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The role of anomalously warm western-central Mediterranean SST during the Last Glacial Maximum for regional precipitation in the surrounding Alpine mountain ranges

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We have compared the spatial pattern of annual average marine sea surface temperature (SST) reconstructions with glacier equilibrium line altitudes (ELA´s) in the Last Glacial Maximum (LGM) to trace similarities and differences. The spatial pattern in the LGM shares surprisingly many similarities with the present climate. A major difference is the stronger NW-SE thermal gradient in the LGM, resulting from a cooling by up to 9 ºC in the Gulf of Lions (NW) relative to the present, and a cooling of only 2 ºC in the southern Ionian Sea, respectively. At higher elevation (snowline), however, the NW-SE thermal gradient was much less steep, showing a cooling by 9 ºC in the NW and by 6 ºC in the SE, respectively, reflecting invasion of polar air masses. The similarities of the spatial pattern appear to result from the guarding role of land-sea distribution and relief for the wind field at sea-level and at altitudes between 1 and 2.5 km. Steep lapse rates caused by relatively warm SST along the eastern margins of the western Mediterranean basin and the Ionian Sea in the LGM are probably caused by slight differences of wind trajectories, higher average wind speed in the western basin, and lower wind speed in the central basin, respectively. An important consequence of the increased lapse rate is unstable atmospheric layering and convective increase of precipitation. Enhanced local convective precipitation at the western margin of the Dinarides, the Italian mountain ranges, and eastern Corsica was possibly supported by lower regional wind speeds.

Frequent SSW-directed invasion of polar air into the western Mediterranean triggered more frequent formation of a cyclonal vortex in its rear in the Gulf of Genoa, since the

glaciated Alpine chain acted as an obstacle (cyclon tracks Va and Vb). In contrast to the present, Genoa cyclons of track Vb (Baltic track) seem to have been often blocked by central European high pressure, as the latter region remained dry. In contrast, the southern flank of the Alps as well as the aforementioned mountain ranges received relatively high amounts of precipitation, supplied by stationary Genoa cyclons.