EMS Annual Meeting Abstracts
Vol. 16, EMS2019-878, 2019

High resolution regional climate simulation at the alpine LGM

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During the last glacial maximum (LGM, 26.5-19.0 ka BP) the global circulation likely modified due to the onset of the North American Ice Sheet, resulting in the North Atlantic jet stream pushed southward over the Mediterranean region. In this configuration, moist air masses originating in the sub-tropical regions moved towards the mid-latitudes under the forcing of a marked latitudinal pressure gradient leading to increased precipitation over the European Alps and the development of an extensive glacial coverage.
In order to understand the influence of the global atmospheric circulation to the climate of the Alpine area, we use a high resolution regional climate simulation with the RegCM4 model nested within a Global Climate Model (GCM). In such a way we would eventually simulate the precipitation distribution responsible to develop and maintain widespread piedmont glaciers in the Alps during the LGM. We focus on the Tagliamento paleoglacier in the southeastern Alps, one of the only three glacial systems in the Alps for which chronologic constrains are available. This glacier was primarily characterized by its large size of the piedmont lobe respect to the small-size and low-altitude catchment basin, elements that might be responsible for its sensitivity to the smallest climatic forcings.

In this work, we discuss the methodology used to set the ground components mirroring the expected conditions at the LGM peak in order to run the simulation. Changes in topography, land type, vegetation, soil texture and glacier distribution compared to the present are taken into account. In particular, the topography was modified by lowering the present coastline by 120 m and filling the resulting gap with bathymetric data. The other components were reproduced assuming similar environmental conditions for the Alps during the LGM and by using as reference for the piedmont area recent Alaskan analogues.
Being one of the few applications of Regional Climate Models to paleoclimate studies available in the literature, this work aims to improve the understanding of the main mechanisms and scale interactions that led to the formation and maintenance of paleoglaciers in the alpine foreland of the Eastern Alps during the LGM.