Multiple proxy records have been used for the understanding of environmental and climate changes during the Holocene. For the first time, we here measure meteoric $^{10}$Be isotope of sediments from a drill core collected at the Kunlun Pass (KP) on the northeastern Qinghai-Tibet Plateau (NETP) to investigate moisture and atmospheric circulation changes during the Holocene. The $^{10}$Be flux suggests relative low levels in the Early Holocene, followed by a sharp increase to high values at around 4 ka BP (4 ka BP = 4000 years before present). Afterwards, the $^{10}$Be flux remains on a high level during the Late Holocene, but decreases slightly towards today. These $^{10}$Be deposition patterns are compared to moisture changes in regions dominated by the Indian Summer Monsoon (ISM), East Asian Summer Monsoon (EASM), and the Westerlies. Different from the gradual changes in monsoon patterns, the $^{10}$Be data reveal low levels during the Early Holocene until ~4 ka BP when an obvious increase was indicated and a relative high level continues to this day, which is relatively more in agreement with patterns of the Westerlies. This finding provides a new evidence for a shift in the dominant pattern of atmospheric circulation at the KP region from a more monsoonal one to one dominated by the Westerlies. Our results improve the understanding of non-stationary interactions and spatial relevance of the EASM, the ISM and the Westerlies on the Qinghai-Tibet Plateau.