# Global warming may cause East Asian monsoon belt to shift north

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Credit: NASA

(Phys.org)—A small team of researchers with the Chinese Academy of Sciences has conducted a study of organic matter in parts of China and in so doing has concluded that the southern drift of the East Asian monsoon rain belt will reverse itself and travel north—courtesy of global warming. In their paper published in *Proceedings of the National Academy of Sciences*, the team describes how they studied the past to predict the future of summer monsoon rain patterns over China.

For the past couple of decades parts of northern China have been

experiencing draughts, which scientists have found is due to the East Asian monsoon belt shifting south—areas in the south, meanwhile, have been experiencing summer flooding. But this trend may not last long, the research team in China suggests, because global warming is likely going to cause the monsoon belt to shift northward again.

To gain some perspective regarding the East Asian monsoon belt, the researchers looked to conditions that existed since the Last Glacial Maximum (LGM)—aka the last Ice Age, the peak of which occurred approximately 20,000 years ago. Logic suggests that monitoring the movement of the monsoon belt as the Earth warmed after the LGM, should offer clues as to how it might behave this time around. To find out which way it might have moved back then, the researchers collected loess-soil deposits from several locations in China's Loess Plateau—the thinking was that plants that lived during frequent rains, due to monsoons, would have a C4 photosynthetic pathway, while those that lived in drier areas, would not. Thus by tracking the locations of the remains of such plants using carbon isotope ratio measuring techniques, the team was able to create a timeline of monsoon movement. The timeline showed the East Asian monsoon belt slowing moving north (approximately 300-km) after the end of the LGM—and that, the team suggests, is strong evidence that the belt will do the same thing once again as the planet heats up (and the Earth's thermal equator moves northward), reversing the southerly movement and bringing rains once again to a parched northern China and relief for those in the south getting too much rain.

**More information:** Warming-induced northwestward migration of the East Asian monsoon rain belt from the Last Glacial Maximum to the mid-Holocene, Shiling Yang, DOI: 10.1073/pnas.1504688112

**Abstract**
Glacial–interglacial changes in the distribution of C3/C4 vegetation on

the Chinese Loess Plateau have been related to East Asian summer monsoon intensity and position, and could provide insights into future changes caused by global warming. Here, we present δ13C records of bulk organic matter since the Last Glacial Maximum (LGM) from 21 loess sections across the Loess Plateau. The δ13C values (range: –25‰ to –16‰) increased gradually both from the LGM to the mid-Holocene in each section and from northwest to southeast in each time interval. During the LGM, C4 biomass increased from 40% in the southeast. The spatial pattern of C4 biomass in both the LGM and the mid-Holocene closely resembles that of modern warm-season precipitation, and thus can serve as a robust analog for the contemporary East Asian summer monsoon rain belt. Using the 10–20% isolines for C4 biomass in the cold LGM as a reference, we derived a minimum 300-km northwestward migration of the monsoon rain belt for the warm Holocene. Our results strongly support the prediction that Earth's thermal equator will move northward in a warmer world. The southward displacement of the monsoon rain belt and the drying trend observed during the last few decades in northern China will soon reverse as global warming continues.