

Regional temporal evolutions of heat waves and cold surges In China during 1961-2008

QIAN Weihong* (钱维宏), Ding Ting (丁婷), ZHANG Zongjie (张宗健)

Monsoon and Environment Research Group, School of Physics, Peking University, Beijing 100871

ABSTRACT

Heat waves are severe persistent extreme events. The daily maximum/minimum temperature and relative humidity records at 510 stations in China for the period 1960-2008 were used to investigate the geographical patterns and temporal variations of heat wave (HW) events. Dry HW events and wet HW events were compared by different definitions. Regionally, dry HW events and wet HW events are commonly located in southeastern China in the monsoon area, neither dry HW events nor wet HW events in the northeast part of Northeast China and Southwest China, while dry HW events and few wet HW events are observed in the north-northwest part of China.

In the north-northwest part of China, a high frequency of site dry HW events mainly occurred from May to August, with one peak in June. In the southeast part of China, site dry HW events occurred from April to September and mostly in June, while site wet HW events occurred from April to October and mostly in September.

Totally, 163 regional wet HW events were derived. The longest ten regional wet HW events persisted more than 20 days, while their mean duration was about 11 days. The range of coverage affected by the top ten regional wet HW events was from 47 to 79 grids, while 19 grids on average for all events. For the top ten events, six occurred after 1990s, compared with four before then. The global surface warming was clear since 1979, but regional wet HW frequency and severity in East China were relatively low in 1980s and increased remarkably since 1990s. Possible reasons might be partly due to strong inter-decadal and interannual variations in regional atmospheric circulations as well as water transport related directly to temperature contrasts in different regions, rather than the global-mean temperature changes.

Regional prolonged low temperature (LT) is severe damage event in China. Homogenized daily temperature records at 549 stations in China for the period of 1960-2008 were used to identify all regional prolonged LT events and investigate their geographical patterns and temporal variations. After considering the limitation of the definitions for site prolonged LT event and regional prolonged LT event by National Climate Center (NCC) of China, new definitions were proposed in this work. Based on the present definition, total 552 regional prolonged LT events were identified in the last 49 years. Quantitative criteria such as duration, extent, intensity and a comprehensive index (*CI*) were developed to quantify the event severity. Four special databases of extreme regional LT events were established with the longest duration of 46 days from November in 1967 to January in 1968, the largest extent of 290 grids in November 1976, the highest intensity in April 2003, and the severest comprehensive impact in November 1967, respectively. All the regional prolonged LT events were further classified into three groups, namely strong, moderate and weak events, according to the *CI* values. Spatially, strong events frequently affected north of Xinjiang and along the Yangtze River to the south of the Yangtze River, moderate events often occurred in Xinjiang, Northeast and south of the Yangtze River, and weak events mainly appeared in southwest and south coastal regions. In the last 49 years, the annual frequency of regional prolonged LT events in China showed a significant decreasing trend with a rate of -1.99 times/decade and the significant transition decade was in the 1980s. The variation of annual *CI*, annual duration and annual intensity show similar trend, with high value in 1960s-1970s and low values in 1990s.

Key words: heat wave, regional prolonged low temperature, extreme temperature event, duration index, comprehensive index, spatiotemporal variation