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Rapid-update X-band radar observations of two severe storms in Vienna, Austria

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Severe thunderstorms and associated weather phenomena like large hail, heavy precipitation and strong winds pose a substantial threat to public safety and infrastructure. Thunderstorms are commonly monitored using C- or S-band weather radars with update times between 2 to 5 minutes for volumetric scanning, and range resolutions in the order of 250 to 500m. Recent studies, however, suggest potential benefits of rapid-update dual-pol radar observations for operational nowcasting and the understanding of microphysical processes in thunderstorms.

Since early 2020, the University of Natural Resources and Life Sciences in Vienna operates a mobile, dual-pol X-band radar. While its range is limited to 50 km - significantly less than the maximum range of conventional C- or S-band radars - it provides a radial resolution of 50 m and update times of 1 min for volumetric scans with up to 8 elevation angles.

We present detailed observations of two severe thunderstorms passing over Vienna: A supercell in June 2020 producing hailstones of up to 4 cm diameter, and a squall line in July 2020 with wind gusts up to 40 knots. Both systems showed typical polarimetric signatures of heavy storms such as ZDR columns, albeit with large differences regarding their temporal evolution and their location within the storm. In addition, a dual-Doppler retrieval of the three-dimensional wind field using data of the C-band radar at Vienna airport was conducted to examine the storm dynamics.