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Subannual-to-biannual-resolved record of Indian Summer Monsoon intensity in the early Holocene recorded by a travertine at the eastern edge of Tibetan Plateau

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Decadal-to-centennial abrupt variations of Indian Summer Monsoon (ISM) intensity in the early Holocene and their responses to the solar and/or earth internal forcings are still in debate. Here, we present a subannual-to-biannual-resolved (0.8-2 years) ISM intensity record spanning from 11.6 to 10.2 ka BP inferred from a $\delta^{18}\text{O}$ time series of a travertine with deposition rate of 0.09-0.61cm/year at Zhangjiagou, Huanglong, Sichuan province, located at the eastern edge of Tibetan Plateau. Chronology is well established with absolute U-Th dating methods. The results show that the ISM intensity dynamics match the North Atlantic climate changes recorded in Greenland ice cores and Cariaco Basin marine sediments. One of the striking features is that change in ISM intensity is generally consistent with change in sunspot number inferred from tree-ring $\Delta^{14}\text{C}$ data [1]. This agreement suggests an instant response of ISM to solar activity on decadal-to-centennial time scales [2]. Another highlight is an abrupt and sharp increase in $\delta^{18}\text{O}$ value at 11.32 ka BP in the travertine record. It suggests this weak ISM event could be associated with the freshwater outbursts into the Arctic Ocean [3]. Comparison of our travertine and global hydroclimatic proxy records show that ISM in the early Holocene was sensitive to irradiance and high-latitude hydroclimate in the northern hemisphere.

References:

[1] Solanki S et al. (2004) Nature 431: 1084-1087

[2] Wang Y et al. (2005) Science 308: 854-857

[3] Fisher T et al. (2002) Quat Scie Revi 21:873-878

