



Glaciers and ice caves as interconnected features in the geomorphological evolution of the landscape of high karstic environments

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Glaciers and ground ice occurrence in high elevated karstic areas of the world have generally been seen and studied as separated aspects of the same topic: the mountain cryosphere. If mountain glaciers are considered to be sensitive indicators of climate variability, the lesser known part of the cryosphere is actually represented by high altitude ice caves, namely natural caves formed in bedrock (karstic massifs, but lava tubes as well) where perennial accumulation of ice is preserved. Being part of ground ice, ice caves are commonly considered as sporadic permafrost phenomena. The real distribution and the size of ground ice in mountain areas of the world remain still unknown, although recent studies suggest that the number of ice caves in the Alps could reach several thousand of units, thus representing a possible important source of freshwater storage in high altitude karstic areas. A critical topic in ice cave studies is the understanding of how the internal environment interacts with the external one and how these systems react to changes in thermal conditions and external ice cover. New insights on the fluid-dynamic behaviour of ice caves can be given by numerical methods thus improving and integrating the information that could be obtained from standard experimental measurements. This, in turns, could also lead to a more refined interpretation of the size and evolution of the paleocryosphere of such areas during colder glacial or warmer interglacial phases in order to improve the interpretation of the hydrological functioning of these areas with great impact on the geomorphological evolution of the landscape. A case study from the Southern Alps will be presented where a multidisciplinary research on past and present evolution of the cryosphere is undertaken.