Global Climate Zones in the Last Glacial Maximum Found in a Paleoclimate Model

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This study diagnoses global climate zones in the Last Glacial Maximum (LGM: about 21,000 years ago) by using outputs of MIROC-ESM in the third phase of the Paleoclimate Model Intercomparison Project (PMIP3), which is based on MIROC developed at the University of Tokyo. In this study, we apply a clustering algorithm, k-means++, of unsupervised machine learning to three physical quantities: temperature, specific humidity, and the anomaly from the zonal mean of specific humidity, to determine global climate zones.
Clustering of temperature and specific humidity shows that the differences between present days and in LGM are larger in the Northern Hemisphere than the Southern Hemisphere, especially in the mid-latitudes. The large different regions show the change toward the equator by about 5 degrees on average. Especially during warm season (April to September) in the Northern Hemisphere, climate zones shifted equatorward by nearly 10 degrees. Latitudinal changes in climate zones are greater in the summer hemisphere than in the winter hemisphere, with differences of about 4 degrees in the northern hemisphere and of about 1 degree in the southern hemisphere.
Clustering of specific humidity using the anomaly from the zonal mean indicates that the region from Asia to Siberia was wet in the LGM of the Northern Hemisphere cold season (October to March), and in the warm season, the west coast of North America was wet. During the Northern Hemisphere warm season in the LGM, east of the Laurentide Ice Sheet was drier than present.
Focusing on the East Asian region, this study confirmed that the almost entire region around the Japanese archipelago was in to a colder climate zone during the LGM. Around the Yellow Sea during the cold season changed to wet climate, and the region from the Yellow Sea to the Sea of Japan during warm season changed to dry climate in the LGM.

Keywords: Paleoclimate, Paleoclimate Model Intercomparison Project, Last Glacial Maximum, Global Climate Zones, Unsupervised Machine Learning Clustering

