Monitoring the last Apennine glacier: recent in situ campaigns and modelling of Calderone glacial apparatus

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The Calderone glacier is at present the most southern glacier in Europe (42° 28' 15" N). The little apparatus (about 20.000 m^2 in surface area) has been giving an interesting response both to short- and long-term climatic variations which resulted in a considerable reduction in surface area and volume. The glacial apparatus is split into two ice bodies (glacierets) since 2000. The two glacierets are located in a deep northward valley below the top of the Corno Grande (2912 m asl) in the centre of the Gran Sasso d'Italia mountain range (Central Italy). Such glacial apparatus has been subjected to a strong reduction, with a loss of total surface area of about 50% and thickness of about 65%with respect to the hypothetical size (about 105.00 m^2 and 55 m at the Little Ice Age).

Since early 90s the Calderone glacier has been subjected to several multidisciplinary field campaigns to monitor and evaluate its role as an environmental indicator in the framework of global warming. Starting from historical series related to more than a century of records, the variability of the different glacier properties has been estimated by using classical geomorphologic methods as well as in situ and remote sensing techniques. In particular, the last field campaigns, in 2015, 2016 and 2019, have been carried out using Ground Penetrating Radar equipped with different antenna frequencies, drone-based survey, snow pit measurements and chemical-physical sampling. The measurement campaigns have been complemented by a regional climate analysis, spanning the last fifty years, and snowpack modelling initialized with microphysical snow data (e.g., snow density, crystal shape and size, hardness). The snowpack chemical analyses include the main and trace elements, soluble inorganic and organic ions, EC/OC and PAH, with different spatial resolution depending on the analytes. We present here the methodological approach used and some preliminary results.