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Research paper

Assessment of influencing factor method for delineation of groundwater potential zones with geospatial techniques. Case study of Bostanlik district, Uzbekistan

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ABSTRACT

The present study shows the groundwater potential assessment and an effective management of the groundwater resources in Bostanlik district, Uzbekistan based on the integrated utilization of remote sensing and GIS techniques. For the current study, various thematic spatial layers such as soil map, geology map, land use/land cover (LULC), elevation, slope, stream proximity, stream density, curvature, topographic wetness index (TWI) and precipitation are used to delineate groundwater potential zones. GIS based multi-criteria decision analysis (MCDA) was applied. The percentage of groundwater potential zones identified using given factors is shown as 6%, 45%, 26%, 13%, and 10% respectively from very high to very low classes. High and very high probability of groundwater existence occurs within or across the Charvak reservoir and along the Chirchik river. Territories, covered by mountains have low and very low potential of groundwater resources. The rest of the territory has moderate potential for groundwater resources. For the validation of obtained results we have used 31 observed spring locations. Results of overlaying the final map with spring locations shows relatively high accuracy rate. The results of the research can be helpful for determining potential groundwater reserves of the Bostanlik district.

1. Introduction

Groundwater is the most important natural resources in many countries of the world. Groundwater is a sources of drinking water has enough positive signs comparing with the surface water (Khosravi et al., 2018b). Nowadays the contamination of the groundwater is also becoming a vital issue for the community. Rapid population growth in developing countries coupled with climate change exerts additive pressure on water demand, and groundwater resources can be a lifebuoy to avoid water scarcity issues and social tensions (Andualem and Demeke, 2019; Arulbalaji et al., 2019; Lee et al., 2012; Viet-Ha et al., 2020).

Groundwater zones strongly vary through space and time. These factors include hydrological features, such as land use and land cover, soil types, geology and geomorphology, precipitation and evaporation, water bodies, irrigation etc. (Lee et al., 2012; Vidhya and Vinay, 2018). Groundwater resources are being extensively used for several purposes around the world, but mostly for domestic and industrial purposes. In arid and semi-arid countries with small precipitation with high surface runoff, groundwater is also used for agricultural purposes (Selvam et al., 2014).

1.1. Groundwater challenges in Uzbekistan

During the Soviet period, groundwater resources were not as extensively used for agriculture and irrigation as they are now due to the following factors: adequate quantity of surface water, water supply for farms and good irrigational and melioration infrastructure with reliable financial support from the government (Rakhmatullaev et al., 2012). Groundwater resources were only used for livestock farming and other specific purposes.

After the failure of the Soviet Union, the Central Asian countries

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