

## **Weakening of Asian monsoon, not cloud cover change, determines the climatic variability in montane cloud forest**

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Tropical montane cloud forests (TMCF) are unique ecosystems characterized by frequent cloud immersion. Stable hydroclimate maintains a high level of species endemism and regulates water resource far beyond the geographic extents of TMCF. So far, vulnerability assessment of TMCF has focused on the changes of cloud behavior and its impacts on the stability of hydroclimates. However, large-scale climate driver, such as monsoon may interact with local clouds to mediate climatic variability. In montane cloud forests in Taiwan, the cloud cover kept decreasing since 1950s, but annual temperature variability (TAR) was also reduced. Increasing minimum temperature in the coldest season and decreasing maximum temperature in the warmest season both contributed to the reducing TAR. We found that temperature in the coldest season was mainly mediated by winter monsoon, while the cloud cover has limited direct effect. Temperature in the hottest season was largely determined by precipitation, which was influenced by summer monsoon without the effect of cloud cover change. As such, the change of monsoon system, not cloud cover, dominates climatic variability in montane cloud forest. We applied multiple dendroclimatic proxies to reconstruct local climates for the past 480 years (AD 1533-2012). The dynamics of cloud cover are within the range of long term fluctuation. However, the magnitude of warming in the cold season has never been observed for the past half millennium. We provided the first cloud reconstruction in Asian montane cloud forest where the weakening of prevailing monsoon systems has led to a warmer but less variable climate regime.