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MeteoDrones – Influence of UAV data on Short-Term Fog and Cloud Forecasting

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The Planetary Boundary Layer (PBL), which is the lowest part of the atmosphere, is the main trigger of phenomena like fog, low stratus, freezing rain and thunderstorms. A major reason for the short-term forecasts (up to 24h lead time) to not achieve better prediction skills for above phenomena is the data gap in the PBL. Data observed on the ground and the very sparse radio sonde soundings are not able to describe the dynamics of the lower atmosphere well enough for the numerical weather models to predict the further development.
Meteomatics has been operating rotary wing unmanned aerial vehicles (UAVs) profiling the lower atmosphere since 2012 to fill that data gap. By now more than 14'000 profiles from ground to maximum altitudes between 500 and 3'000 meters above ground were conducted. Most notably, this was done during a measurement campaign around Zurich airport in winter 2018: UAVs at 6 locations in the vicinity of the airport were profiling the lower atmosphere continuously for two weeks. The data profiles were operationally ingested into Meteomatics' in-house Weather Research & Forecasting (WRF) numerical weather model Swiss1k and for analysis purposes into MeteoSwiss' COSMO model. The models were run with and without MeteoDrone profile data being assimilated to evaluate the influence of the additional data on the forecast skills, focusing on fog and cloud development.
The results show that the assimilated MeteoDrone profiles had a positive or strongly positive impact on the fog or cloud analysis and consequently on derived parameters as visibility or icing potential. The latter being economically relevant particularly for aerodrome operations.