

## **Analysis of the effects of recent climatic droughts on the salinity of subterranean waters using geostatistical and GIS methods in Yazd- Ardakan Plain**

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### **Extended Abstract**

#### **Introduction**

Droughts are one of the most common climatic changes that occur in many arid and semi-arid regions of the world with high intensities every few years. In many years, the occurrence of droughts is also unknown for a while, therefore, the identification of drought itself, is considered as a valuable finding for managing the water resources in areas such as Iran, most of which are formed by arid and semi-arid regions. Precipitation is the most important determinant variable in drought conditions among climatic variables. Rainfall is the most important variable whose variations are directly reflected in soil moisture and surface runoff, variations in underground water reservoirs and others. The purpose of this research is to investigate the best method of drought interpolation in the Yazd-Ardakan plain, to identify areas at risk of this phenomenon and to identify its spatial distribution, and also to investigate the relationship between drought and the salinity of groundwater and the spatial distribution of saline water in the Great Plain of Yazd – Ardakan.

#### **Materials & Methods**

In this research, regarding the lack of long-term statistical period of some stations and considering the distribution of stations in this basin, the annual precipitation data of meteorological stations of Yazd - Ardakan plain during 2 long term period of 7 meteorological stations (1346-1391), and short term precipitation and salinity period of 41 meteorological stations and 47 underground water wells (1375 to 1391) have been used all together. The standardized drought index for the determining drought condition and descriptive statistics methods in SPSS software has been used to describe the state of groundwater salinity using Excel software. The Pearson, Man-Kendhal, and Spearman correlation analyses were also used to determine the relationship between drought and the state of salinity of groundwater. Finally, the Geographic Information System (GIS) was also used to map the zoning of groundwater salinity.

#### **Results & Discussion**

The results of the assessment showed that in the correlation analysis with all 3 Pearson, Man-Kendhal, and

Spearman statistics, a negative trend along with inverse correlation is observed between the precipitation (SPI) and salinity based on the Z grade, in none of which the significant level is observed. The existence of a strong correlation between these two parameters with a one year delay was among the other results of this research. Using GS+ and GIS, the best variogram model was selected and the maps of drought, groundwater salinity and salinity variations were also drawn. Generally, in most stations with negative precipitation trend, a positive trend of underground water salinity is observed, and groundwater quality has also changed more strongly in areas with more drought outbreak and its salinity has also increased.

### Conclusion

The occurrence of droughts, on the one hand, increasing water demand in the area, on the other hand, exacerbate the shortage and need for water. Therefore, the monitoring of future droughts and wet years should be considered very important in terms of management strategies of the region. Passing such crises require the efficient management of water resources under present conditions, especially during drought periods. Usually, during such a period, the region's water shortage, are provided from the groundwater resources and through increasing the water extraction from wells, to meet basic needs such as drinking. Therefore, in such cases, the quality issue of the extracted water from these wells becomes more important. The available statistics show that the water quality in the Yazd-Ardakan plain (electrical conductivity) is a function of annual precipitation (as the most important feature of droughts in the region), and with the annual precipitation increasing and decreasing, the groundwater quality also undergoes changes. In general, the results of the analysis of the studied parameters indicated that the climate of Yazd-Ardakan plain was associated with a rainfall reduction trend, which is one of the important factors of drought, so that, its consequences have also affected the level and quality of water resources. It has been observed in this research, that droughts have had a considerable effect on the salinity of groundwater in most of the areas. Therefore, it is generally stated that the groundwater quality has changed more strongly in areas with more drought outbreaks and its salinity has increased.

**Keywords:** Drought, Subterranean Waters, Salinity, Geostatistical, Geographic Information Systems (GIS), Yazd-Ardakan Plain