



Supplement of

The impact of orography on the troposphere-to-stratosphere transport during a typhoon event in the tropics

Massimo Martina et al.

Correspondence to: Massimo Martina (massimo.martina@matfyz.cuni.cz) and Petr Šácha (petr.sacha@matfyz.cuni.cz)

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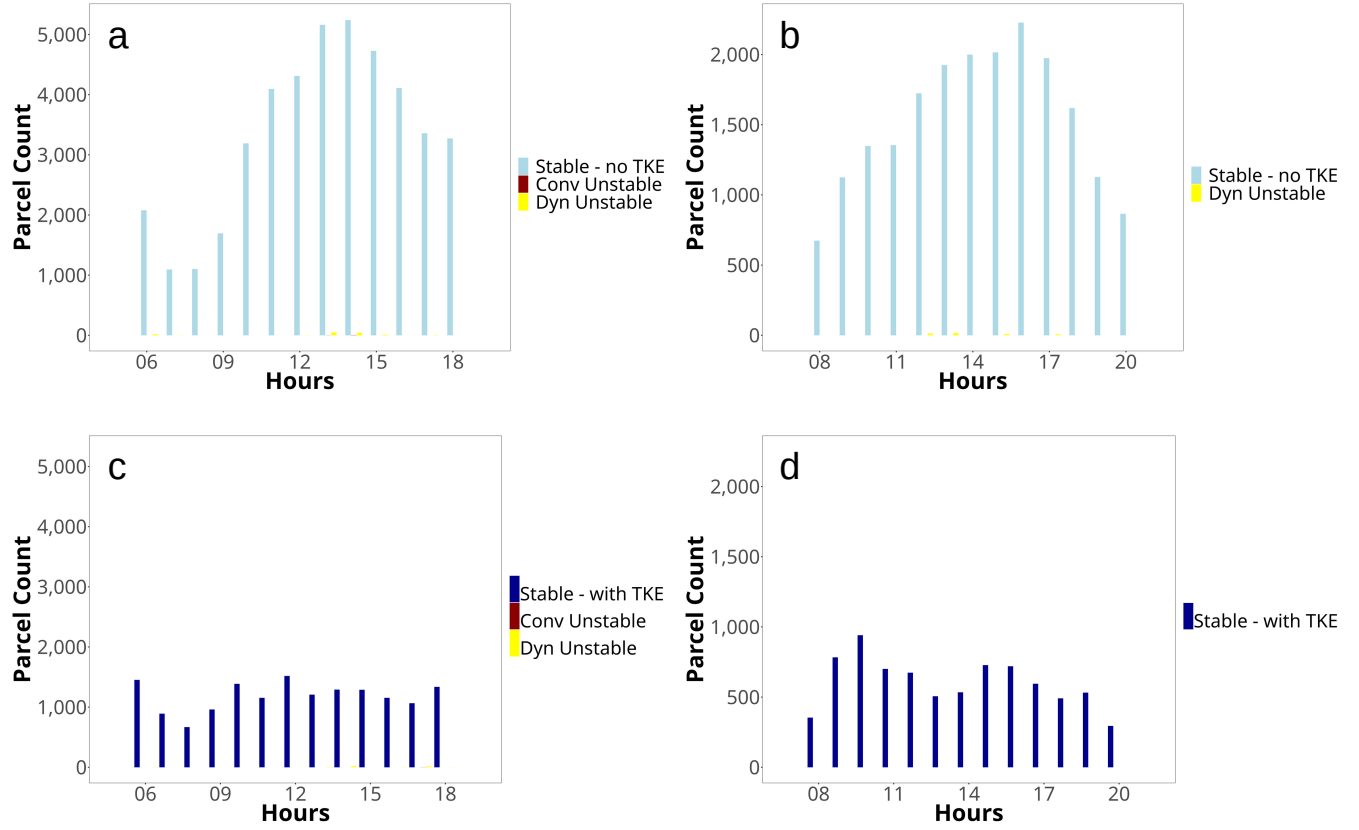


Figure S1: Intrusions per hour entering the TTL (first column) and the stratosphere (second column) across the R1 target region on 26 October 2020, categorized using stability regimes. The panels refer to: (a) TTL intrusions over land, (b) stratospheric intrusions over land, (c) TTL intrusions over sea and, (d) stratospheric intrusions over sea. The bars indicate the absolute parcel counts categorized into four distinct environmental regimes based on their Richardson number (Ri) and Turbulent Kinetic Energy (TKE): convective instability ($Ri < 0$, dark red), dynamical instability ($0 \leq Ri \leq 0.25$, yellow), stable conditions with non-negligible turbulence ($Ri > 0.25$ and $TKE > 0.1$, dark blue), and stable conditions with negligible turbulence ($Ri > 0.25$ and $TKE \leq 0.1$, light blue).

