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Effect of Upper-Level High Pressure in Eastern Europe and Convection Activities in the Western North Pacific Subtropical Region on the Prediction of Heatwaves over the Korean Peninsula

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Heatwaves are meteorological disasters that can damage human health and reduce agricultural production when extremely high temperatures are involved. A heatwave over the Korean Peninsula in 2018 broke the temperature and duration records kept since observations began. This event caused significant socio-economic damage. High pressure in the upper atmosphere over Eastern Europe and strong convection over the western North Pacific subtropical region are major fluctuations known to strengthen heatwaves over the Korean Peninsula. This study analyzed how these factors affected predictions of the 2018 heatwave over the Korean Peninsula using the sub-seasonal to seasonal (S2S) prediction model. Of the 11 models used in the S2S prediction project, 6 were selected: CMA, ECCC, ECMWF, KMA, NCEP, and UKMO. These models underestimated the daily surface temperature from July to August 2018 compared with observations, and the prediction errors gradually increased as lead-time increased. The model that simulated significant upper-level high pressure events in Eastern Europe and convection activities in the western North Pacific subtropical region predicted surface temperatures for the Korean Peninsula that were similar to the observed values. The increase in air pressure in the upper atmosphere over Eastern Europe is related to the recent expansion of areas affected by heatwaves in Europe. Even in the S2S models, the model that accurately predicted the characteristics of the heatwave showed excellent prediction performance for the Korean Peninsula. The increase in convection activities in the western North Pacific subtropical region increased when the amplitude of phases 4–6 of the Madden–Julian Oscillation (MJO) was large and they included many days. If the S2S model simulates the characteristics of the MJO accurately, the surface temperature prediction performance for the Korean Peninsula will increase. Therefore, it is very important for the S2S model to predict these two factors accurately, particularly when predicting heatwaves similar to that which occurred over the Korean Peninsula in 2018.

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