A Spatial Analysis of Groundwater Level of the Coastal Aquifer In South Florida

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INTRODUCTION

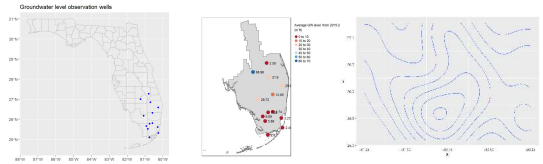
Most freshwater sources in Southern Florida, are from underground aquifers. These aquifers are among the most productive in the world [1,11,12]. Therefore, understanding the groundwater level and quality of Southern Florida is very important. The volume of groundwater in storage is decreasing in many areas of South Florida in response to pumping[1,10]. Another challenge, the Southern Florida groundwater quality being affected by anthropogenic and geogenic variability [2]. There is a saltwater intrusion towards the mainland from the ocean, affecting both surface and groundwater resources [3, 13]. The groundwater depletion in Southern Florida will impact the available freshwater for domestic water supply, irrigation, industrial activities, and environmental flow. Further, due to the groundwater head differences, the seawater intrusion to the mainland will be increased [7,8] Hence, the South Florida water resources need sustainable management. In connection, investigating the spatial and temporal groundwater quality is the first step for further management scenario developments [4,5]. Understanding and predicting the water quality interactions between the shallow aquifer and surface water is critical in meeting current environmental regulations[6].

RESEARCH QUESTIONS

1. How does the groundwater level fluctuate in the coastal aquifer of South Florida?
2. How does electrical conductivity (EC) vary in South Florida?

OBJECTIVES

- Developing the groundwater level map of Southern Florida.
- Creating the groundwater quality map of EC of Southern Florida.

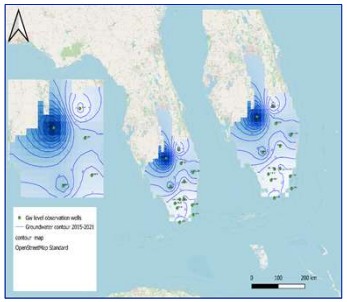


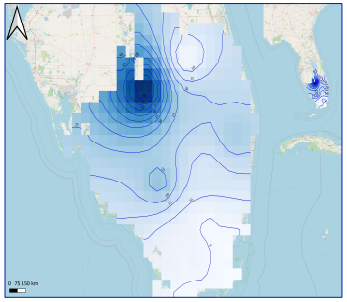
Study area : South Florida water management district

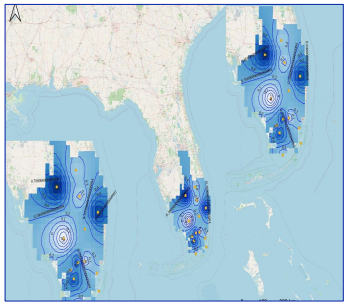
METHODS AND MATERIAL

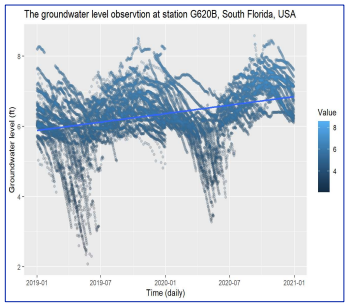
This project's goal was to download, analyze, and present visualizations utilizing tools in the R program including, dbhydroR, spatial analysis, lubridate, mapview and ggplot. The hydrological data was collected from the South Florida Water Management District's corporate environmental database, DBHYDRO. The groundwater quality data was collected using the R code from 2010 to 2020. Statistical analysis of the data: The descriptive statistics will be analyzed using the RStudio, and a groundwater level and salinity couture maps will be developed.

- Load R packages and download data from listed sources.
- Load the the groundwater level and water quality data from DBHYDRO and SP CONDUCTIVITY.
- Analyze and process the data and find the average value of the selected stations.
- Use point data to create visualizations in R program.









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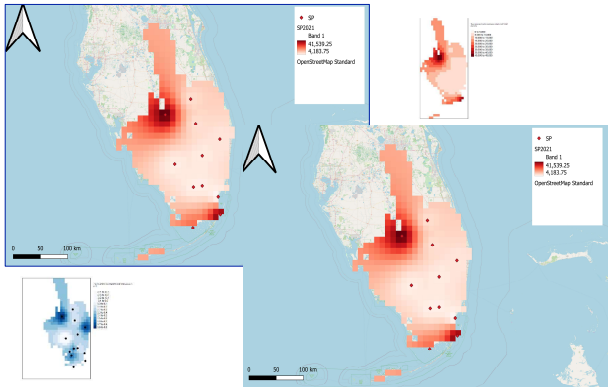
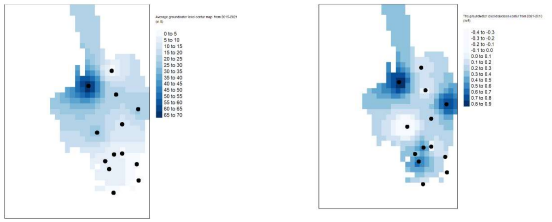
RESULTS



The spatial maps show that the groundwater is depleted around Hendry country. The specific conductivity is higher values observed around the gw depleted & boundaries to the offshore.



