#### **COST-TOPROF**

### J-CAL2 Joint microwave calibration experiment



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# Ground-based microwave radiometers (MWR)

#### Benefits

- Integrated properties (Liquid water path LWP / Integrated Water Vapor IWV)
- Temperature (T) & humidity profiles (WV)
- Continuous long-term, unmanned observations on temporal scales down to seconds → fill gaps between radiosondes
- Measurements during both cloudy and clear air
- Price, commercial availability

#### Limitations & challenges

- Limited vertical resolution (2-4 deg. of freedom), declines with height
- Calibration
- Absorption modeling
- Automatic data quality control (QC) systems
- Coordinated networks





# **Goals of J-CAL**

 Establishing standards for operation and optimum calibration of passive microwave radiometers

- J-CAL1 (Lindenberg August 2014) -> Recommendations for LN2 calibrations
- J-CAL2: uncertainty analysis for sky-tipping calibrations

## Specific goals of J-CAL2

- Perform "manual" sky-tipping calibrations (K-Band) with parallel instruments (elevation scans). Is there any random-walk effect?
- Defining quality criteria for sky-tipping calibrations
- Launch clear-sky radiosondes for intercomparison
- Low V-Band issues? G4 Hatpro with specified center band -> is there any difference to clear sky radiosondes?

# Instruments

- HATPRO instruments of different series:
  - G1 (Leipzig/Kiel, 2006)
  - G1 (IMGW Poland, 2008)
  - G1 (KNMI, 2005)
  - G4 (RPG demonstrator, 2014), several instruments
  - G4 (INOE Romania, 2014)
- extra radiosondes





# **Results JCAL2**

## Sky tipping uncertainties

- One week of perfect autumn weather for skytip analyses -> 20% of time successful!
- Is it useful to perform sky-tipping calibrations in a MWR network? Will be discussed in WG3 later today.
- Comparison with clear-sky sondes (low V-Band issue) > no distinct sign

# What is sky-tipping?



## Sky-tipping uncertainties

Which criteria should be applied?

r=0.9991, chi^2=0.1



26.24

25.44

Frequency [GHz]

27.84

31.40

0

22.24 23.04

23.84



## Sky-tipping uncertainties

Which criteria should be applied?

r=0.9991, chi^2=0.1

r=0.9999, chi^2=0.1





# **Sky-tipping uncertainties**



# **Comparison with clear-sky sondes**



# **Comparison with clear-sky sondes**



# **Comparison with clear-sky sondes**



## Low V-Band issue



# Recommendations for MWR in networks

- Operation
  - regular maintenance
- Data handling
  - which data types to be stored, at what frequency
- Calibrations HATPRO/Radiometrics profiler
  - Frequency of automatic calibrations
  - Perfomance of LN2 calibrations
- Error characterisations

# Conclusions

- Accurate calibrations are vital for network operation of passive MWR
- Absolute calibration for K-Band using Tipping curve shows similar results as LN2
- Low V-Band issue: Characterization of offset necessary
- Recommendations for operators will be distributed after J-CAL2

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