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Evaluating the cave carbonate chemical signal as a proxy for rain patterns in Mallorca Island

Isabel Cacho (1), Mercé Cisneros (1), Judit Torner (1), Albert Català (1), Ana Moreno (2), Heather Stoll (3,4), Miguel Iglesias (3), Ileana Bladé (5), and Joan Fornos (6)

(1) Universitat de Barcelona, Dept. Dinámica de la Terra i l'Oceà, Barcelona, Spain, (2) Instituto Pirenaico de Ecología, IPE-CSIC, Zaragoza, Spain, (3) Departamento de Geología, Univ. de Oviedo, Spain, (4) Dept. Erdwissenschaften, ETH Zurich, Zürich, Switzerland, (5) Dept. Fisica Aplicada, Universitat de Barcelona, Spai, (6) Grup de Ciències de la Terra, Dept. de Biologia, Universitat de les Illes Balears, Spain.

Mallorca's climate is marked by a strong seasonal cycle in both temperatures and precipitations which is likely to be recorded in the carbonate precipitates formed in its extended karst systems. Here we present isotopes and trace elements measured in dripwaters collected at weakly and/or seasonal bases since spring 2013 in three caves from Mallorca that represent the eastern and S-eastern sector of the island. This information is complemented with isotopic composition of rain events in the same region, other cave environmental parameters and chemistry of seasonal farmed carbonates in the same caves. Drip water results are very consistent between the different studied caves and indicate an important attenuation of the rainfall isotopic signal in the epikarst and only extreme climate conditions such as the severe dry conditions in summer 2015. Farmed carbonates present a clear seasonal cycle with low values, in both carbon and oxygen isotopes, in summer and autumn and high values in winter and spring. This cyclicity can not be attributed to amount effect or rain composition and we propose a close relation to cave environmental conditions. High CO_2 concentrations in summer and autumn would avoid degasification reducing the PCP process and resulting in more negative isotopic relationships in both oxygen and carbon isotopes. Coherently, this CO_2 cycles are in phase with those of temperature since both reflect ventilation rates in the cave. Nevertheless, ultra-high resolution profiles of Mg/Ca ratios measured by laser ablation on last century carbonate precipitates in the same caves, reveal a inter-annual variability with a persistent cyclicity which show coherent patterns with the instrumental rain records from Mallorca. This comparison reveals the potential of the Mallorca carbonates to reveal the long-term precipitation evolution of the island.