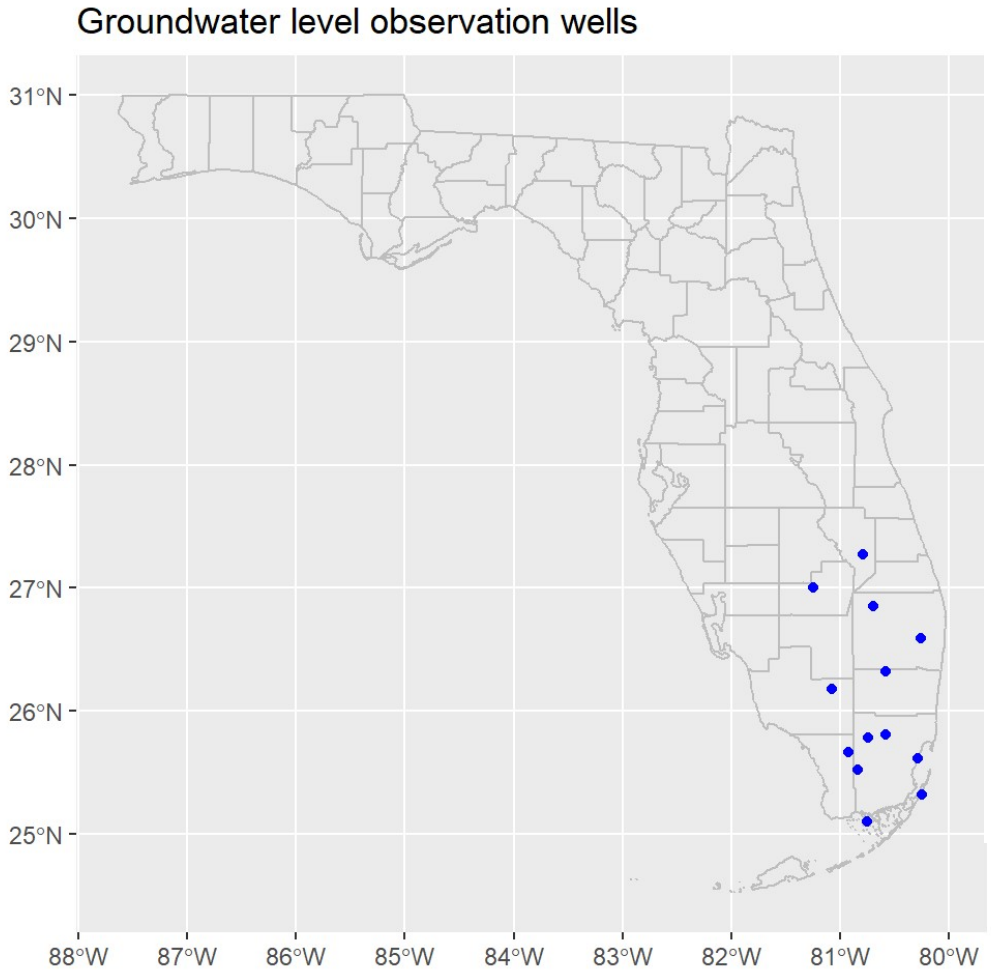
CONCLUSION

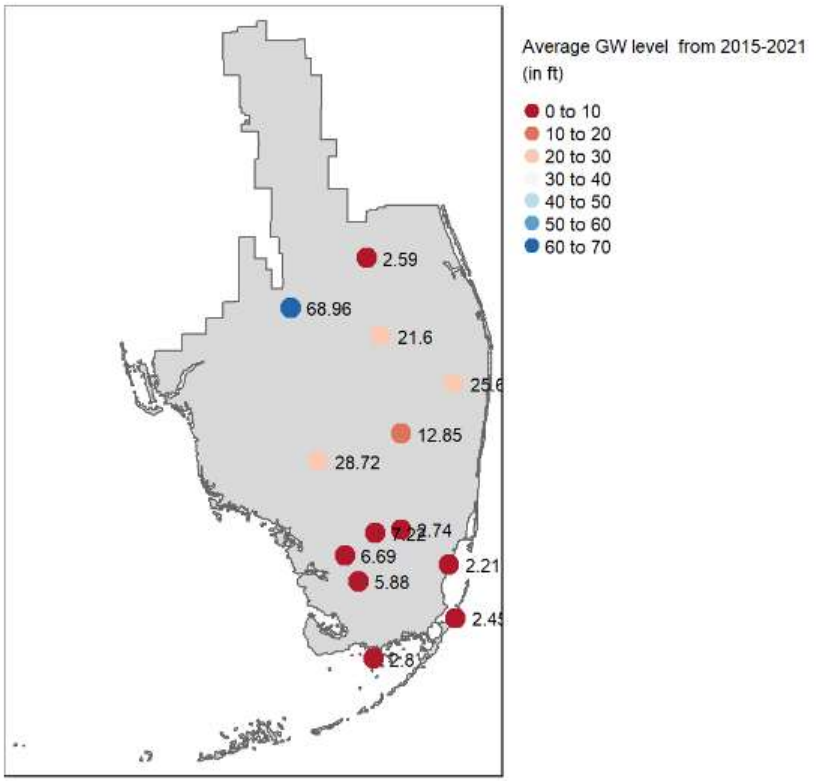
In many cases, conductivity is linked directly to the total dissolved solids (TDS). High quality deionized water has a conductivity of about 0.05 µS/cm at 25 ° C, typical drinking water is in the range of 200–800 µS/cm, while sea water is about 50 mS/cm (or 50,000 µS/cm). The contours show higher than the threshold values.

