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A measurable evaluation of the connections between ground- and surface-water in erdos plateau, china's hailiutu river basin

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Abstract

As for the Erdos Plateau, "Because surface water and groundwater are so inextricably linked, hydrological processes are notoriously difficult to comprehend. The more we understand hydrology, the better we can manage the water sources that are available at the same time. Long-term economic growth and poverty reduction are dependent on a healthy ecosystem and responsible use of water resources. There haven't been many studies to see if groundwater withdrawal affects stream flow, which is likely due to the complexity of the water systems here. To ensure the long-term viability of water resource management, a better understanding of the interactions between groundwater and surface water is required. This study seeks to further our understanding of the groundwater-surface water exchange taking place on Erdos. Plateau "in terms of the interaction of groundwater and surface water on the Erdos Plateau.

Keywords: Plateau, Groundwater, Water Resource, Management

INTRODUCTION

Hydrological "cycles" have long been thought of as separate entities, but groundwater and surface water interact in a variety of ways depending on physiographic conditions (e.g., Winter, 1999; Sophocleous, 2002). The availability of groundwater and surface water is critical for global social and economic development. These interactions have been largely overlooked in the development of water resource management policies because they are difficult to assess or quantify (Winter, 1999). According to Findinglay (1995), groundwater and surface water interactions have a significant impact on stream ecosystems, with implications for ecology, river restoration and conservation (Boulton et al., 2010), and the preservation of groundwater-dependent ecosystems (Zhou et al., 2013, Bertrand et al., 2014). There is still a lot! There is some confusion about how groundwater interacts with surface water bodies like rivers, lakes, and reservoirs. Hydrologists and hydrogeologists have identified climate and human activities as the two most important factors, though distinguishing between them on an individual basis remains difficult and contentious (Milliman et al., 2008; Uhlenbrook, 2009; Zhao et al., 2009; Xu, 2011).

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Water resources management has been implemented in several locations in China in order to promote "sustainable development" (Ministry of Water Resources, China, 2005). There are both institutional and technical barriers for those who live in arid/semi-arid regions where groundwater is an important source of water for the community and the environment. Groundwater and surface water interactions play an important role in arid and semi-arid environments. There is some confusion about how groundwater interacts with surface water bodies like rivers, lakes, and reservoirs. Hydrologists and hydrogeologists have identified climate and human activities as the two most important factors, though distinguishing between them on an individual basis remains difficult and contentious (Milliman et al., 2008; Uhlenbrook, 2009; Zhao et al., 2009; Xu, 2011).

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LITERATURE REVIEW

Direct field "investigations" (e.g., Oxtobee and Novakowski 2002) and measurements (Anderson, Anderson, and colleagues, 2005) have been used in recent studies of groundwater-surface water interactions to identify hydraulic head differences as well as chemical and isotopic tracers (Conant, 2004, Schmidt, et al. 2007). Remote sensing and field observations have been widely used in hydrological research as part of upscaling processes (for example, Ford et al., 2007). Because of this flexibility, numerical modeling approaches have been used to study the interactions between groundwater and surface water for transition zone water, as well as the importance of water balance in a mesoscale lowland river catchment, in order to conduct water resources assessments (Gauthier, 2009).

Krause et al., 2007. Scibek et al. (2007). Anthropogenic impacts must be considered when assessing the geographical and temporal interactions of groundwater and surface water. Previous research revealed the need for a variety of approaches to quantify human influences on groundwater-surface water interactions. This thesis is based on a synthesis of scientific findings on groundwater-surface water interactions.

STATEMENT OF THE PROBLEM

Erdos City in "Inner Mongolia" and Yulin City in Shaanxi province administer the Erdos plateau, which covers approximately 200,000 square kilometers. Deserts and barren rocks cover half of the

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area. The country has a population of approximately 26 million people. Arid to semi-arid conditions are common in the country's interior. Annual average precipitation varies.
The region is dry, with annual rainfall ranging from 400 mm in the east to 200 mm in the west. The annual evaporation rate could be as much as 3500 millimetres, which is a lot. Surface water supplies are limited because the potential evaporation exceeds the precipitation. The plateau's primary water source is groundwater (Gao et al., 2004). Most terrestrial ecosystems rely primarily on groundwater for survival. Overgrazing and cultivation operations, however, exacerbated the ecosystem's decline. Desertification, soil erosion, and other forms of land degradation are widespread on the Erdos plateau (Wang, 2008). Erdos, one of China's new energy bases, is located within the Yellow River watershed and is a top priority for China's western development plan in the twenty-first century. The region's economic growth has been fueled by the extraction of coal, natural gas, oil, and minerals. Increasing water demands from business, agriculture, society, and the environment pose a challenge to local governments, which must meet them in order to fulfill their mandates. This has already put undue strain on the already fragile water infrastructure, with potentially fatal consequences. Surface water balance management has always regarded Erdos plateau groundwater as a loss term or static storage. Streams, aquifers, and groundwater-dependent ecosystems have all suffered as a result of the failure to consider groundwater-surface water interactions. Groundwater and surface water interactions take many forms, depending on the physiographic and hydro-climatic conditions that exist. However, these relationships are frequently influenced The extent of human activity is little known.

