

Applications



- Liquid water path (LWP) measurements
- Integrated water vapour (IWV) measurements
- Attenuation monitoring
- Beacon experiments
- Cloud observations
- Climate monitoring
- Satellite tracking (GPS, Galileo)
- Tau / opacity estimation

Features

- Direct-Detection receiver technology
- High temporal resolution (1 second), spatial resolution ($<4^\circ$ HPBW at 20 GHz, $<2^\circ$ HPBW at 70 GHz)
- Automatic calibration with sky-tipping (software controlled, 2 minutes)
- Auto-calibration receivers: complete internal calibration by noise diode switching (gain calibration) and rapid Dicke switch (ferrite circulator, for system noise temperature calibration)
- History of calibrations, post-processing possible
- Elevation and azimuth scanning with positioner: Fully steerable
- IWV (integrated water vapour) and LWP (integrated cloud liquid) full sky maps
- Immune to RF interference below reception bands (e.g. radio transmitters, mobile phones etc.), direct detection receiver layout
- Purely passive operation, no internal oscillators or other RF sources
- Full control over scans: customized or tracking of astronomical objects (e.g., the sun) or satellites
- Fibre-optical data cable for lightning protection and secure data transmission
- Operating software for radiometer includes:
 - Remote Operation (web-server application)
 - Detailed instrument status and control
 - Automatic recovery after power failures
 - User defined schedules for measurements and calibration
 - Internal data file backup system
 - Satellite Tracking (GPS data from receiver and RINEX orbit parameter files)
 - User interface for complex scan pattern definition
 - Level-0 voltage raw data
 - Level-1 calibrated brightness temperature data
 - Level-2 retrieved products data (LWP, IWV)
 - Data formats: Binary, netCDF, ASCII, BUFR
 - Data manipulation and display, time series, analysis
 - Housekeeping data
 - Data quality checks / quality flags
 - Detection and removal of RF Interferences

- Free software updates from FTP server
- North-alignment by software feature (sun-tracking plus GPS)
- GPS clock and receiver
- Rain detection sensor
- Sensors for pressure, temperature, and relative humidity

Models

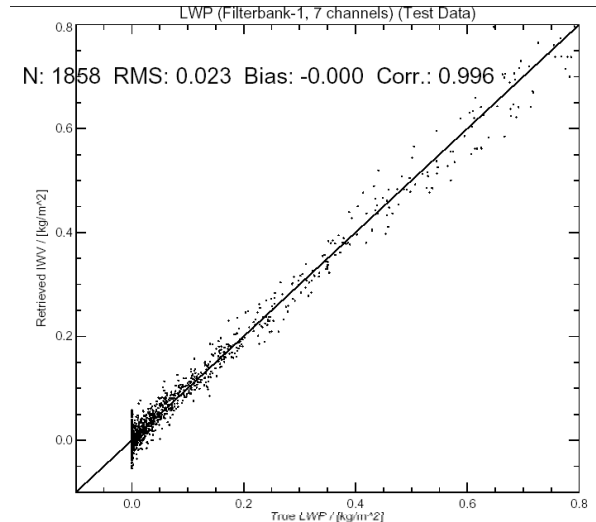
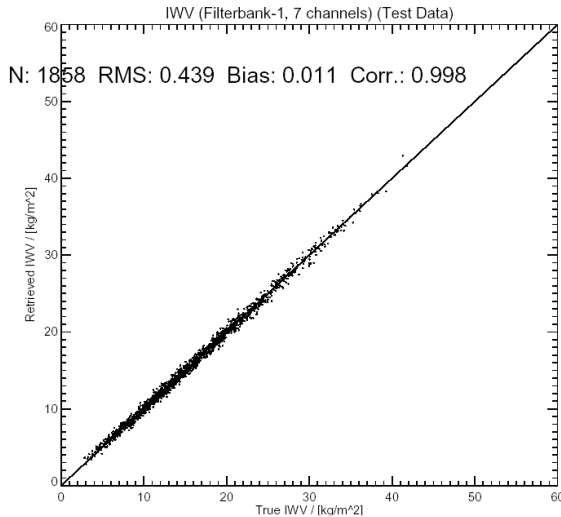
- **RPG-LWP**
Standard Dual-Channel radiometer
 - Channel-1: 23.8 GHz Direct Detection, 230 MHz bandwidth
 - Channel-2: 31.4 GHz Direct Detection, 230 MHz bandwidth
- **RPG-LWP-U90**
Extension of standard model to higher sensitivity at small LWP and smaller LWP bias errors
 - Channel-1: 23.8 GHz Direct Detection, 230 MHz bandwidth
 - Channel-2: 31.4 GHz Direct Detection, 230 MHz bandwidth
 - Channel-3: 90.0 GHz Direct Detection, 2.000 MHz bandwidth
- **RPG-LWP-U72**
 - Channel-1: 23.8 GHz Direct Detection, 230 MHz bandwidth
 - Channel-2: 31.4 GHz Direct Detection, 230 MHz bandwidth
 - Channel-3: 72.5 GHz Direct Detection, 2.000 MHz bandwidth
- **RPG-LWP-U82:**
 - Channel-1: 23.8 GHz Direct Detection, 230 MHz bandwidth
 - Channel-2: 31.4 GHz Direct Detection, 230 MHz bandwidth
 - Channel-3: 82.5 GHz Direct Detection, 2.000 MHz bandwidth
- **RPG-LWP-U72-U82:**
 - Channel-1: 23.8 GHz Direct Detection, 230 MHz bandwidth
 - Channel-2: 31.4 GHz Direct Detection, 230 MHz bandwidth
 - Channel-3: 72.5 GHz Direct Detection, 2.000 MHz bandwidth
 - Channel-4: 82.5 GHz Direct Detection, 2.000 MHz bandwidth
- **RPG-TAU-225-350:**
 - Channel-1: 225 GHz Heterodyne Receiver, 4000 MHz bandwidth
 - Channel-2: 350 GHz Heterodyne Receiver, 4000 MHz bandwidth

