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A Case Study of the Highest Ever Altitude of In Situ Observations of Convective Hydration of the Stratosphere during the DCOTSS Field Campaign

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On 24 June 2022, remnant outflow from a tornadic supercell storm that occurred in northern Kansas on the evening of 23 June 2022 was observed by the high-altitude NASA ER-2 aircraft during the Dynamics and Chemistry of the Summer Stratosphere (DCOTSS) field campaign. Namely, preliminary analysis indicates that stratospheric water vapor enhancements were observed at altitudes up to approximately 19.25 km (~1 km higher than any prior documented event), approximately 460 K potential temperature (~30 K higher than any prior documented event), and ozone mixing ratios of more than 1400 ppbv (more than double any prior documented event). The responsible storm was one of the most extreme events observed annually in the United States, within no more than 10 per year such high-reaching storms based on ground-based radar climatology. Here, we review the event using high-resolution ground-based radar volumes and satellite imagery and show that it reached altitudes exceeding 19 km for at least an hour. Linkages to the Kansas storm will be demonstrated via trajectory analyses initialized in the volumes impacted by the storm (as determined from radar and satellite observations). Broader evaluation of stratospheric composition impacts resulting from this event will also be presented.