
Regime shift in the occurrence of extreme heat day in East Asia during boreal summer

Yong-Han Lee^{*1}, Sang-Wook Yeh^{†1}, and Jin-Sil Hong¹

¹Department of Marine Science and Convergent Technology, Hanyang University – 55, Hanyangdaehak-ro, Sangnok-gu, Ansan-si, Gyeonggi-do, South Korea

Abstract

The frequency of extreme heat days in boreal summer, such as heat waves and tropical nights, is also increasing, and it has a significant impact on human as well as socioeconomic conditions. We defined extreme heat days (EHD) as the days exceeding or equaling the 90 percentile threshold of the climatological (1981-2010) Tmax and Tmin. During the period of 1979-2019, the frequency of East Asian EHD has increased as the time progresses. In particular, the average frequency since 1997 significantly increased from 0.6 days/months to 1.6 days/months with a distinct regime shift. To determine the characteristics of the frequency of EHD occurrence before and after the regime shift, the entire period was divided into P1 (1979-1996) and P2 (1997-2019) period. For each period, the authors investigated the relevance of marine and atmospheric variables and compared their differences. Compared to the P1 period, the frequency of EHD in the P2 period was closely related to the tropical sea surface temperature. It was confirmed that the structures of sea surface temperature, outgoing long wave radiation and precipitation in the Indian Ocean and Western Pacific are different between the P1 and P2 periods. Furthermore, the frequency of EHD in East Asia during the P2 period is highly correlated with the increase in sea surface temperature and the decrease in sea ice concentration in the North Barents Sea. These results suggest that oceanic and atmospheric variables related to the frequency of EHD occurrence in East Asia could be changed, which might be due to either a natural variability or anthropogenic forcing.

Keywords: East Asia, Extreme heat day, Variability, Regime shift

*Speaker

†Corresponding author: swyeh@hanyang.ac.kr