OBJECTIVE OF THE STUDY

As part of this project, we want to understand and measure how groundwater and surface water interact on the Erdos Plateau.

Here are the specific goals:

In order to "identify and quantify the spatial and temporal variations of GW-SW interactions"

Research Question

How does "GW-SW" influence the process of interaction?

RESEARCH METHODOLOGY

The flow simulation will be performed using the well-known numerical model code MODFLOW (McDonald and Harbaugh, 1984). Each numerical model grid cell is 50 by 50 m in size, so the model grid has 310 rows and columns. The model's highest point is determined using a Digital Elevation Model (DEM) with a resolution of 30 x 30 metres. The model's lowest elevation is

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derived from a small amount of borehole data. Hydrogeological factors such as hydraulic conductivity, specific yield, and storage will be classified into three groups based on their lithology. The General-Head Boundary (GHB) package from MODFLOW will be used to simulate deep groundwater discharge in the Hailiutu River. Flow into or out of In this case study, a GHB cell is estimated using the difference between the head in the model cell and the stage of the Hailiutu River. Because the Bulang stream functions as a drain and receives constant groundwater flow, the MODFLOW Drain package will be used to simulate groundwater discharge. It will be necessary to model the net recharge, which will be determined by subtracting precipitation from evapotranspiration using the Recharge program.

The catchment water balance can be calculated using P, "evapotranspiration (ET), discharge of the Bulang River (Q), deep groundwater circulation (D), and change in storage (dS/dt) in the watershed: $P - ET - Q - D = ds/dt$ While ET and deep circulation fluxes cannot be directly monitored in the field, precipitation and discharge can Changes in groundwater levels can also affect the Bulang River. Based on observations of sap flow from maize, salix shrub, and willow tree sap flow at the field site, the area's ET will be estimated using NDVI-produced plant cover data from remote sensing.

DATA ANALYSIS

In 2006, Ge and Boufadel Furthermore, Wagner and Harvey (2007) investigated the precision of tracer approaches for monitoring water movement between underground and aboveground (2001). At high baseflow levels, they discovered that the stream tracer approach is resistant to surface-to-subsurface exchange. The hydraulic gradients and thermal approaches clearly show that groundwater discharge to surface water predominates along this 180-meter reach, reducing the risk of overestimating groundwater discharge due to solute loss. In this case study, the EC value of groundwater along the stream bank, EC measurement errors along the reach, and discharge measurement errors may all have an impact on seepage calculation uncertainty. We'll use a hypothetical error distribution. Investigate the effect of possible EC and discharge measurement errors on the calculated seepage. Groundwater monitoring wells in the stream valley show significant variation in EC values (510 S/cm), which is most likely due to irrigation. The projected electrical conductivity (EC) values for natural stream water are lower than those for ground water. Thus, a 5% deviation from the mean is used in the sensitivity analysis. An EC increase or decrease of 5% at various points along the river will be used to assess "groundwater seepage and discharge rate estimation influenced by measurement inaccuracies."

CONCLUSION

In light of this, the Erdos Plateau in northwest China will be the focus of research into the relationship between underground and above-ground water. Using a multidisciplinary approach, will assess groundwater-surface water interactions in the Hailiutu River catchment. The water cycle, chemical composition (including stable isotopes), temperature, and modelling can all be studied. To draw conclusions from these methods, chemical and isotopic profiles in a river's tributary will be collected through fieldwork, in-situ data from the past and present, and sub- and watershed-scale numerical modelling. This study's findings could support a variety of hypotheses.

LIMITATIONS OF THE STUDY

Groundwater-surface water interactions have been investigated in a variety of ways. Rather than relying solely on field measurements to detect and quantify groundwater-surface water interactions, this thesis employed a variety of approaches, including numerical modelling, isotope analysis, temperature monitoring, and a number of other techniques. The exchange of solutes between soil, rocks, and water has an impact on both groundwater and surface water. Because of evaporation and artificial release of solutes, salt accumulates on the top soil, complicating the chemistry of the various constituents. As a result, this study's approach of estimating groundwater seepage rates using the chemical profile along the stream provides a novel and efficient method to directly measure seepage rates along the river. a low cost and high degree of dependability.

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