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Large-scale circulation control of summer extreme hot events over China

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The classification of summer extreme hot events (EHEs) over China is made based on a case analysis about a summer EHE occurred in northern China in 2010 in terms of the Self-organizing map (SOM) using the ECMWF reanalysis data. It is found that EHEs over northwest China (NWC), north China (NC), northeast China (NEC), mid-eastern China (MEC) and south China (SC) are associated with five persistent anticyclone types.

Composite analyses show that the persistent anticyclone warms the land surface mainly by enhancing shortwave radiation through reducing cloud fraction. The lower atmosphere is heated by long wave radiation, latent heat flux and sensible heat flux of the land surface and warm advection and adiabatic warming of the anticyclone, though main heating terms for different EHE types are different. Further analyses revel that the anticyclone in southern China is mainly caused by westward movement of western Pacific subtropical high which has been studied a lot, while the anticyclone in northern China is mainly formed by downward wave activity propagation, and the background zonal wind decides the propagation direction.

Because the upstream anticyclone of the wave train is more like a blocking, the relationship between upstream blocking and downstream anticyclone is further studied. Upstream blocking can explain about 50% of the EHEs which is treated as an essential large-circulation control, and only blockings with intensified zonal wind in mid-latitudes can cause warming in northern China.