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Global spatial distribution of climate response to the cosmic ray intensifications during the Maunder Minimum

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Solar variability as sunspot intensity and solar magnetic activity influence climate. Here we focus on the Hale solar magnetic cycles and their subsequent characteristic enhancements of GCR flux during the Maunder Minimum (AD 1645-1715) in order to distinguish the effect of GCR from the other external forcing factors as Total Solar Irradiance or Ultra Violet.

In our previous study, we revealed that humidity conditions in central Japan and air temperature conditions in Greenland were synchronized to the rapid intensification of GCR flux at the solar cycle minima of negative magnetic polarity during the Maunder Minimum. In order to investigate the spatial distribution of climate response (air temperature, precipitation, etc.) to GCR enhancements from a global perspective, we analyzed annual paleoclimate data from more than 50 sites around the world using the NOAA database for the Maunder Minimum. We separated the AD 1632-1735 into four periods based on the solar magnetic cycle and we superimposed each of the cycle to obtain a compile signal in order to compare with GCR.

Preliminary results of the analyses of 30 data sets showed that air temperature and humidity conditions in East Asia were cold and wet at the solar cycle minima of negative magnetic polarity. There were also cold signals in Western North America, which were synchronized to solar magnetic cycles. However, no distinct climate responses were found in the other regions as South America and Australia. These results suggest that climate response to GCR intensification has complex spatial pattern, but more analyses are required to confirm. In this paper, we report the more detailed results of our analysis.

Keywords: Solar Magnetic Activity, Galactic Cosmic Ray, The Maunder Minimum