

返回首页

Observations of ozone production in a dissipating tropical convective cell during TC4

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From 13 July–9 August 2007, 25 ozonesondes were launched from Las Tablas, Panama as part of the Tropical Composition, Cloud, and Climate Coupling (TC4) mission. On 5 August, a strong convective cell formed in the Gulf of Panama. World Wide Lightning Location Network (WLLN) data indicated 563 flashes (09:00–17:00 UTC) in the Gulf. NO₂ data from the Ozone Monitoring Instrument (OMI) show enhancements, suggesting lightning production of NO_x. At 15:05 UTC, an ozonesonde ascended into the southern edge of the now dissipating convective cell as it moved west across the Azuero Peninsula. The balloon oscillated from 2.5–5.1 km five times (15:12–17:00 UTC), providing a unique examination of ozone (O₃) photochemistry on the edge of a convective cell. Ozone increased at a rate of ~1.6–4.6 ppbv/h between the first and last ascent, resulting cell wide in an increase of $\sim(2.1\text{--}2.5) \times 10^6$ moles of O₃. This estimate agrees to within a factor of two of our estimates of photochemical lightning O₃ production from the WLLN flashes, from the radar-inferred lightning flash data, and from the OMI NO₂ data (~ 1.2 , ~ 1.0 , and $\sim 1.7 \times 10^6$ moles, respectively), though all estimates have large uncertainties. Examination of DC-8 in situ and lidar O₃ data gathered around the Gulf that day suggests 70–97% of the O₃ change occurred in 2.5–5.1 km layer. A photochemical box model initialized with nearby TC4 aircraft trace gas data suggests these O₃ production rates are possible with our present understanding of photochemistry.

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