

## **Assimilation of Mode-S EHS Aircraft Observations in COSMO-KENDA**

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Aircraft observations of wind and temperature collected by airport surveillance radars (Mode-S EHS) were assimilated in COSMO-KENDA (Kilometre-scale ENsemble Data Assimilation) which couples an Ensemble Kalman Filter to a 40 member ensemble of the convection permitting COSMO-DE (Consortium for Small-Scale Modelling) model. The number of observing aircrafts in Mode-S EHS was about 15 times larger than in the AMDAR system. Between both aircraft observation systems, comparable observation error standard deviations in wind and a larger error in temperature were diagnosed a posteriori using analysis residuals in observation space (Desrozier's method).

With the high density of Mode-S EHS observations, a reduction of temperature and wind error in forecasts of one and three hours was found mainly in the flight level and less near the surface. The amount of Mode-S EHS data was reduced by random thinning to test the effect of a varying observation density. With the current data assimilation setup, a saturation of the forecast error reduction was apparent when more than 50 percent of the Mode-S EHS data were assimilated. Forecast kinetic energy spectra indicated that the reduction in error is related to analysis updates on all scales resolved by COSMO-DE. Evolution (every 15 minutes) of forecast kinetic energy spectra compared to the control experiment showed behavior of COSMO-DE model depending on amount of data assimilated.