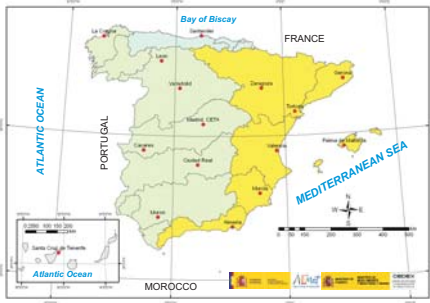


Contribution of the Spanish Network for Isotopes in Precipitation and related modeling activities to characterize water bodies and their evolution

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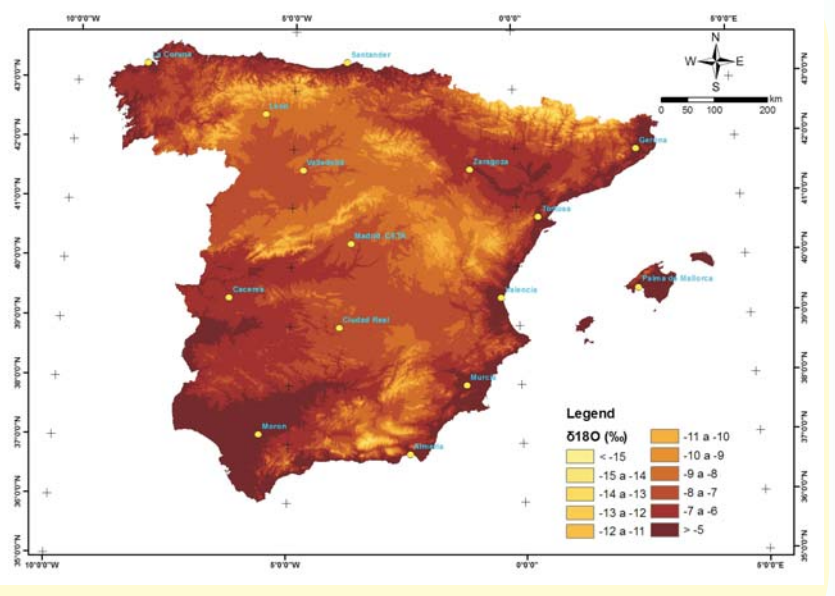
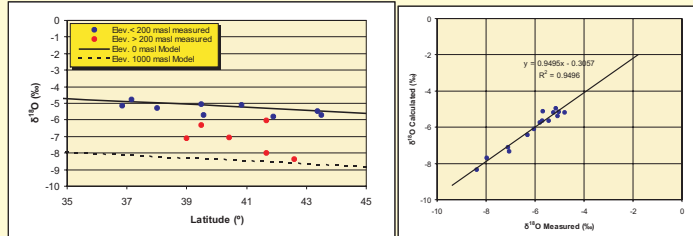


REVIP NETWORK

A database has been built that compiles systematic isotope information from composite monthly samples of precipitation collected in the Spanish Network for Isotopes in Precipitation (REVIP). REVIP is operative and managed since 2000 by the Centro de Estudios y Experimentación de Obras Públicas (CEDEX) in collaboration with the Agencia Estatal de Meteorología (AEMET). It consists of 16 meteorological stations located in continental Spain and in Balearic and Canary islands. REVIP is part of the Global Network for Isotopes in Precipitation (GNIP), managed by the International Atomic Energy Agency (IAEA), in cooperation with the World Meteorological Organization (WMO). REVIP data are being treated by CEDEX and IGME in order to establish the spatial and temporal isotope distribution in Spain for both research and water management purposes.

MODELING THE ISOTOPE DISTRIBUTION IN PRECIPITATION

$\delta^{18}O$ monthly values were used to derive amount-weighted mean annual $\delta^{18}O$ for each REVIP station. These values are controlled by distillation of atmospheric vapor, driven primarily by changes in air-mass temperature. The main geographical and climate factors that control temperature were used to predict $\delta^{18}O$ observed values. As a result, the spatial distribution of $\delta^{18}O$ in precipitation over Spain has been explained by a simple multiple regression model, based on two geographic factors: latitude and elevation. Using GIS tools, a continuous digital map of the $\delta^{18}O$ distribution in Spain has been generated that reproduces closely the observed $\delta^{18}O$ values.

