FACTORS CONTROLLING THE STABLE ISOTOPIC COMPOSITION OF RECENT PRECIPITATION IN SPAIN

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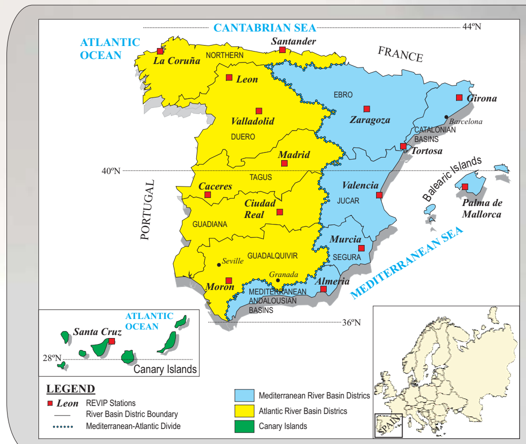
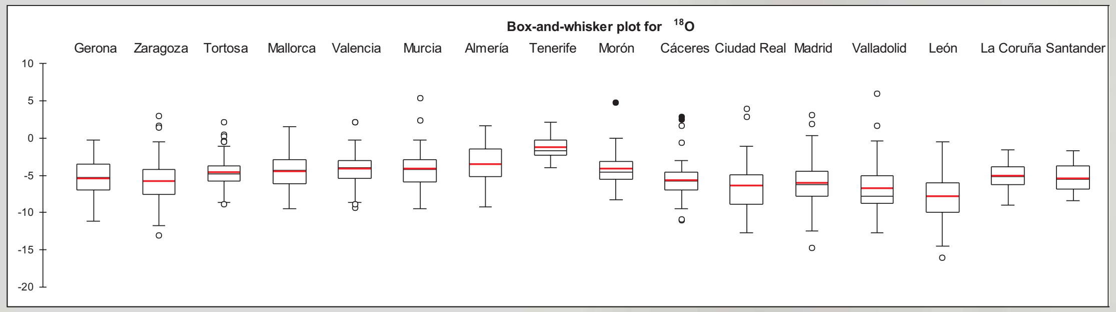
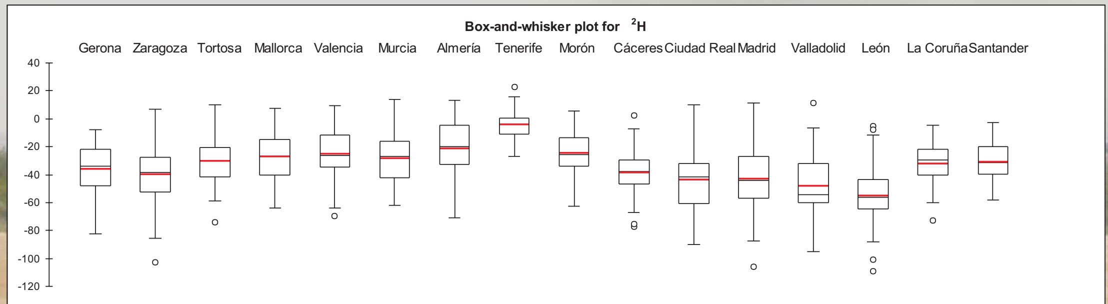


1. INTRODUCTION

^{18}O and ^{2}H analyses are being performed for composite monthly samples of precipitation collected at 16 meteorological stations included in the "Red Española de Vigilancia de Isótopos en la Precipitación" (REVIP), the Spanish Network for Isotopes in Precipitation, a contribution to GNIP.

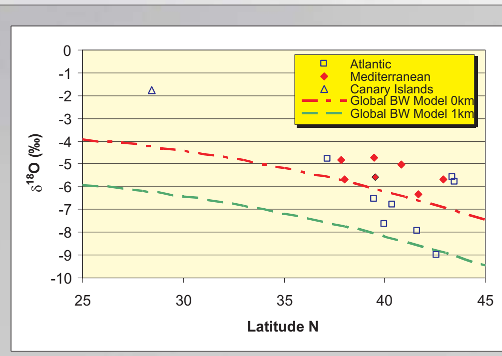
REVIP was designed to be representative of Spanish geographic (N-S and E-W, different physiographic setting and topographic height) and climatic (stations representative of semiarid and humid areas, continental and littoral, Atlantic and Mediterranean) conditions. All main River Basin Districts defined at national level are represented in REVIP.

