# Response of groundwater level in observational boreholes of Sarcheshmeh copper mine to rainfall

**Hassan Sahraei Parizi and Nozar Samani**
**Science Faculty, Shiraz University, Shiraz 71454, Iran**

Sahra526@gmail.com

**Abstract**

Sarcheshmeh copper mine is one of the largest porphyry copper deposits in the world, which is located in a mountainous region in south-eastern Iran. The considerable amount of mean annual precipitation together with fractured rocks, which facilitate the groundwater recharge, make a lot of problems for mining operation due to groundwater entrance to the pit. Determination of the relationship between rainfall occurrence and groundwater level response is a key factor for constructing an appropriate dewatering plan for the pit. In this study the fluctuations of groundwater level at three observational boreholes and rainfall records of the Sarcheshmeh meteorological station are analyzed by employing time series techniques both in time and frequency domains. The results show a relatively quick response of groundwater level to rainfall in two boreholes while the groundwater level in the third borehole show longer lag time with rainfall due to different length of flow path and structural properties.

**Keywords: Time Series, Groundwater response, rainfall, Sarcheshmeh copper mine**

## 1. INTRODUCTION

A groundwater level, whether it be the water table of an unconfined aquifer or the piezometric surface of a confined aquifer, indicates the elevation of atmospheric pressure of aquifer. Any phenomenon that produces a change in pressure on groundwater will cause the groundwater level to vary. Differences between supply and withdrawal of groundwater cause levels to fluctuate. Stream flow variations are closely related to groundwater levels. Other diverse influences on groundwater levels include meteorological and tidal phenomena, urbanization, earthquakes and external loads [1].

Successive monitoring of a variable such as sales of a company, price of a good, air temperature and *etc.* with time in intervals of hour, day, week, month and *etc.* is called a time series [2]. Hydrological and hydrogeological data such as rainfall, evaporation, groundwater level and river's discharge are monitored successively, so that they can be analyzed by time series analysis [3].

Time series are consisted of deterministic as well as stochastic components, deterministic component includes trend (long term changes of mean) and periodicity (regular periodic changes) [4].

Determination of the relation between rainfall and groundwater level fluctuations by stochastic methods is the objective of this research. In this respect, time-series techniques are used and the following sets of data are analyzed:

a) weekly rainfall (cumulative rainfall depth of all rainfall events during each week) monitored at Sarcheshmeh copper mine meteorological station;
b) Weekly groundwater level at three observational boreholes at west wall of Sarcheshmeh copper mine.

All data sets extend for about 3.5 years (188 weeks) from May 2003 to October 2006. These time series are analyzed firstly by univariate techniques and stationary time series are produced by removing the deterministic component of data, then the relation between rainfall and groundwater fluctuations determined by bivariate analysis. Figure 1 shows the location of observational boreholes and meteorological station in the geological map of Sarcheshmeh area.