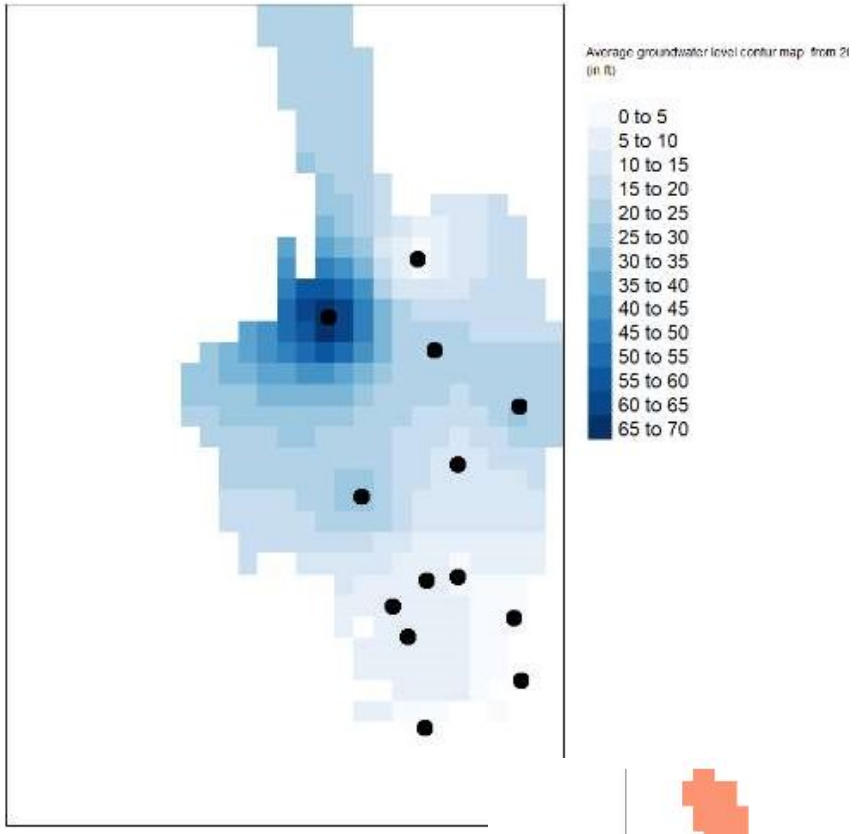
REFERENCES

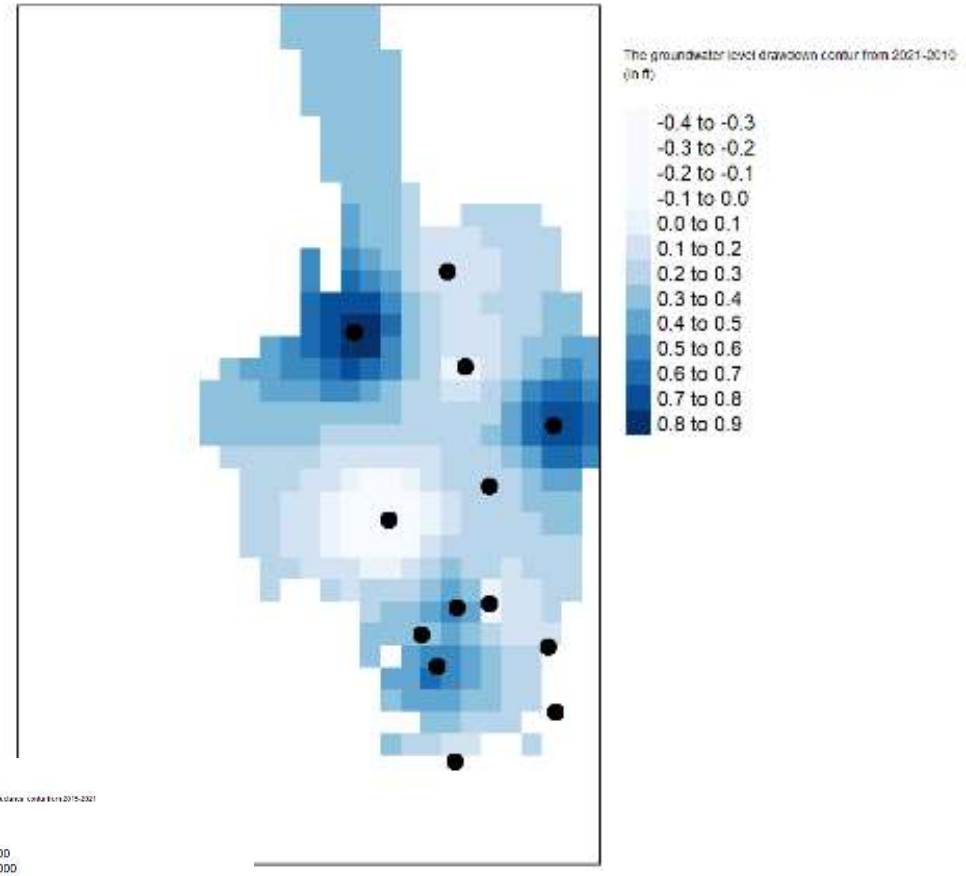
1. Knox, G. W. (1988). Drought tolerant plants for North and Central Florida. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.
2. Carriker, R. R. (1987). *Agriculture and Groundwater Quality: The Florida Experience* (No. 792-2016-52227, pp. 149-156).
3. Al Naeem, M. F. A., Yusoff, I., Ng, T. F., Maity, J. P., Alias, Y., May, R., & Alborsh, H. (2019). A study on the impact of anthropogenic and Chowdhury, A. H., Scanlon, B. R., Reedy, R. C., & Young, S. (2018). Fingerprinting groundwater salinity sources in the Gulf Coast Aquifer unningham, K. J., & Florea, L. J. (2009). The Biscayne aquifer of southeastern Florida. Geography/Geology Faculty Publications, 20.

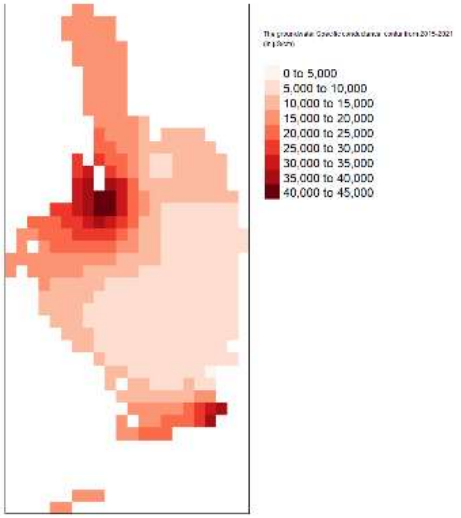
Study area


Groundwater level observation wells
31°N
30°N
29°N
28°N
27°N
26°N
25°N
88°W
87°W
86°W
85°W
84°W
83°W
82°W
81°W
80°W


Average GW level from 2015-2021
(in ft)
0 to 10
10 to 20
20 to 30
30 to 40
40 to 50
50 to 60
60 to 70
2.59
68.96
21.6
12.85
28.72
2.74
6.69
2.21
5.88


Average groundwater level contur map from 2
(in ft)
0 to 5
5 to 10
10 to 15
15 to 20
20 to 25
25 to 30
30 to 35
35 to 40
40 to 45
45 to 50
50 to 55
55 to 60
60 to 65
65 to 70


The groundwater level drawdown contur from 2021-2010
(in ft)
-0.4 to -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to 0.0
0.0 to 0.1
0.1 to 0.2
0.2 to 0.3
0.3 to 0.4
0.4 to 0.5
0.5 to 0.6
0.6 to 0.7
0.7 to 0.8
0.8 to 0.9


0 to 5,000
5,000 to 10,000
10,000 to 15,000
15,000 to 20,000
20,000 to 25,000
25,000 to 30,000
30,000 to 35,000
35,000 to 40,000
40,000 to 45,000