## TOPROF WG 3: Ground-based microwave radiometers



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TOPROF meeting, Toulouse, October 19-21, 2015

# **Objectives**

**Overarching goal**: Exploit MWR for data assimilation and now-casting

Measurement focus: PBL

**TOPROF objective**: Development of a sustainable network of European MWR

#### Tasks:

- 1. Establish procedures for providing QC MWR data (+ uncertainties)
- 2. Standardize data processing chain
- 3. Towards data assimilation (WG4); develop requirements & tools; perform first assimilation studies



## **J-CAL: Joint CALibration experiments**

# Establishing standards for operation and optimum calibration of passive microwave radiometers

- J-CAL1 (Lindenberg August 2014) → Recommendations for LN2 calibrations and repeatability
- J-CAL2 (Meckenheim, RPG September 2015) → uncertainty analysis for sky-tipping calibrations and assessment of LN2 calibrations

Participants from: LIM, UzK, IMGW, KNMI, TROPOS, INOE and RPG







- ✓ 5 different HATPRO generations
- ✓ joint LN2 calibrations at the beginning, then 2 weeks of regular TB comparisons to RS
- ✓ continuous sky-tipping of all instruments → perfect autumn weather 2. week!!



### **JCAL2- first results**



assess performance of older vs. newer HATPRO generations  $\rightarrow$  are the derived differences consistent with our uncertainty assumptions?



## User recommendations for MWR in an network → handbook

### **Calibrations HATPRO/Radiometrics profiler**

- how to optimally perform of LN2 calibrations
- frequency of automatic calibrations
- uncertainty characterization

### Operation

- standardized measurement modes
- regular maintenance

### Data handling

 which data types to be stored, at what frequency planned: distribution as a "living document" via TOPROF website



### **Standardized data flows**

- first data following CF and HD(CP)<sup>2</sup> conventions have been collected and tested for MWRnet "core" sites (finalization of data formats in WG3 meeting)
- mwr\_pro (V4) software for reprocessing MWR software from raw data now available from <u>ftp://gop.meteo.uni-</u> koeln.de/pub/loehnert/mwr\_pro/
- are starting to produce O-B statistics (DWD and MeteoSwiss)





- **RS** assimilated!
- Low bias/std for lead=0
- Fast increase of bias/std with lead time for z<2km

- **NO RS assimilated!**
- Slow and weak increase of bias/std with lead time
- MWR contributes mostly for z<1.5km



snd

0h

1h

4h

6h

8h

9h

10ł

11

З

### **STSM: MWR Tb Assimilation with 1D-Var**

Francesco De Angelis (U. L'Aquila) visiting Pauline Martinet (Météo France) for 35 days (17/09-23/10)

**Main goal**: Evaluation of the NWPSAF 1D-Var interfaced with RTTOVgb to retrieve temperature, humidity and liquid water path

Methodology: Observing System Simulation Experiments (OSSE)

- Simulation of MWR observations from AROME (1.3 km French model) forecasts and RTTOVgb + perturbation according to the observation error covariance matrix R
- Perturbation of the AROME forecasts according to the background error covariance matrix B to produce 1D-Var background



### **STSM: Main achievements**

#### Before the STSM:

- 1D-Var ready to perform T and Q retrievals
- Computing Jacobians with the brute force method
- No real evaluation of the retrieval quality

#### After the STSM:

- Evaluation of T and Q retrievals using brute force Jacobians
- Modified 1D-Var uses RTTOVgb \_K (tangent linear and adjoint operators) for the computation of Jacobians
- Evaluation of T and Q retrievals in clear-sky with RTTOV\_K (either Q or IWV as control variable)
- Modification of RTTOVgb to perform cloudy-sky simulations;
- Retrievals of T, Q and LWP for cloudy profiles.



## **STSM: Preliminary results**

- Zenith vs scan (90°, 30°, 19.2°)
- 180 profiles
- convergence rate 80% (94% if IWV is used)
- T, Q and LWP are simultaneously retrieved (only profiles with LWP > 5 gm<sup>-2</sup>)







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# Assimilation study by Caumant et al.

Assimilation of humidity and temperature observations retrieved from ground-based microwave radiometers into a convective-scale model

- Assimilating T and H retrievals into NWP
- DA experiment in the framework of HyMeX
- 2-month period (Oct-Nov 2011)
- Obs: 13 MWR
- Model: Météo-France Arome WMed
- DA: 3DVAR, T&H profiles every 3 h Paper under revision: QJRMS

**Conclusion**: "safe" assimilation of MWR data possible  $\rightarrow$  neutral to positive impact on forecasts of precip. systems **Issues**: instrument density & uncertainties in retrieved products



Observations



24h rainfall accumulation MWR assim.



