

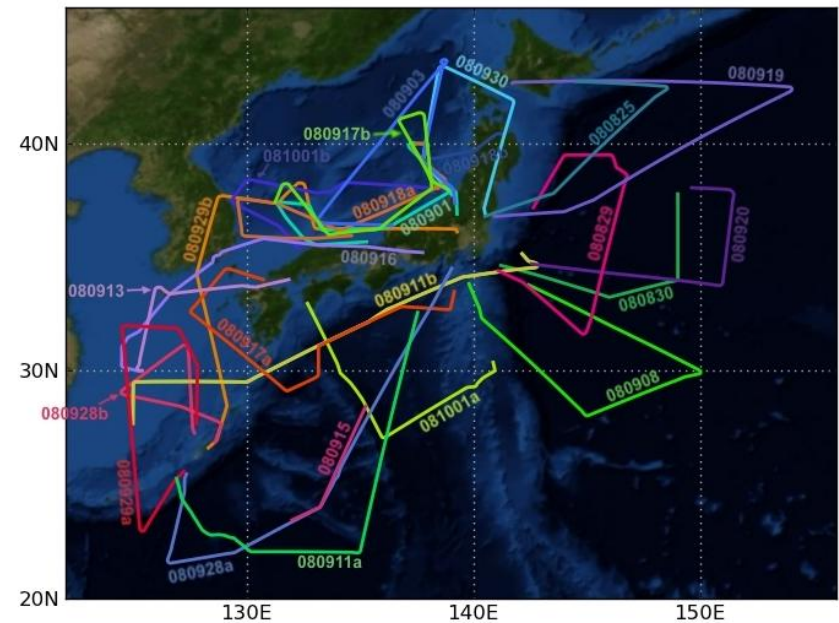
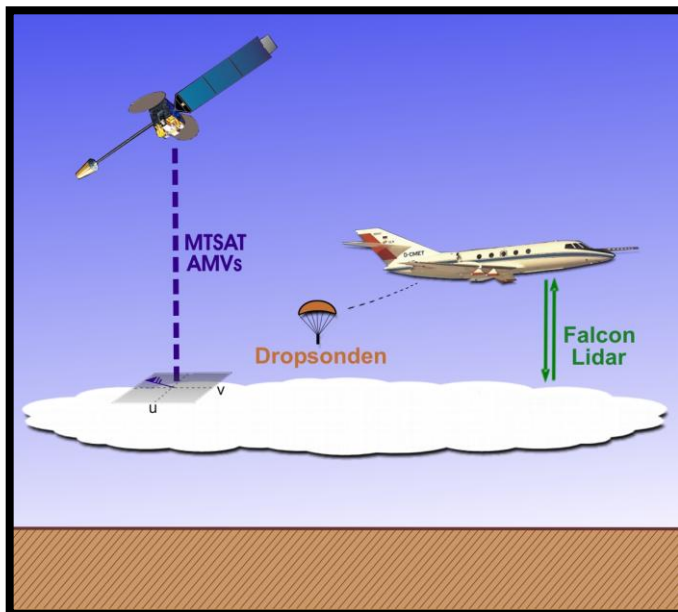
# Height correction of AMVs (Atmospheric Motion Vectors) using satellite lidar observations from CALIPSO

