Temperature profiling with ground-based microwave radiometers during the SoFog3D campaign
Retrieval setup

Data set (COSMO-REA2 reanalysis)

Liquid-Cloud-Model (95% rh-threshold)

Atmospheric parameter: \( p(z), T(z), q(z), LWC(z), LWP, IWV \)

Training set

RT-Model

Inversion through a statistical model i.e. multivariate regression

Coefficients

Testing set

RT-Model

Comparison
Additional retrievals

HATPRO:

- Neural Network (NN) approach (RPG)
  - NN has been trained with AROME reanalysis data with 1.3 Km spatial resolution
- 1D-variational (1DVAR) (Dr. Pauline Martinet)
  - MWR observations are combined with an a-priori profile originating from the AROME model

MTP5:

- Regularization (ATTEX)
  - Based on solving the equation for the tropospheric delay of a radio signal in the microwave regime
Bias between MWR and RS

- MTP-5 regression -> high underestimation at the surface and overestimation at ~250m
- Zenith only retrieval misses information at the surface level -> high bias
- Other retrievals stay at ~0.5K bias under 1000m
STD between MWR and RS

- Lowest variance for regression (HATPRO) at ~150m
- 1DVAR lowest variance from ~250m
- Zenith retrieval higher variance near surface
- Variance of MTP-5 regression near surface and in 200-500m significantly higher

N = 33
Case studies

- Thick inversion near the surface
- MTP-5 overestimated
- HATPRO zenith retrieval overestimated near the surface
- All retrievals overestimated in 150-650m w.r.t. radiosonde
- Inversion is well detected by both MWR
Case studies

- Sharp inversion at 250m
  -> 1DVAR able to resolve, other retrievals a smoother profile
- Better performance of the MTP-5 regression in contrast to expected bias/std