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マウンダー極小期の太陽磁場サイクルに対する中部日本・台湾の気候応答
Climate responses in central Japan and Taiwan to the cosmic ray intensifications during the Maunder Minimum

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Relationship between solar variations and climate has been long discussed for various time scales. It is difficult to distinguish the impacts of the multiple solar parameters (total solar irradiance (TSI), solar ultraviolet (UV) radiation, and galactic cosmic rays (GCRs)) on climate, because these variations are nearly synchronized. However, GCR fluctuations related to solar magnetic activity have slightly different features compared to the other external forcing factors (TSI, UV). According to previous studies, the cosmic ray fluctuation was particularly unique during the Maunder Minimum (A. D. 1645-1715), when almost no sunspots were observed. Annually measured tree-ring Δ^{14}C and ice-core ^{10}Be data have shown that decadal variations of GCRs had been remarkably amplified during the Maunder Minimum. This characteristic amplification may be utilized to shed light on the GCR influence on climate.

In this study, we employ tree rings that can reconstruct both annual climate (δ^{18}O) and cosmic ray fluctuations (Δ^{14}C) during the Maunder Minimum. By using these proxies, we can directly compare these reconstructions without any dating error. Annually measured tree-ring δ^{18}O records from central Japan have shown significant wet climate at every remarkable GCRs enhancement. On the other hand, there is no significant climate response in tree-ring δ^{18}O record from Taiwan. We suggest that these climate responses may be related to a stationary position of the Baiu front. Recent satellite observations have shown that GCRs may cause the increase of low cloud amount at tropical western Pacific region. It can be suggested that cooling of tropical western Pacific region caused by GCR enhancement might have caused the weakening of Pacific high and indirectly brought wet rainy seasons in central Japan.

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