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Mt. Grand Combin ice core: correspondence among meteorological, morphological and geophysical evidence with ice core analysis

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High-altitude regions of the planet are particularly sensitive to climate change and current global warming is strongly affecting the Alpine cryosphere. Mountain glaciers have generally experienced worldwide retreat since the second half of XIX Century. During this period the Alps lost about two/thirds of their initial area and area loss rate is accelerating since 2003. In addition to the well-known consequences on alpine environment and society, retreat and disappearance of glaciers, represent also huge damage to the climate history of our planet. Indeed, once a glacier melts, all of the climate and environmental information that has been stored inside it for thousands of years will be literally washed away and lost forever.

For this reason, it is necessary to preserve the memory of past climate and environmental conditions until the glacier ice is still sufficiently cold to preserve fundamental information.

Ice Memory (IM) is an international Alpine glaciers salvage program research project, sponsored by UNESCO, to drill ice cores from high elevation temperate glaciers all around the world, to characterize their climatic and environmental records and ultimately store them as an inheritance for future generations, in the coldest place in the world, Antarctica.

Currently, several nations are selecting specific glaciers in their territory to collect ice core samples. The Italian researchers (from CNR and Cà Foscari) have selected five study areas for glacier drilling on Mt. Grand Combin, Mt. Monte Rosa, Mt. Marmolada, Mt. Montasio and Mt. Grand Sasso d'Italia.

In October 2018, the Italian team has extracted a first preliminary ice core sample from the summit of the Corbassiere glacier (4200 m a.s.l.) on Mt Grand Combin. In addition, a geophysical survey (40 and 200 MHz) on a sample area of 4.4 ha around to the drilling site has been realized in order to detect the best point for drilling during the official survey that will occur in 2020. The overall objective of this work is the characterization of the study area. The specific objectives are: a) meteorological and geomorphological characterization, b) ice core chemical and isotopically analysis and c) reconstruction of the bedrock topography.

For the study area, first preliminary results evidence an increase in temperature above 0.34 $^{\circ}C/10_{yrs}$ from 1950 to 2017. In response to the current climate change, we have calculated that the Corbassiere glacier has lost about 14% of his area, from 17.8 km^2 in 1973 to 15.2 km^2 in 2009. In addition, the first elaboration of the geophysical survey using a 40 MHz scanning shows that the maximum ice thickness is about 100 m. These preliminary results confirm both the increase of temperature and the trend of Alpine glaciers retreat. In addition, first chemical and isotopically measurements confirm the layering preservation over the last decade despite the increasing summer melting. Further elaborations are still in progress in order to match the meteorological trend with the isotopic signal, to recognize the snow and ice stratigraphy using the more resolute geophysical scanning (200 MHz) and to match the scanning with the ice core sample.