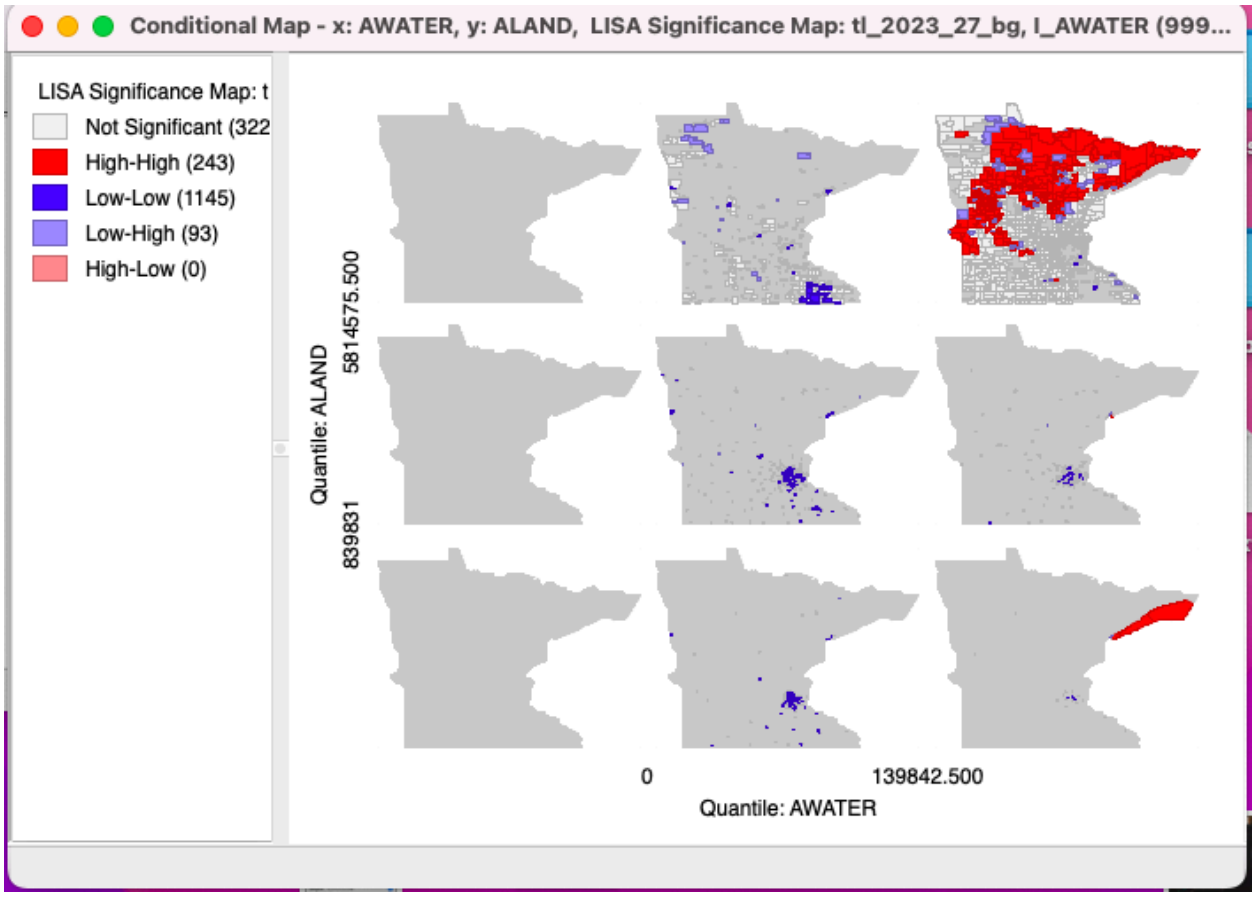

LISA Significance Map: tl_2023_27_bg, I_AWATER (999 perm)
LISA Significance Map: tl_20
Not Significant (4706)
p = 0.000011 (0)
#obs=4706

