

Possible link of an exceptionally strong East Asian summer monsoon to a La Niña-like condition during the interglacial MIS-13

Hao Lu^{1,2}, Qiuzhen Yin¹, Jia Jia², Dunsheng Xia², Fuyuan Gao²

¹*Georges Lemaître Centre for Earth and Climate Research, Earth and Life Institute, Université Catholique de Louvain, 1348 Louvain-La-Neuve, Belgium*

²*Key Laboratory of West China's Environmental System (Ministry of Education), College of Earth and Environmental Sciences, Lanzhou University, Lanzhou 730000, China*

The S5-1 paleosol unit, which corresponds to marine isotope stage (MIS) 13, had undergone the most intense pedogenesis during the Quaternary in the central Chinese Loess Plateau (CLP). It has been suggested to represent the greatest humidity and extremely strong East Asian summer monsoon (EASM). However, the extremely strong EASM occurring in the relatively cool interglacial MIS-13 seems to be a paradox. In the meantime, evidence shows that regional diversity may exist in the relative intensity of the S5-1 soil formation. In order to understand these discrepancies, we first verify systematically the S5-1 soil development across the whole CLP by using numerous available loess records. We then examine the spatial variation of the magnetic susceptibility of different loess-paleosol sections to identify the spatial change of the EASM intensity during MIS-13. We also compare the loess records with other monsoon records in China. Our results show that there is a spatial difference in the intensity of the S5-1 paleosol formation. In the central CLP, S5-1 is indeed the strongest developed. However, in the western CLP, it is weakly developed, whereas the S4 paleosol which corresponds to MIS-11 is the most developed. As compared to MIS-11, the northern front of the EASM during MIS-13 didn't penetrate into or expanded westward, but was located more northerly and eastward. Based on the sea surface temperature records in the tropical Pacific, we suggest that the abnormal variation of the EASM during MIS-13 is related to a strong La Niña or La Niña like climate condition. Under such a condition, the Western Pacific Subtropical High (WPSH) becomes weaker and retreats more northeastward, leading to more precipitation in the mid-east region of northern China (including the east-central CLP), and the summer monsoon rain belt could not penetrate into the western inland.