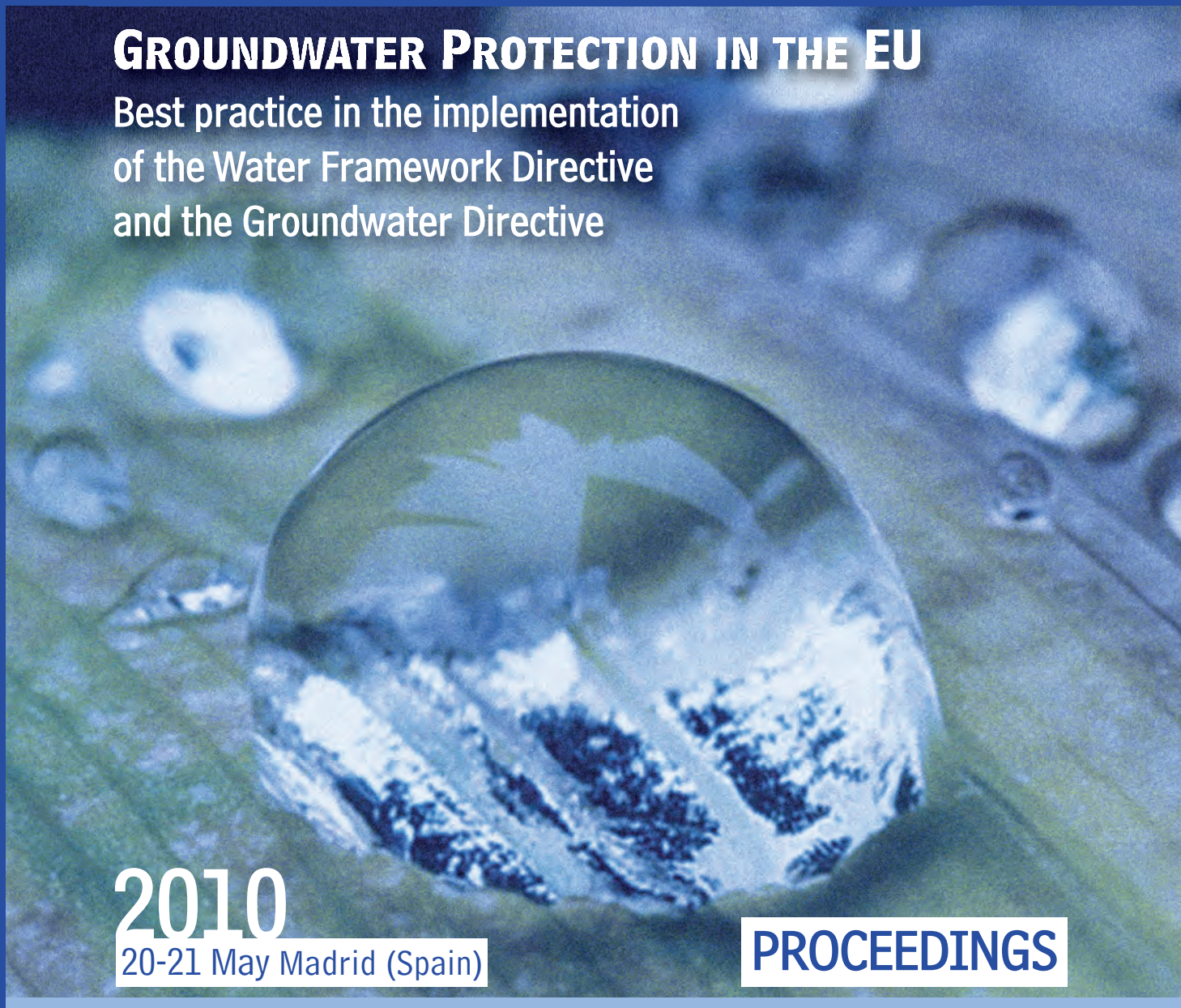
EUROPEAN GROUNDWATER CONFERENCE



GROUNDWATER PROTECTION IN THE EU

Best practice in the implementation
of the Water Framework Directive
and the Groundwater Directive

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PROCEEDINGS

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

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The stable isotope composition of precipitation in Spain has been studied for decades in order to characterize the input function to surface and ground waters. This isotope fingerprint is then used in hydrological research and water resources management to delineate source or recharge areas, to study the origin of water and mixing processes, to perform water balances, or to characterize evaporation. In the last decade, 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 managed by the Centro de Estudios y Experimentación de Obras Públicas (CEDEX) in collaboration with the Agencia Estatal de Meteorología (AEMET), and consists of 16 meteorological stations located in continental Spain and in Balearic and Canary islands. $\delta^{18}O$ monthly values were used to derive amount-weighted mean annual $\delta^{18}O$ for each 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.

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 as a test for 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, 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 (as seen in the Duero Basin in a preliminary application). Future developments are going on in order to further test the model including the study of temporal variations and the comparison model results with a larger data set of isotope information of surface and groundwater samples from a wider set of geographic and climatic situations.

Keywords:

Stable isotope, sources of water, water trends, status indicators.