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## Meteorological and geographical control on stable isotope signature of precipitation in a Western Mediterranean area (Tuscany, Central Italy)

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Stable water isotopes of precipitation are widely used to track processes occurring within the hydrological cycle and to understand regional atmospheric patterns that influence a specific area. Moreover, the use of the oxygen isotopic composition in continental carbonates (e.g. speleothems) is a well-established practice to reconstruct climatic variations in the recent past. In the Mediterranean basin, the continental carbonate  $\delta^{18}\text{O}$  is generally used as a proxy of paleoprecipitation since the water-calcite fractionation factor is able to compensate the  $\delta^{18}\text{O}$ -T gradient of about  $0.2\text{‰}/\text{°C}$  typical of rainfall in this area. However, few comprehensive investigations were performed in the Western Mediterranean in order to analyze the statistical relationships between measured stable isotopes in precipitation and meteorological variables, and none of them accounted for the possible seasonality in these relationships. Understanding the degree of dependence of the rainfall isotopic signature from precipitation amount and temperature at present day is of primary importance in Tuscany (Central-Western Italy), where many performed palaeohydrological studies require a more precise and quantitative interpretation. To this end, in the present study 560 isotope monthly data ( $\delta^{18}\text{O}$ ,  $\delta^2\text{H}$ , and deuterium excess) of precipitation collected in 11 sites through Tuscany from 1971 to 2018 were gathered in a database. A large part of dataset was extracted from GNIP database (and integrated with new data) or derived from local hydrogeological studies, whereas 83 new measurements were produced at two novel sites. Then, only sites whose monthly data covered almost one year were considered for processing, resulting in 474 precipitation samples archived along with monthly mean temperature and rainfall amount. In this framework, a LMWL for Tuscany Region was determined for the first time by applying different regression techniques. A Spearman's rank correlation analysis was performed to summarize the strength and direction of the relationship between stable isotope signatures of precipitation and meteorological variables, both at monthly and annual timescale. The monthly correlation was also investigated on seasonal basis. Finally, the influence of local geographical effects (altitude, distance to the coast, etc.) on the isotopic signals registered at different sites was

evaluated.