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Regional atmospheric circulation over Europe during the Last Glacial Maximum and its links to precipitation

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The Last Glacial Maximum (LGM) exhibits different large-scale atmospheric patterns compared to present-day climate due to altered boundary conditions. The impacts on the regional atmospheric circulation and associated precipitation patterns over Europe for the LGM are characterized for the first time with a weather typing approach (circulation weather types, CWT) from (paleo-) climate simulations. While the CWTs over Western Europe are prevailing westerly for both present-day and LGM conditions, considerable differences are identified elsewhere: Southern Europe experienced more frequent westerly and cyclonic CWTs under LGM conditions, while Central and Eastern Europe was predominantly affected by southerly and easterly flow patterns. Precipitation patterns under LGM conditions show increased rainfall in Western Europe but are reduced over most of Central and Eastern Europe. These differences are explained by changing CWT frequencies and evaporation patterns over the North Atlantic Ocean. The regional differences of the CWTs and precipitation patterns are linked to the North Atlantic storm track, which was stronger over Europe in all considered models during LGM, explaining the overall increase of the cyclonic CWT. Enhanced evaporation over the North Atlantic lead to an increased amount of available moisture over the ocean. Despite the overall cooling during the LGM, this explains the enhanced precipitation amounts over southwestern parts of Europe, particularly Iberia. This study links large scale atmospheric dynamics to the regional circulation and associated precipitation patterns and provides an improved regional assessment for climate conditions in Europe under LGM conditions.