

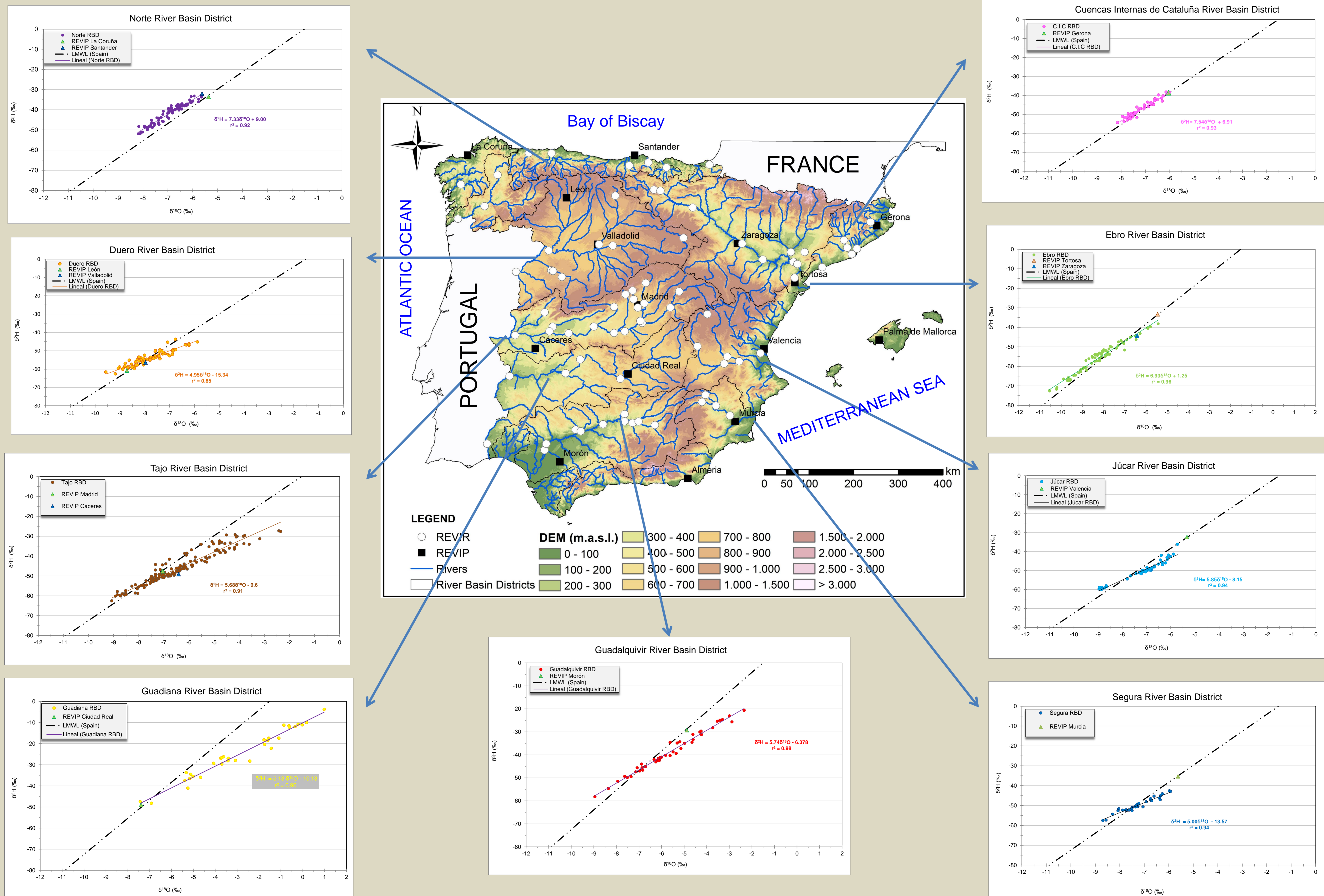
Stable isotopes composition of river water across peninsular Spain

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INTRODUCTION: The Spanish network for stable isotopes in rivers (REVIR) consists of 80 sampling stations distributed along the major River Basin Districts in peninsular Spain, shown in the map over a digital elevation model (DEM), where quarterly (seasonally) water samples are taken for $\delta^{18}\text{O}$ and $\delta^2\text{H}$ analysis. REVIR makes use of the Radiological Environmental Monitoring Network managed by the Nuclear Safety Council and the Ministry of Agriculture, Food and Environment, that operates since the late 1970s. After two consecutive water years (2008-09 to 2009-2010), 579 stable isotope analyses have been produced by the REVIR.

RESULTS & DISCUSSION: A preliminary study of the data in the $\delta^{18}\text{O}$ - $\delta^2\text{H}$ space reveals the different isotopic signature and hydrological behaviour of the river basins caused mostly by their different geographic and climatic conditions. The isotopic values of the closest REVIP stations (Spanish network for isotopes in precipitation) are also shown for comparison:

- 1) The effect of evaporation is noticeable with decreasing latitude. Isotope values for surface waters lie along evaporation lines with slopes between 4.9 and 5.7 in southernmost watersheds. This is also the case for the longest rivers more regulated by dams (Duero, Tajo, Guadiana and Guadalquivir) in which residence time in a semiarid climate has been artificially increased;
- 2) More negative values for $\delta^{18}\text{O}$ and $\delta^2\text{H}$ are found in the watersheds that include the higher mountain ranges, and are influenced by seasonal processes of snow accumulation and melting, such as the Ebro basin, which drains the Southern Pyrenees;
- 3) Noticeably, watersheds from the "Norte River Basin Districts", clearly dominated by the input of Atlantic Ocean and the Bay of Biscay rainfall, show the higher values of the deuterium excess, 13.6‰. These values have been previously reported in Spain and other European countries for precipitation typical of a Mediterranean Sea origin. Alternative hypotheses for the origin of the vapour causing precipitation in this area are under study, including the North Atlantic Ocean or the local Bay of Biscay where the relative humidity over the ocean may be lower;
- 4) The spatial distribution of sampling stations, which belong to a previous network not designed for this purpose, may impose a bias in these preliminary observations that will be analysed in depth in further studies.



CONCLUSIONS: The spatial variability of the stable isotopic composition surface waters in Spain has been characterised by the information supplied by REVIR. This information provides a reference for: **1)** the study of the processes modifying the isotope signals observed in river waters from the isotope input of precipitation (i.e. evaporation, interaction with ground water,...); **2)** the calibration of the models to simulate the spatial distribution of isotopes in precipitation; **3)** the study of the evolution of these isotope signals in relation with changes in climate factors; **4)** the study of the effect of evaporation from surface water bodies (lakes and dams) in water resources. It will also facilitate the application of the European Union Water Framework Directive in a context of climate change by providing a better knowledge of the origin and evolution of surface waters through the study of their characteristic isotope signature.

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