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Interaction of water components in the semi-arid Huasco and Limarí river basins, North Central Chile

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Abstract. For sustainable water resource management in semi-arid regions, sound information is required about interactions between the different components of the water system: rain/snow precipitation, surface/subsurface run-off, groundwater recharge. Exemplarily, the Huasco and Limarí river basins as water stressed river catchments have been studied by isotope and hydrochemical methods for (i) the origin of water, (ii) water quality, (iii) relations of surface and groundwater.

Applying the complex multi-isotopic and hydrochemical methodology to the water components of the Huasco and Limarí basins, a differentiation of water components concerning subsurface flow and river water along the catchment area and by anthropogenic impacts are detected. Sulphate and nitrate concentrations indicate remarkable input from mining and agricultural activities along the river catchment.

The ^{2}H-^{18}O relations of river water and groundwater of both catchments point to the behaviour of river waters originated in an arid to semi-arid environment.

Consequently, the groundwater from several production wells in the lower parts of the catchments is related to the rivers where the wells located, however, it can be distinguished from the river water. Using the hydrological water balance and the isotope mixing model, the interaction between surface and subsurface flows and river flow is estimated.

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1 Introduction

In the Coquimbo and Atacama regions the vulnerability of the natural water resources is increasing by the water requirements of the agricultural and mining industry and of the urban development which requires a sustainable water resource management. An increasing demand of sound information about the origin of water resources, their quality, the groundwater recharge conditions, surface and subsurface run-off, rain/snow precipitation and water use is required for a proper management of water resources. A water quality data base was established for several important catchment areas in semi-arid zones by the CADE-IDEPE in 2004 (CADE-IDEPE, 2004a, b). These data were evaluated according to sustainable water resource management by Ribbe et al. (2008) due to the water quality and monitoring practice for requirements of water policy and legislative measures. Because of increasing demand of water for agriculture, mining, and domestic use, groundwater abstraction gains importance in river catchments, but needs a better understanding about its interaction with surface water in semi-arid watersheds. Groundwater resources in two relevant

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