



## **Characteristics of 2016 and 2018 heat wave events over South Korea and their predictability in the operational prediction system of KMA**

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Because of global warming and abnormal climate change, record-breaking heat wave events have been increasing over South Korea. In particular, the heat wave events for recent two years (i.e. 2016 and 2018) have been recorded as the longest and most damaging events ever. The average numbers of heat wave days (maximum surface air temperature) during JJA were 22.4 days (29.4°C) in 2016 and 31.5 days (30.3°C) in 2018. According to the Korea Centers for Disease Control and Prevention, the numbers of patients affected by the summer heat wave were 2,125 in 2016 and 4,519 in 2018. Therefore, accurate prediction of a heat wave is necessary to reduce the related damages.

First, the total number of 96 heat wave events over South Korea for 39 years (1980-2018) are defined by spatiotemporal temperature criteria. Then, the simulated surface air temperature for 36 hours is evaluated for heat wave events among the two years to examine the predictability of the Korea Meteorological Administration (KMA)'s operational prediction system. The bias between model and observation data has a diurnal variation; the model tends to underestimate (overestimate) surface air temperature in the late afternoon (early morning). Regardless of the heat wave event, a negative bias of the maximum surface air temperature tends to be largest over the southeastern region of South Korea. The results of KMA's operational local prediction system (LDAPS) are compared with those of the global system (GDAPS) to investigate the cause of temperature bias. The cold bias over the northern region of South Korea in GDAPS is prominently decreased by LDAPS, whereas that over the southeastern region still exists. Also, the temperature bias of LDAPS was larger in 2016 than 2018. Cluster analysis is also conducted to investigate the cause of different predictability among the 2016 and 2018 heat wave events. Heat wave events for 39 years are classified by 500 hPa geopotential height anomaly over East Asia using the k-means clustering analysis method. The predictability of GDAPS in 2016 and 2018 heat wave events are assessed by each event with focusing on the synoptic characteristics of clusters.

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