Kathrin Folger, Martin Weissmann

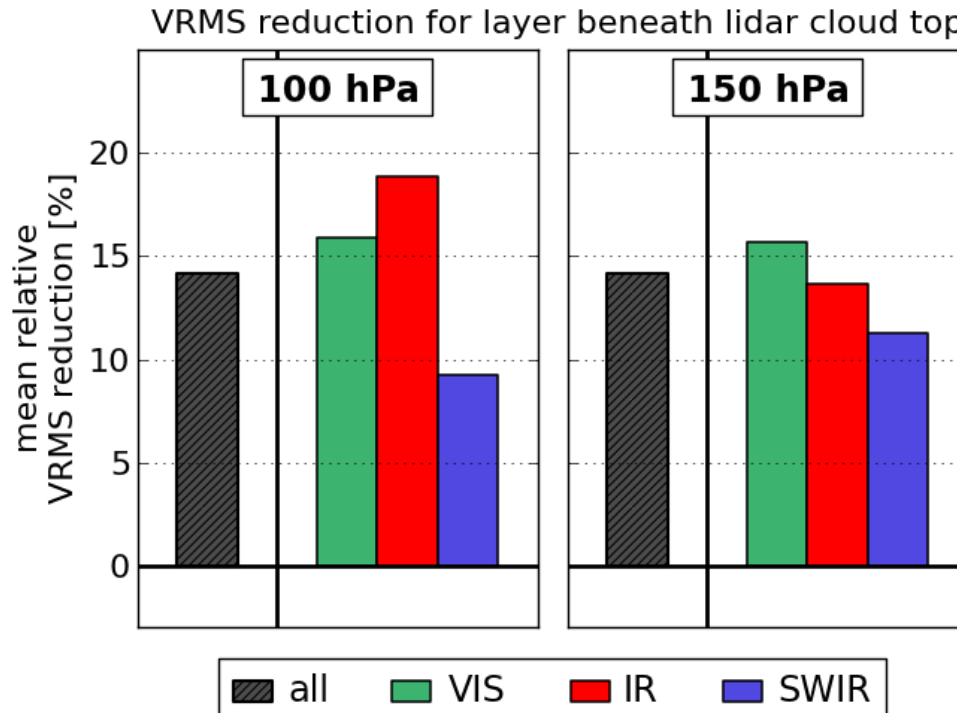
## AMV height assignment issues → can lidar observations help?

### THORPEX Pacific Asian Regional Campaign (T-PARC) 2008

- airborne lidar observations on 24 DLR Falcon flights
- over 300 dropsondes for verification
- MTSAT-AMVs



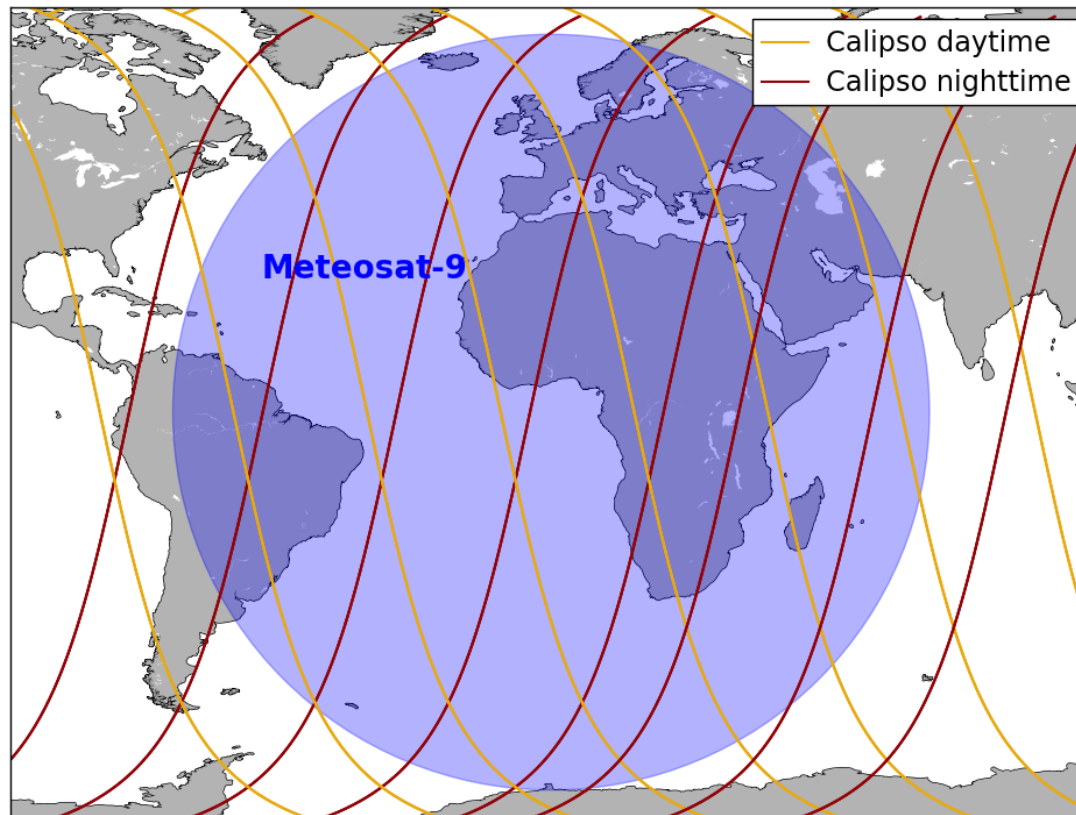
## AMV height correction using airborne lidar observations during T-PARC/TC08