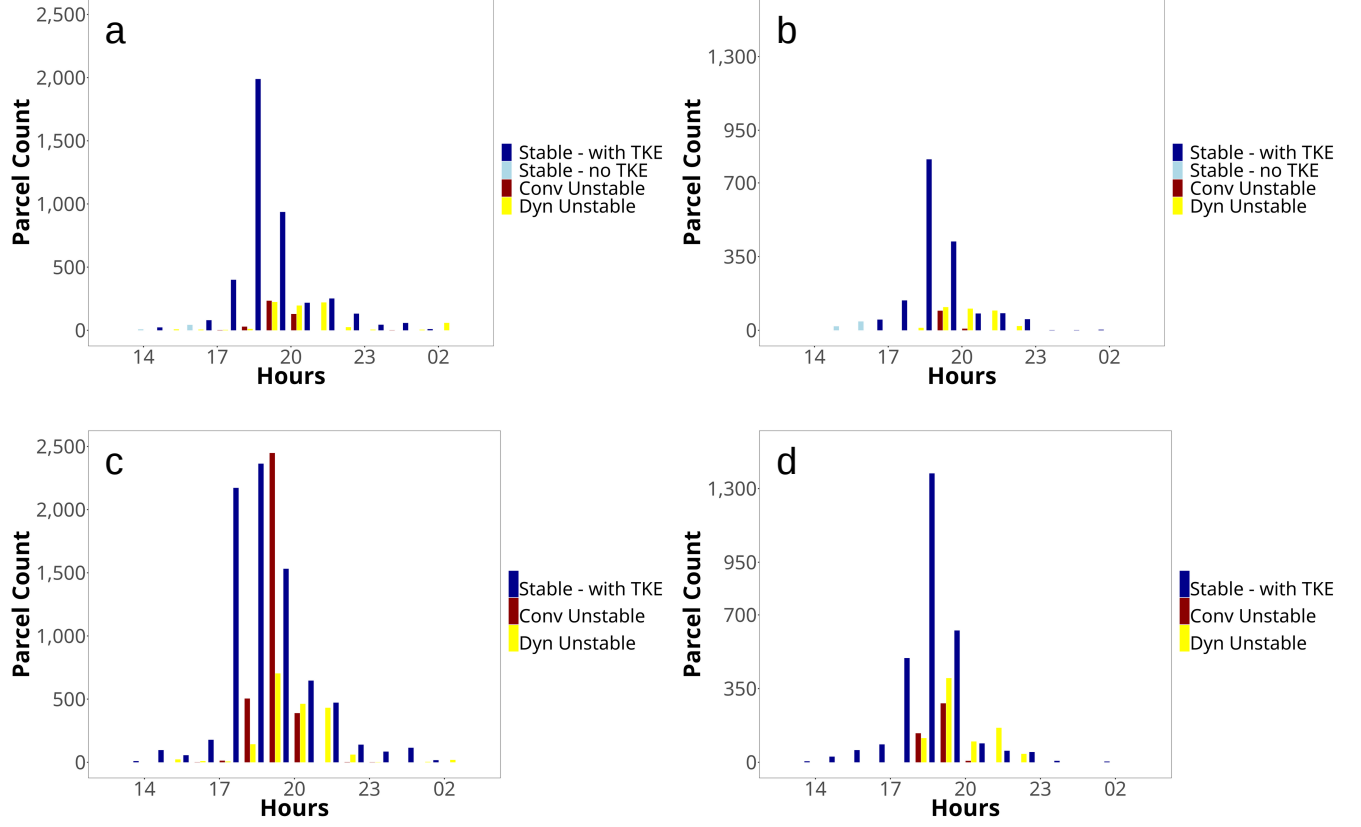


Figure S2: Intrusions per hour entering the TTL (first column) and the stratosphere (second column) across the R3 target region from the 25 October 2020 at 2 p.m. to the 26 October 2020 at 2 a.m., categorized using stability regimes. The panels refer to: (a) TTL intrusions over land, (b) stratospheric intrusions over land, (c) TTL intrusions over sea and, (d) stratospheric intrusions over sea. The bars indicate the absolute parcel counts categorized into four distinct environmental regimes based on their Richardson number (Ri) and Turbulent Kinetic Energy (TKE): convective instability ($Ri < 0$, dark red), dynamical instability ($0 \leq Ri \leq 0.25$, yellow), stable conditions with non-negligible turbulence ($Ri > 0.25$ and $TKE > 0.1$, dark blue), and stable conditions with negligible turbulence ($Ri > 0.25$ and $TKE \leq 0.1$, light blue).

