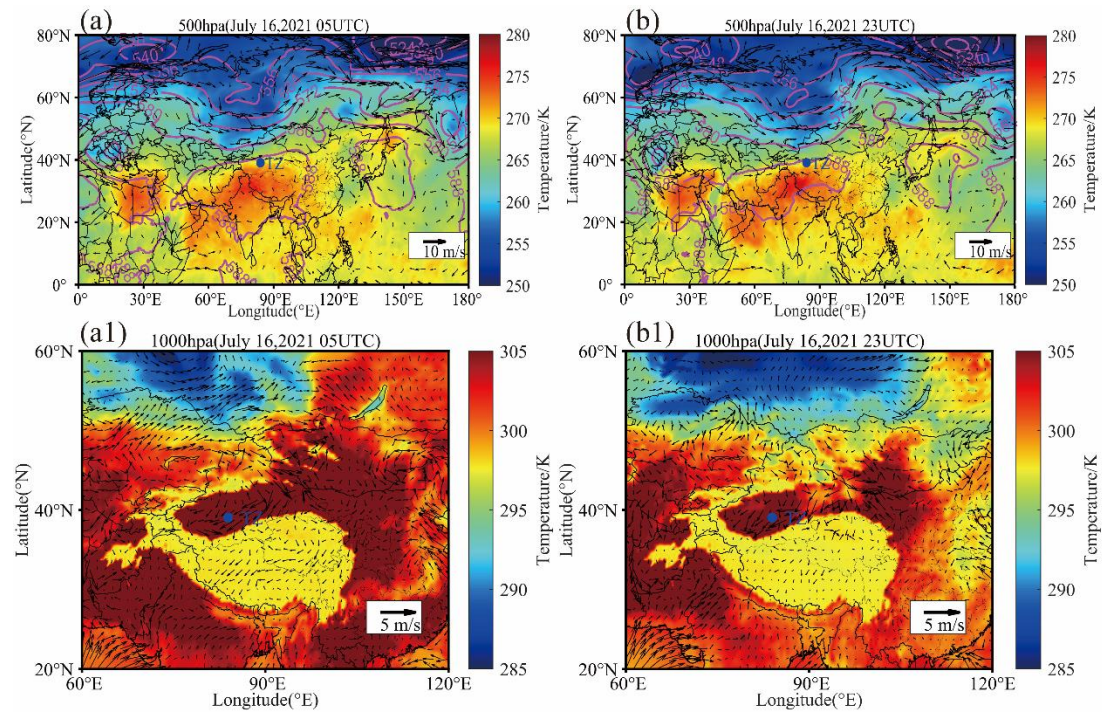
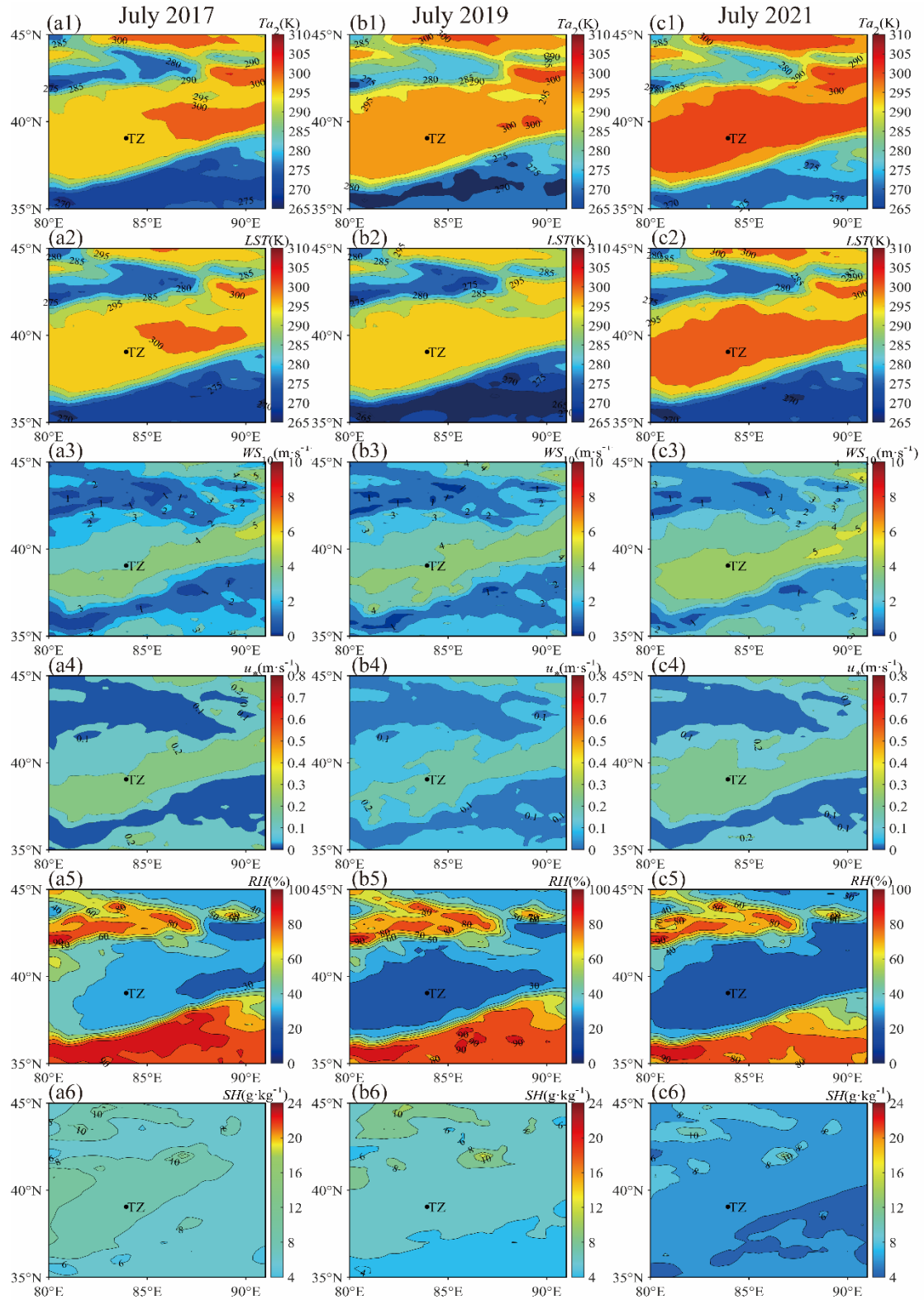


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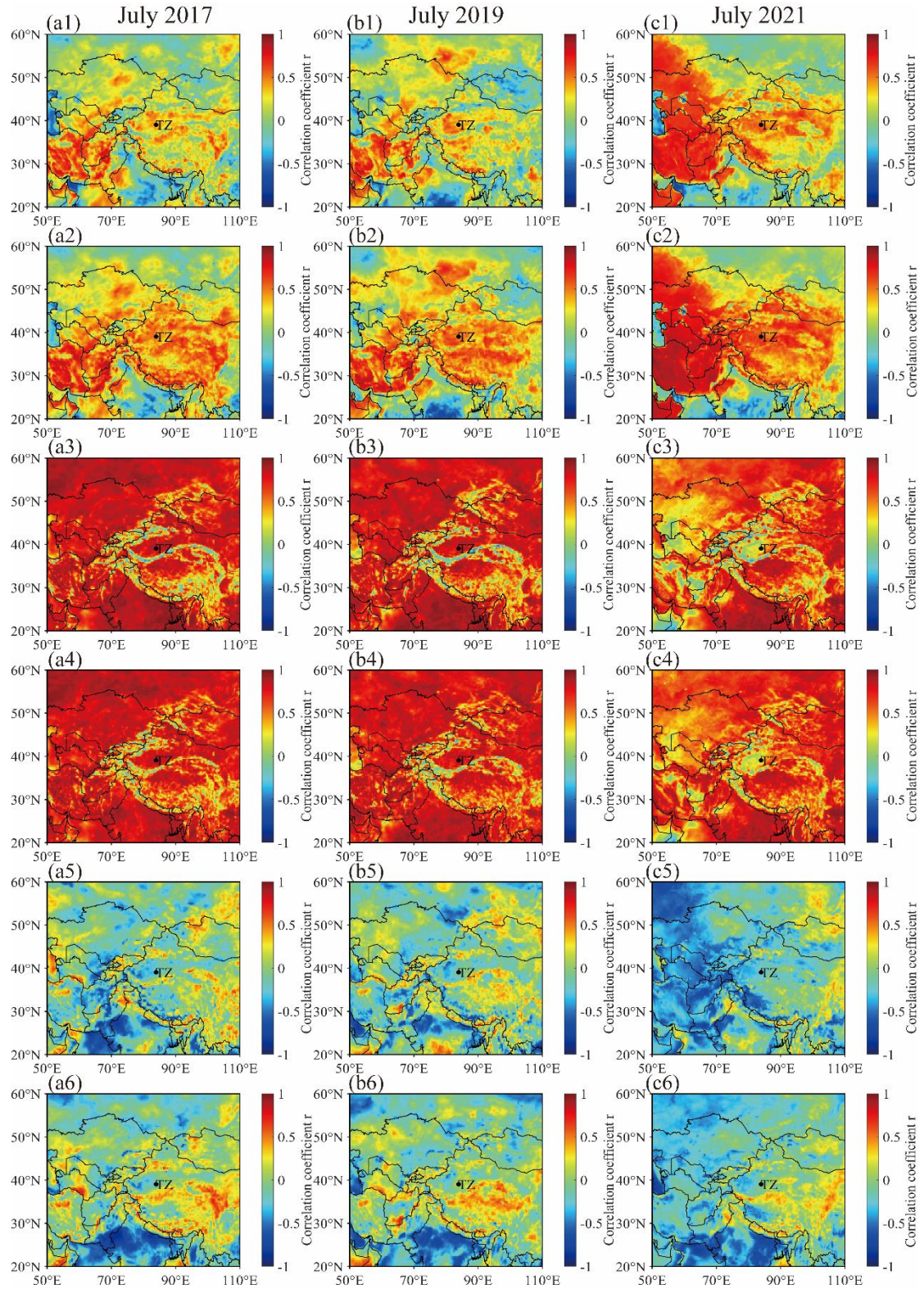


**Figure S1.** Weather situation map. **(a)** July 16, 2021 05UTC 500hpa; **(b)** July 16, 2021 23UTC 500hpa; **(a1)** July 16, 2021 05UTC 1000hpa; **(b1)** July 16, 2021 23UTC 1000hpa. The purple solid line is the potential height (unit: potential meter); the arrow is the wind speed (unit: meter/second); and the color is the temperature (unit: K). Solid blue circles are research sites.



**Figure S2.