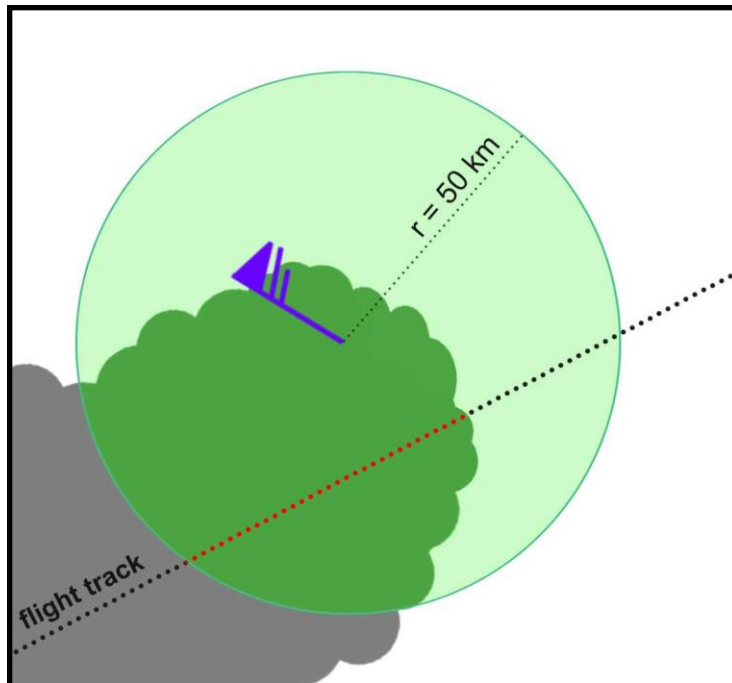
Weissmann, M., K. Folger and H. Lange: Height correction of atmospheric motion vectors using airborne lidar observations. J. Appl. Meteor. Climatol., 2013

# AMV height correction using satellite lidar observations

AMVs from Meteosat-9 (geostationary)  
lidar cloud top observations from CALIPSO (polar orbiting)