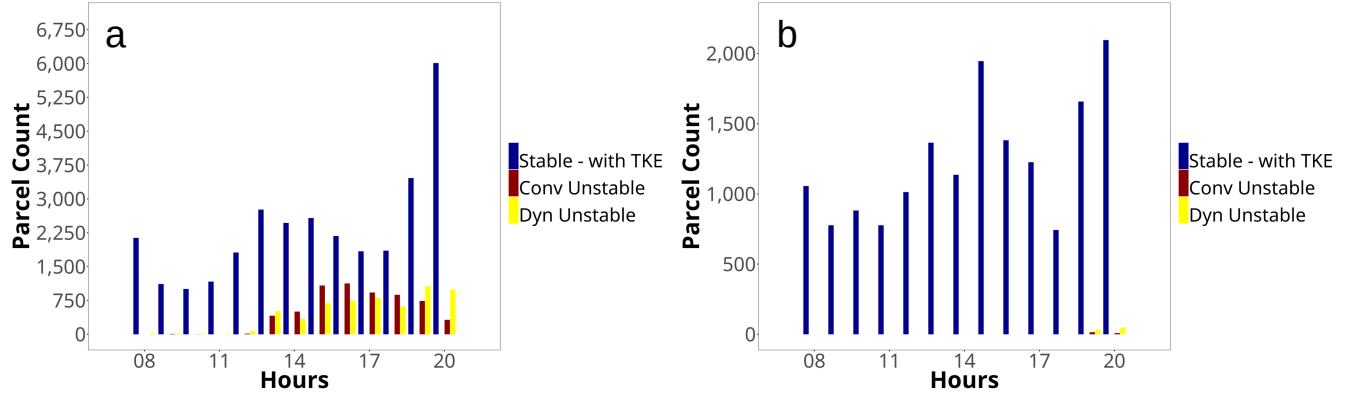


Figure S3: Intrusions per hour entering the TTL (first column) and the stratosphere (second column) across the R5 target region on 26 October 2020, categorized using stability regimes. The panels refer to: (a) TTL intrusions over sea, (b) stratospheric intrusions over sea. The bars indicate the absolute parcel counts categorized into four distinct environmental regimes based on their Richardson number (Ri) and Turbulent Kinetic Energy (TKE): convective instability ($Ri < 0$, dark red), dynamical instability ($0 \leq Ri \leq 0.25$, yellow), stable conditions with non-negligible turbulence ($Ri > 0.25$ and $TKE > 0.1$, dark blue), and stable conditions with negligible turbulence ($Ri > 0.25$ and $TKE \leq 0.1$, light blue).

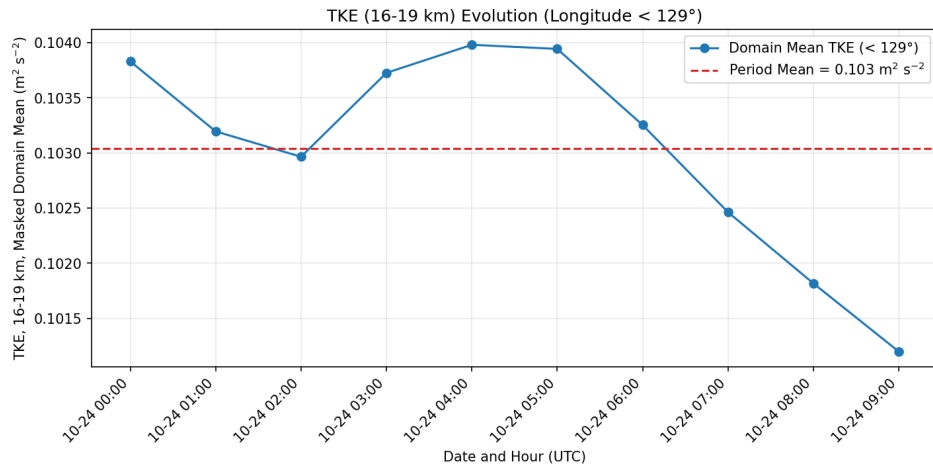


Figure S4: Domain-averaged TKE within the 16–19 km layer for the region west of $129^\circ E$ during the first 10 hours of the simulation on 24 October 2020 (00:00–09:00 UTC). The red dashed line denotes the 10-hour mean TKE.