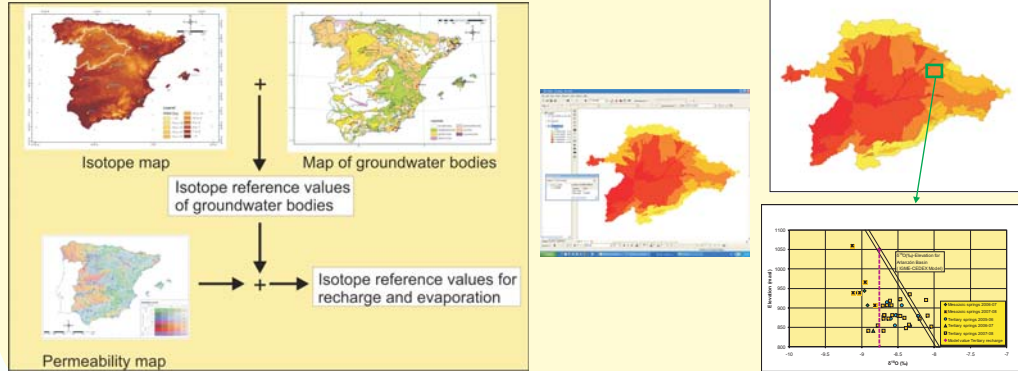


APPLYING THE MODEL

Comparison of the modeled isotope values with isotope data of surface and ground waters from different case studies in Spain, covering a set of geographic and climatic situations, has been attempted in order to test the model and its application in hydrology. The results obtained so far show a good fit between modeled and measured stable isotope values, and are promising to help in the implementation of the Water Framework Directive. The model provides integrated isotope values for precipitation, useful to trace the origin of water in surface and groundwater bodies, and may help to understand the stability or the evolution of these values and serve as an indicator of the causes of natural trends or man-made deviations.

Example for the Duero Basin (Central Spain)

An example was performed for the Duero Basin in which isotope reference values were obtained combining the maps for permeability and groundwater bodies, by means of GIS tools.



Groundwater bodies isotope reference values for Duero Basin

Attributes of a18_duero										
CVB	MSBT	ZONE-CODE	CWRTI	AREA	MMI	MAX	MIN	MEAN	STD	SHM
ES021MSBT0002	1	8992	222000100	-12522958	-8.428124	4.899504	-9.894853	0.736710	-0.976020	
ES021MSBT0003	2	4613	115250000	-12544524	-8.409395	4.236158	-9.915657	0.775236	-0.574032	
ES021MSBT0004	3	4308	107899900	-13254871	-8.445209	4.809663	-9.949548	0.841523	-1.296254	
ES021MSBT0005	4	4312	107820000	-970715	-8.251481	1.481719	-8.612663	0.256401	-0.714641	
ES021MSBT0006	5	9844	236020100	-6627586	-7.615176	2.021810	-8.647726	0.300801	-0.975454	
ES021MSBT0007	6	9847	246175000	-932897	-7.785222	1.543348	-8.344502	0.372119	-0.219932	
ES021MSBT0008	7	7463	186570000	-9228914	-7.818952	1.810861	-8.126111	0.274454	-0.602737	
ES021MSBT0009	8	3145	786249900	-8501014	-7.548907	0.954147	-7.860663	0.182965	-0.427170	
ES021MSBT0010	9	13110	327489900	-8128352	-7.483295	1.845058	-7.891466	0.281502	-1.034549	
ES021MSBT0011	10	5209	126450000	-9322799	-7.71594	1.609461	-8.17091	0.239448	-0.333187	
ES021MSBT0012	11	3360	337500000	-8432603	-7.638663	0.79412	-7.982320	0.164875	-1.073654	
ES021MSBT0013	12	8930	223050000	-12244431	-7.64817	4.586261	-8.942025	0.830444	-0.985201	
ES021MSBT0014	13	2983	738249900	-8724743	-7.807821	0.91882	-8.118436	0.159889	-0.298783	
ES021MSBT0015	14	3786	678480000	-8418783	-7.669265	0.787703	-7.890311	0.146954	-0.256414	
ES021MSBT0016	15	4508	112700100	-8715916	-7.770062	0.945234	-8.240305	0.190077	-0.371675	