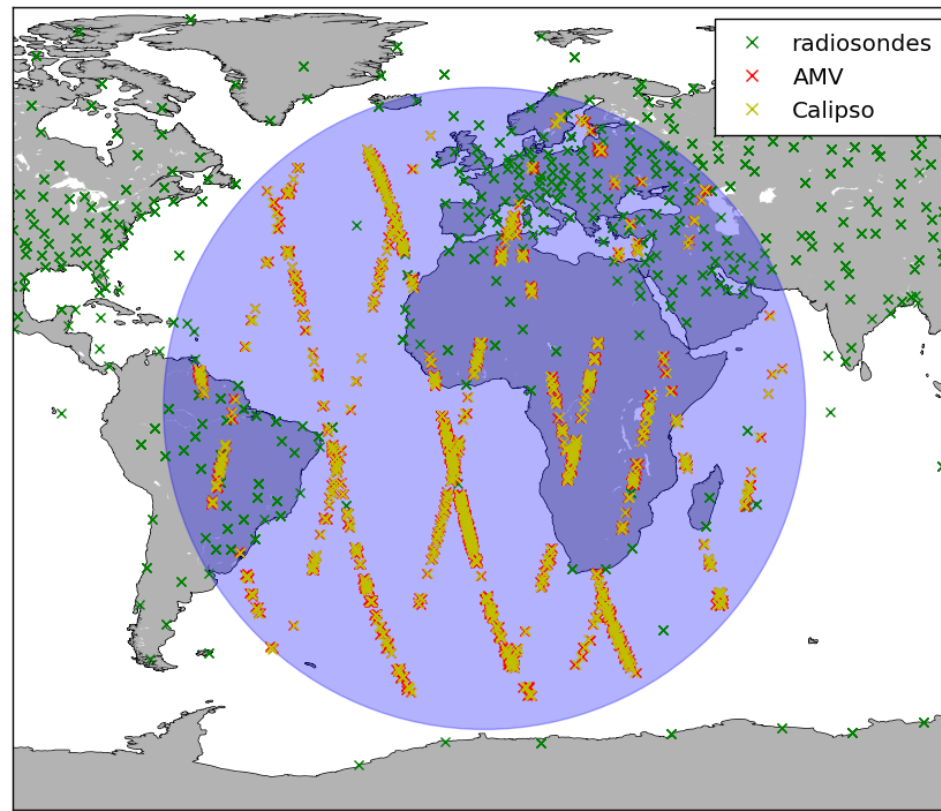


# Collocation of AMVs, Calipso lidar and radiosondes



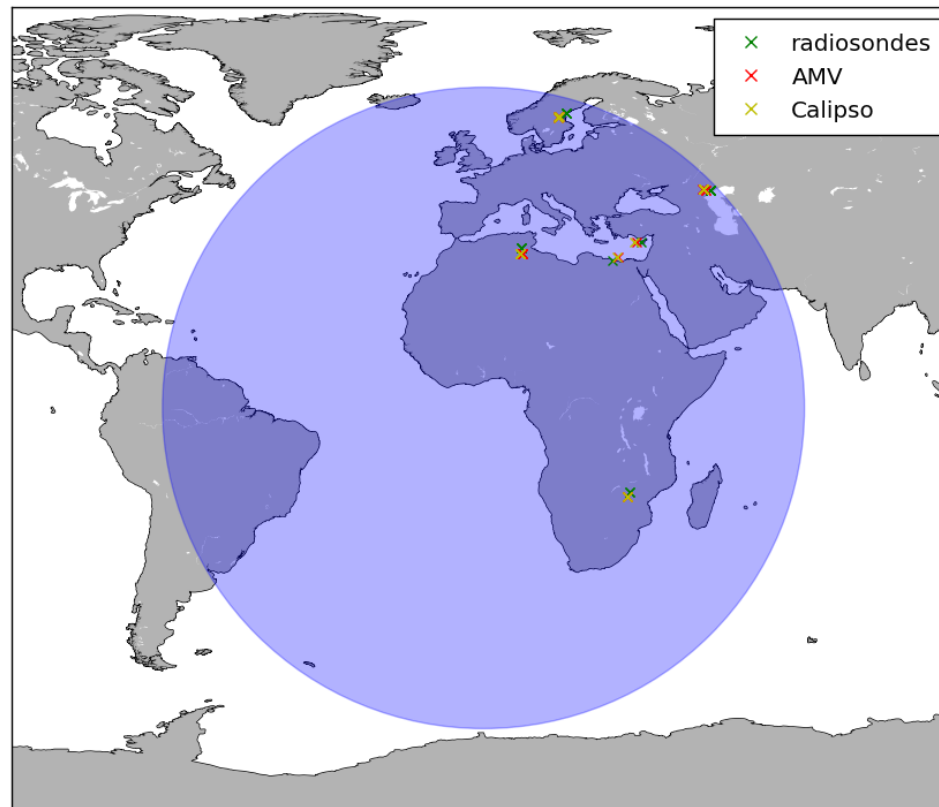
- AMV – Calipso: 50 km, 30 min
- AMV – RS: 150 km, 90 min
- AMV quality index: > 50 (of 100)
- Calipso cloud quality: > 90 (of 100)
- no multilayer clouds
- At least 20 Calipso lidar cloud observations for 1 AMV → Median of all available cloud tops
- RMS of individual Calipso lidar observations to their median  $\leq 70$
- AMV height at most 100 hPa above or 200 hPa below Calipso cloud top