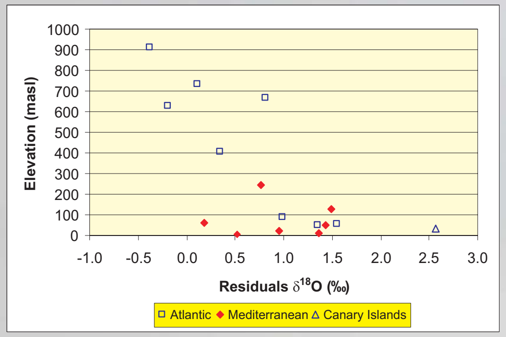




2. METHODS (STATISTICAL ANALYSIS):

A summary statistical analysis of the results obtained from the REVIP for the period 2000-2004 shows a depletion in $\delta^{18}O$ and $\delta^{2}H$ for the Mediterranean stations as the latitude increases (left side of the box-and-whisker plots). A similar tendency is seen for the Atlantic stations as the latitude, altitude and continentality increase (right side of the plots). Two stations located at the Northern most part of Spain (La Coruña and Santander) make this trend to reverse due to their location at the coast and consequently at a lower altitude, showing that elevation also is an essential factor controlling isotope composition.



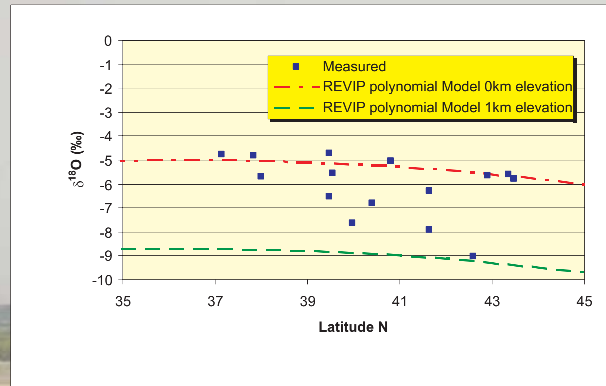


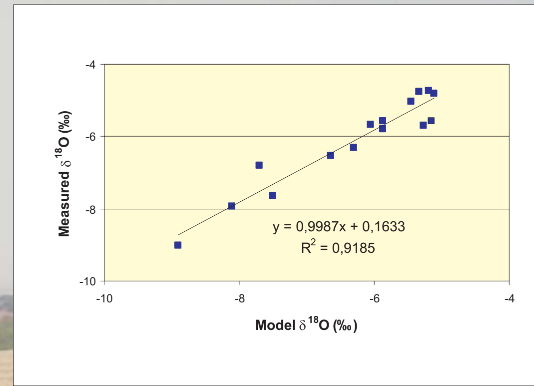
3. METHODS (MODEL FOR $\delta^{18}O$ DEPENDENCE ON LATITUDE AND ELEVATION):

Global model lines obtained for 0 and 1km elevation for the $\delta^{18}O$ contents of meteoric precipitation of the IAEA-GNIP database with increasing latitude and elevation (Bowen and Wilkinson model, 2002(*)) were used to predict the spatial distribution in the isotope composition of recent precipitation in Spain. The equation that describes the $\delta^{18}O$ values as a function of latitude and altitude was derived using a two-step approach: first the dependence on latitude was obtained for GNIP stations, second the effect of elevation was quantified, and finaly the two equations were added.

Residuals between measured isotope values of REVIP stations and global BW model $\delta^{18}O$ versus elevation shows that the isotope composition of REVIP stations are more positive than those for GNIP stations located at similar latitudes, particularly in the case of REVIP coastal stations (elevation < 200 masl).

[(*) BOWEN, G.J., WILKINSON, BH., Spatial distribution of $\delta^{18}O$ in meteoric precipitation, Geology 30(4) (2002) 315-318]





4. RESULTS:

A second approximation was attempted in order to better assess the combined influence of both latitude and elevation on the composition of precipitation Spain. The equation that describes the $\delta^{18}O$ values as a function of latitude and altitude, obtained for all REVIP stations except Tenerife (Canary Islands) which belongs to a different climatic region, is shown below:

$$\delta^{18}O = -0.0131LAT^2 + 0.9507LAT - 0.0037ALT - 22.253$$

where LAT is the latitude in decimal degrees and ALT the elevation of the sampling station in metres. Local model lines were obtained for 0 and 1km elevation for the rate of depletion in ^{18}O of meteoric precipitation with increasing station latitude and elevation for REVIP stations, providing a good first-order estimate of observed $\delta^{18}O$ in Spain (r^2 = 0.92).

5. CONCLUSIONS:

The spatial distribution of $\delta^{18}O$ y $\delta^{2}H$ in precipitation in Spain can be explained in a simplistic form by a simple multiple regression model, based on geographic factors (latitude and elevation). This model reproduces reasonably well the observed main features of the spatial distribution of the stable isotope composition of precipitation over Spain, facilitating the trace of the source of surface and ground waters.

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