

Supplement for “Preliminary diagnosis of primary factors for an unprecedented heatwave over Japan in 2023 summer”

Upward long-wave radiation, sensible and latent heat flux anomalies

Figures S1a–f show anomalous longwave radiation, sensible and latent heat fluxes averaged separately for 16–31 July and 1–15 August 2023. In the region where enhanced downward short-wave radiation was seen (Figs. 5c and 5f), upward anomalous long-wave radiation fluxes were also seen in both periods (Figs. S1a and S1d). This indicates that the enhanced downward short-wave radiation (Figs. 5c and 5f) indirectly brings positive SAT anomalies via the upward anomalous longwave radiation from warm surface. Although upward sensible heat flux anomalies were also seen in parts of the region (Figs. S1b and S1e), their magnitudes were smaller, implying their secondary importance. The upward sensible and latent heat flux anomalies to the east of Japan (Figs. S1b, S1c, S1e, S1f) also indicate the impact of the markedly high SST to the east of Japan on the above-normal SAT. The upward latent flux anomalies (Figs. S1c, S1f) mean increased surface evaporation, which could act to prevent nighttime surface cooling in coastal regions by increasing moisture and the resultant enhancement of the greenhouse effect. The same effect could be operative with the positive SST anomalies in the Sea of Japan and coastal regions of northern Japan.

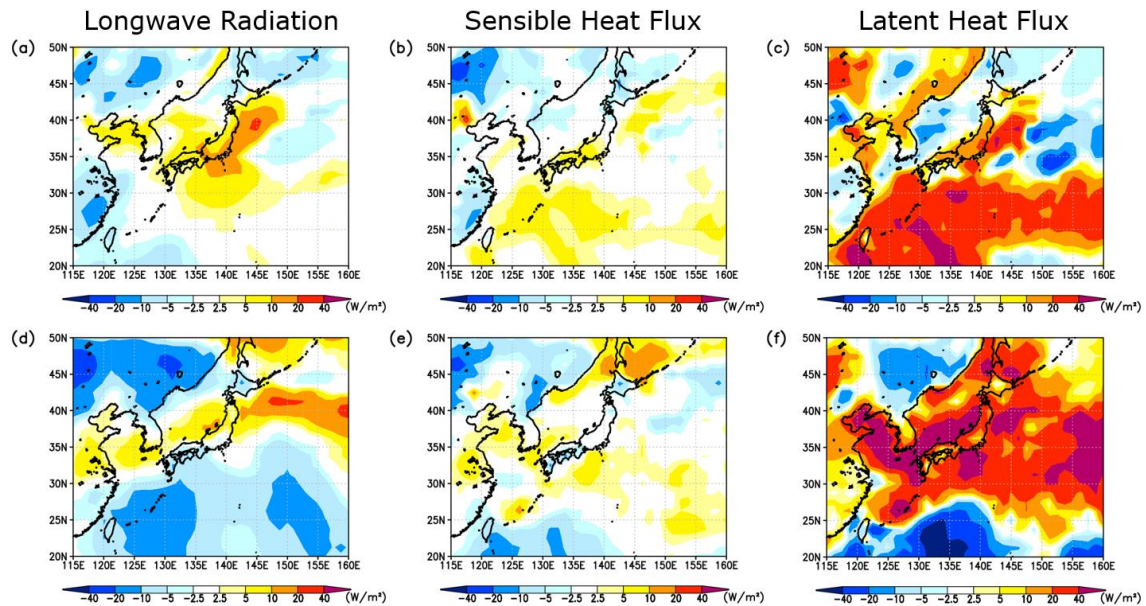


Fig. S1. Anomalous upward (a, d) longwave radiation flux, (b, e) sensible heat flux, and (c, f) latent heat flux (W m^{-2}) averaged for (a, b, c) 16–31 July and (d, e, f) 1–15 August 2023.