## AMVs and Calipso lidar observations for April 1, 2012



ca. 1200 matches

# AMVs, Calipso lidar observations and radiosondes for April 1, 2012



ca. 15 matches

# Dataset:

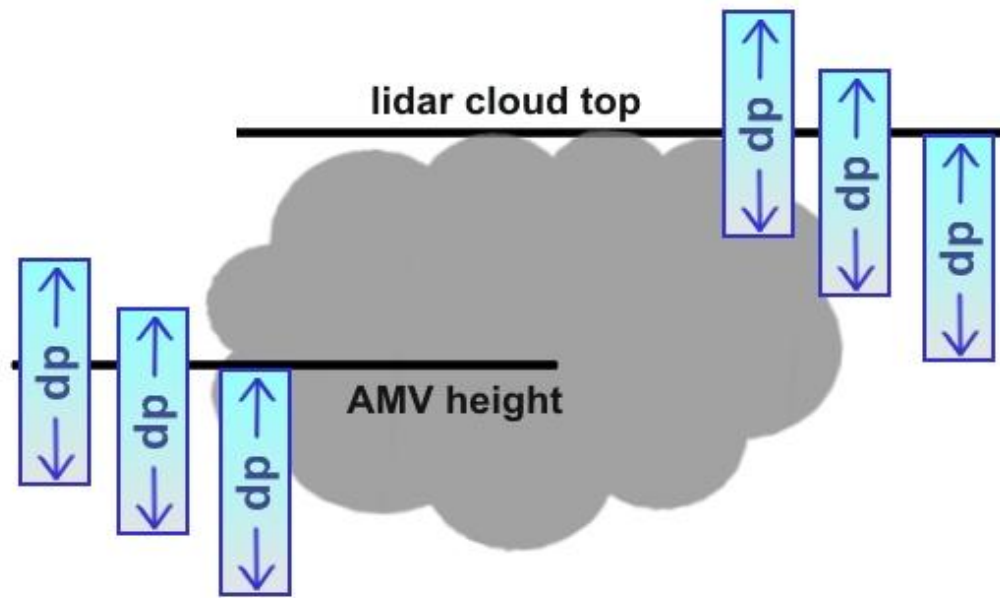
6 month period (April 1, 2012 til September 30, 2012)

Meteosat-9-AMVs with collocated Calipso lidar observations and radiosondes

→ **3438 matches** (1052 VIS, 889 IR, 1497 WV cloudy)

Wind layer  $dp$  in three different positions (centered, 25% above and 75% below)

