CHARACTERISTICS OF STABLE ISOTOPE EMPIRICAL DISTRIBUTIONS IN PRECIPITATION AT CENTRAL EUROPEAN GNIP STATION - LJUBLJANA, SLOVENIA

Mihael Brencic [1]* and Polona Vreca [2]
[1] Department of Geology, University of Ljubljana - mihael.brencic@ntf.uni-lj.si
[2] Department of Environmental Sciences, Jožef Stefan Institute, Jamova cesta 39, SI-1000, Ljubljana

Abstract
Empirical distributions of hydrogen and oxygen stable isotope time series at Ljubljana – Slovenia GNIP precipitation station has been explored. Results show bimodal empirical distribution of hydrogen and oxygen stable isotope data. Bimodal distribution was described as representation of the two populations modelled by two component mixture of Gaussian distributions. The mixture of two populations was described as discrete event by seasonality dependent bimodal distribution.
Keywords: Time Series, Geochemistry, Geochemical Cycles

Introduction

Precipitation can be described as stochastic process that varies temporarily and spatially; it can be expected that their chemical and isotopic characteristics can be described in the similar way. Literature abounds on stochastic modelling of precipitation amount and intensity time series; however stochastic models dealing with chemical characteristics of precipitation are few and stochastic modelling of isotopic time series is even more in the background. The intention of the paper is therefore to explore stochastic characteristics of hydrogen and oxygen stable isotope time series.

Methods

Stochastic characteristics are represented on the hydrogen and oxygen stable isotope time series of Ljubljana precipitation. Ljubljana is a GNIP-network precipitation station where composite monthly precipitations samples are collected. Operation of the Ljubljana station started on May 1981 and proceeds until today. It is central European station where influences of the precipitation originating from Atlantic and Mediterranean air masses are present. Average LMWL is close to GMWL. [1], [2] On the monthly data values exploratory analyses was performed and kernel densities were calculated.

Results

Results show that empirical distribution of both data series is bimodal. Bimodality of empirical distribution $p(x)$ was model as two component mixture of Gaussian distributions $f(x|\mu_1,\sigma_1)$ and $f(x|\mu_2,\sigma_2)$ with parameters μ_i,σ_i. The model can be described as $p(x)=af(x|\mu_1,\sigma_1)+(1-a)f(x|\mu_2,\sigma_2)$ where the appearance of particular component was modelled as discrete event by seasonality dependent bimodal distribution.

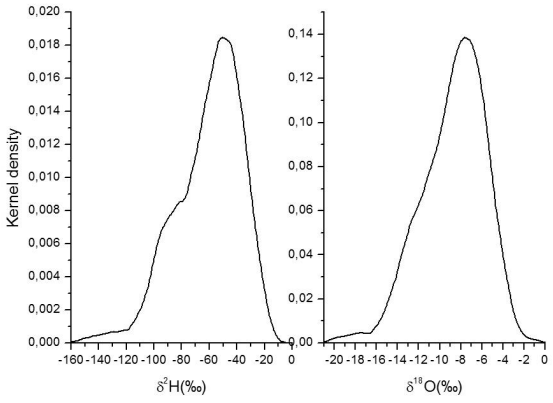

Fig. 1. Kernel densities of oxygen and hydrogene stable isotope composition at GNIP Ljubljana station

Discussion

The model is interpreted as mixing of the Atlantic and Mediterranean are masses in the approximate share of 3:1.

References
1 - Vreca P., Krajcar Bronic I., Leis A., Brencic M., 2008. Isotopic composition of precipitation in Ljubljana (Slovenia). *Geologija*, 51: 169-180.
2 - Vreca P., Krajcar Bronic I., Horvatincic N., Baresic, J., 2006: Isotopic characteristics of precipitation in Slovenia and Croatia: Comparison of continental and maritime stations. *Journal of Hydrology*, 330: 457-469.