** Changes in main meteorological elements (in order: air temperature is a collage of 2 meters ( $Ta_2$ , unit: K), land surface temperature ( $LST$ , unit: K), 10 meter wind speed ( $WS_{10}$ , unit:  $m \cdot s^{-1}$ ), friction velocity ( $u^*$ , unit:  $m \cdot s^{-1}$ ), relative humidity ( $RH$ , unit: %), specific humidity ( $SH$ , unit:  $g \cdot kg^{-1}$ )) in the Taklamakan Desert in July 2017 (a1, a2, a3, a4, a5, a6), July 2017 (b1, b2, b3, b4, b5, b6) and July 2021 (c1, c2, c3, c4, c5, c6). The solid black circle is the research site.





**Figure S3.** Correlation between major meteorological elements and stable boundary layer heights in the Taklamakan Desert in July 2017 (a1, a2, a3, a4, a5, a6), July 2019 (b1, b2, b3, b4, b5, b6) and July 2021 (c1, c2, c3, c4, c5, c6) (in order: air temperature is a collage of 2 meters ( $T_{a2}$ , unit: K), land surface temperature ( $LST$ , unit: K), 10 meter wind speed ( $WS_{10}$ , unit:  $m \cdot s^{-1}$ ), friction velocity ( $u^*$ , unit:  $m \cdot s^{-1}$ ), relative humidity ( $RH$ , unit: %), specific humidity ( $SH$ , unit:  $g \cdot kg^{-1}$ )). The solid black circle is the research site.