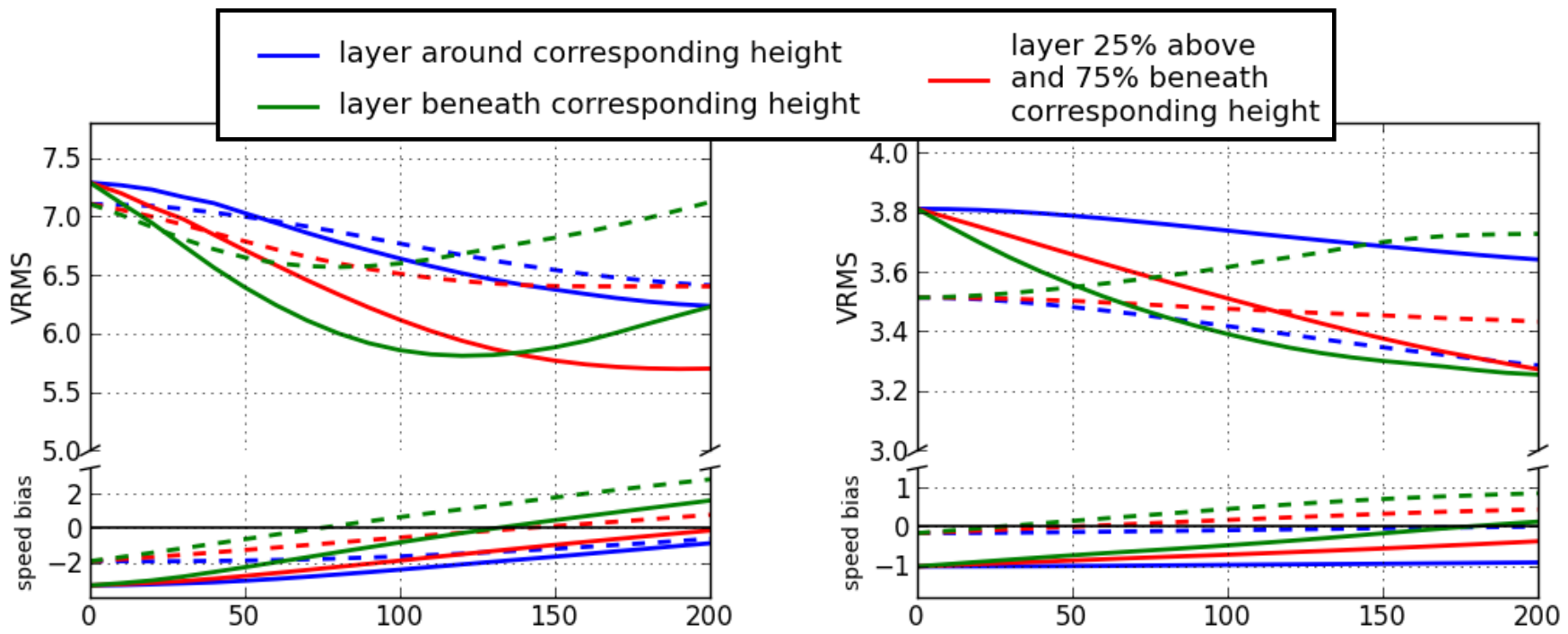
- relative to lidar cloud top
- relative to the original AMV height





# Results

dashed = AMV height  
 solid line = lidar cloud top height



High level AMVs  
 above 700 hPa  
 (WV and IR, 2191 matches)

