

EGU26-2526, updated on 27 Aug 2026

<https://doi.org/10.5194/egusphere-egu26-2526>

EGU General Assembly 2026

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Upper-level warming and its effect on tropical cyclone intensity

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Deep convection associated with tropical cyclones (TCs) can reach the tropopause, which can induce mixing between the troposphere and the stratosphere. Such exchanges have been documented in both numerical simulations and observational studies, which indicate that stratospheric subsidence into the eye of an intensifying storm contributes to the formation of an upper-level warm core. Despite these findings, the influence of this upper-level warming on TC intensity is still poorly understood. In our study, we demonstrate using idealized simulations that the upper-level warming originates from subsiding stratospheric air outside of the storm eye, rather than from subsidence in the eye alone. We show that overshooting convection penetrating into the stratosphere is responsible for the induced subsidence, with both processes intensifying with higher sea surface temperatures (SSTs).