Isotopic ($^{18}$O) signature of CO$_2$-H$_2$O vapor exchange in the vadose air of Nerja cave (Malaga, Spain)

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In caves, carbon dioxide contents and its $\delta^{13}$C signature have been widely studied to provide information about the ventilation regime and the source of carbon dioxide. However, less has been researched about $\delta^{18}$O signature in vadose air. We analysed cave-air samples for the CO$_2$ concentration and oxygen isotopic composition from a monthly sampling campaigns for two years within different halls in Nerja cave. In general terms, ventilation controls the variation of CO$_2$ content seasonally, showing two distinct modes with the highest values in summer. The $\delta^{18}$O values range from -8.74 to +0.47‰ being maximum in January and minimum in September, coinciding with the lowest and highest humidity values within the cave respectively. We found that a gas exchange between $\delta^{18}$O-CO$_2$ and $\delta^{18}$O-H$_2$O vapor is carried out and pattern is repeated every season, showing the importance that water has in karst environment.