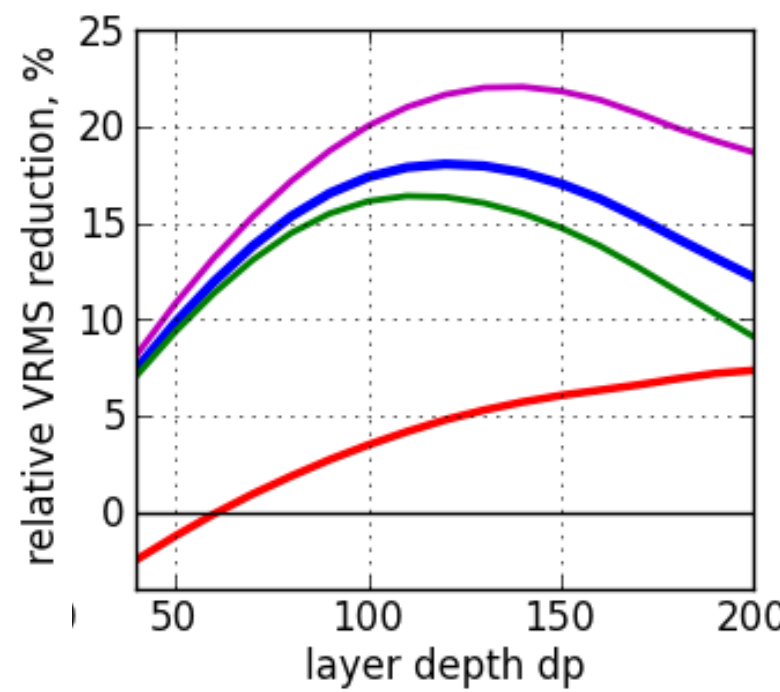
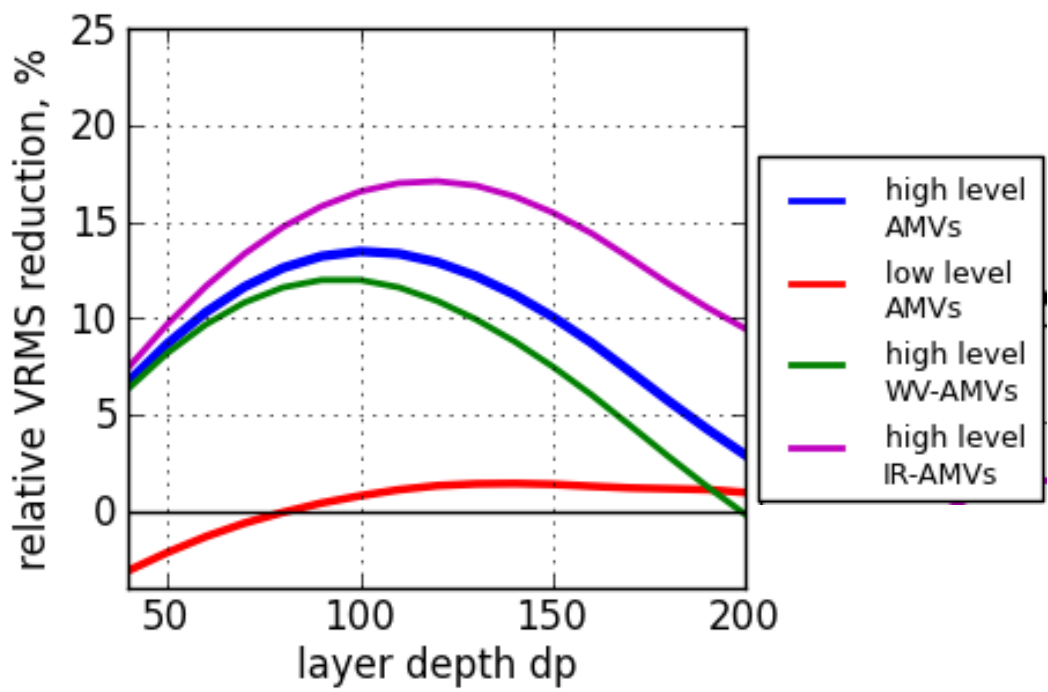
Low level AMVs  
 below 700 hPa  
 (VIS and IR, 1227 matches)



