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Modelling the rock mass response to changing water inflow and thermometric conditions in the Bossea mountain karst aquifer

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The Bossea Cave is a mountain karst aquifer located in the Ligurian Alps (Piedmont, NW Italy). It develops at the contact between a Permian impermeable meta-volcanic basement and an overlying Triassic meta-carbonate sequence. This upper layer is responsible for the drainage of infiltrating water, mainly related to rainfall and snowmelt processes occurring in the aquifer's feeding area. Since 2021, the temperature of the rock mass has been monitored through sub-hourly measurements with a resolution of one hundredth of a degree Celsius. The preliminary results suggest different behaviours across the cave: the rock mass close to the entrance is strongly influenced by meteoclimatic factors, with heat exchange between the external and hypogeal environment determined by the thermometric gradient, exhibiting both daily and long-term effects. In contrast, thermal variations in the innermost rock are less pronounced and are mainly attributed to the propagation of a seasonal heat wave. The thermal inertia causes a delayed temperature peak during the winter months. Moreover, the hydrodynamic behaviour of the aquifer system only affects the rock temperature locally: the main water-rock heat exchange is observed in the proximity of the main drain (Torrente Mora), while this phenomenon is less significant near the secondary vertical seepages.

In parallel, a preliminary study to assess the potential seismic signature of water inflows and related modifications in the rock mass stress is ongoing. After processing data from a seismometer located inside the cave, the effects of rainfalls and snowmelt are distinguishable at specific frequency values in the spectrograms obtained from East, North and vertical channels. These findings provide a basis for future monitoring and analyses about the triggering mechanism of induced deformations in the rock mass and the evolving dynamics of cave morphology.