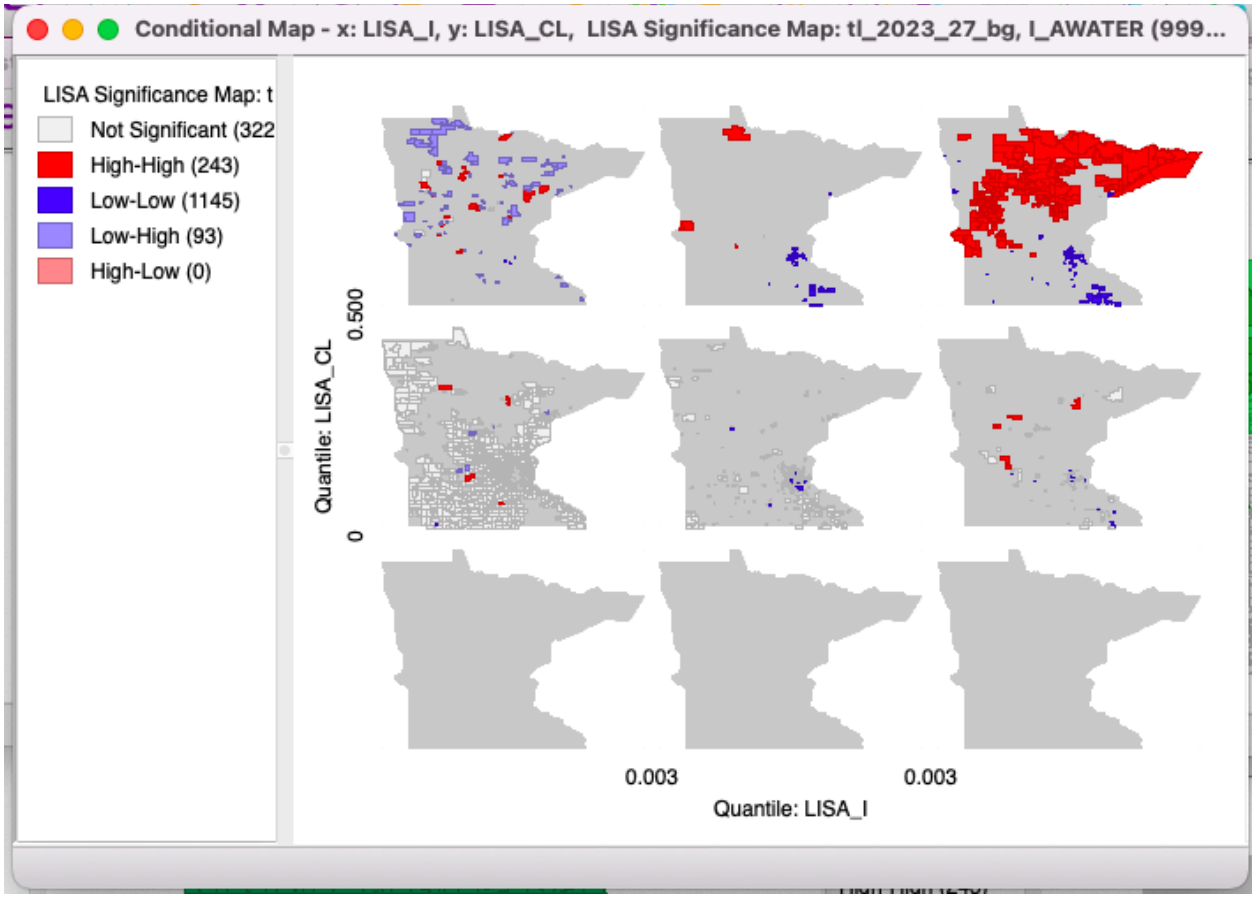


- ***Task 5 Conditional Local Cluster Maps***
  - *Pick one or two conditional variables and generate the corresponding local cluster maps (p<0.05)*
  - *Whether the micromaps suggest different patterns across your conditions?*

Ans-I selected two conditional variables (ALAND and AWATER) and generated conditional local cluster maps (p < 0.05) and I also select 2 variable (LISA_I and LISA_CL) and created 2 maps. By comparing the micromaps, I assessed whether the spatial patterns varied across different conditions, revealing potential interaction effects between the target variable and the conditioning variables.


Conditional LISA Map Variables
Horizontal Cells
Vertical Cells
AWATER
INTPTLAT
INTPTLON
NUM_N_ueen
COORD_X
COORD_Y
Z
Z_LAG
Z_LAG_arch
LISA_I
LISA_CL
COUNTYFP
TRACTCE
BLKGRPCE
GEOID
GEOIDFQ
NAMELSAD
MTFCC
FUNCSTAT
ALAND
AWATER
INTPTLAT
OK
Cancel


Conditional Map - x: AWATER, y: ALAND, LISA Significance Map: tl_2023_27_bg, I_AWATER (999...
LISA Significance Map: t
Not Significant (322
High-High (243)
Low-Low (1145)
Low-High (93)
High-Low (0)
Quantile: ALAND
5814575.500
839831
0
139842.500
Quantile: AWATER


Conditional Map - x: LISA_I, y: LISA_CL, LISA Significance Map: tl_2023_27_bg, I_AWATER (999...
LISA Significance Map: t
Not Significant (322
High-High (243)
Low-Low (1145)
Low-High (93)
High-Low (0)
Quantile: LISA_CL
0.500
0
0.003
0.003
Quantile: LISA_I