## Wind error reduction for a layer below the lidar cloud top relative to...

... a **layer** of the same depth centered at the AMV height

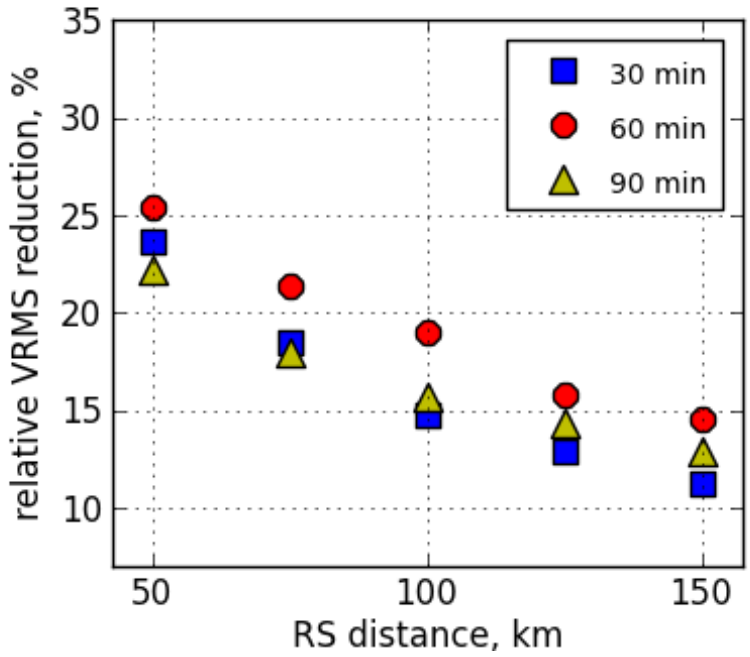
... the exact **level** of the AMV height



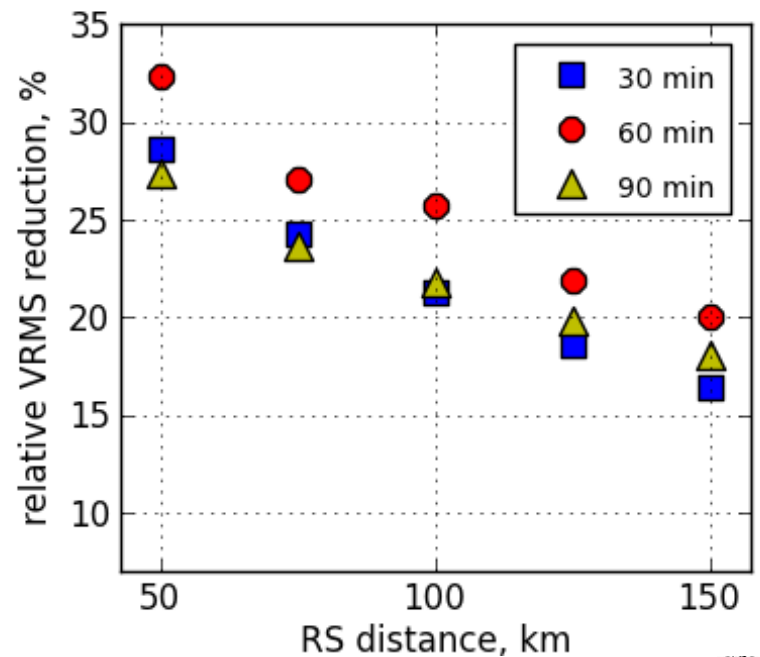
## High level AMVs (pressure < 700 hPa)

relative AMV error reduction as function of horizontal distance and time difference for a 120-hPa-layer below the cloud top relative to...

... a **layer** of the same depth centered at the AMV height



... the exact **level** of the AMV height



# Summary

Analysis of **6 months of data** (April til September 2012):

- Meteosat-9-AMVs
  - Calipso lidar observations (cloud top)
  - Radiosondes for wind evaluation
- } 3500 matches

## Wind error reduction of high level AMVs:

- compared to layer of the same depth centered at AMV height: ca. 13%
- compared to single level value at AMV height: ca. 18%
- better results when horizontal distance and time difference are reduced

Lidar observations (as an independent data source) are expected to reduce the error correlation in addition to the height assignment error

## Outlook

- publish results
- analyse new period in 2013 (different height assignment algorithm from EUMETSAT since April 2013)
- Verification with model (wind layer operator)
- Error correlation studies
- Assimilation studies