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The diurnal evolution of anthropogenic aerosol impacts on clouds

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Reducing uncertainty in aerosol-cloud interactions is necessary for more reliable climate projections. Understanding the effects of anthropogenic aerosols on clouds remains a challenge due to complex processes governing the cloud adjustments to increased cloud droplet numbers. Using SEVIRI data, we study the daily evolution of polluted cloud tracks induced by strong pollution sources in the European part of Russia. We use semi-automated cloud droplet effective radius based statistical classification algorithm to differentiate between polluted and nearby unpolluted pixels in the satellite images. We use the 15-minute resolution Cloud Physical Properties product by KNMI to study changes in polluted cloud properties during the daytime. In some cases, cloud water increases during the day and in some cases decreases in polluted clouds compared to the nearby unpolluted clouds. On average, the diurnal evolution of cloud water is very similar between polluted and unpolluted clouds. Interestingly, there is less cloud water in polluted clouds already in the morning, suggesting that cloud water decreases more in polluted clouds during the night. The relatively weak average decrease in cloud water agrees with MODIS-based estimate (Toll et al 2019, Nature, <https://doi.org/10.1038/s41586-019-1423-9>).