Options (all Models)

- Azimuth positioner (elevation is internal, included in all base units)
 - Fully supported by operating software
 - 0° to 360° rotation
- IR-radiometer Suite
 - Single-Channel: Cloud base information
 - Dual-Channel: Sensitive to small LWP / effective radius of cloud particles
 - Steerable version available (fully synchronous steering with microwave observations)
- Warranty extensions
 - May be ordered at initial deployment or year-by-year

Meteorological Products

- IWV:** Integrated Water Vapour, column amount of water vapour
Ranging from 1.0 to 50.0 kg/m²
- LWP:** Liquid Water Path, column amount of cloud liquid water
Ranging from 0.0 to 1.5 kg/m²

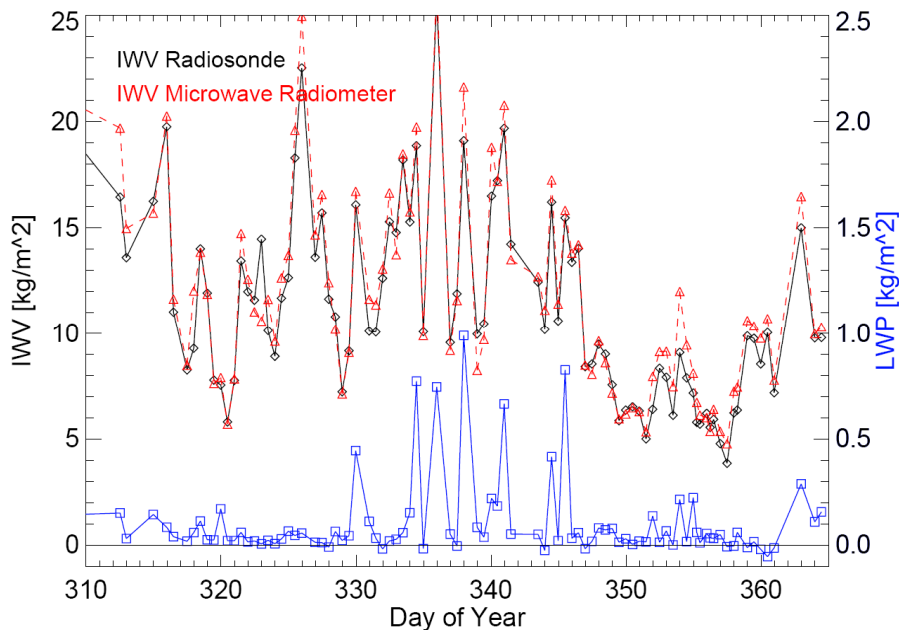


IWV

- very robust retrieval
- RMS 0.45 kg/m²
- Still works in moderate rain

LWP

- Sensitivity of ~10 g/m²
- RMS: 25 g/m²
- Can be expanded by 72/82/90GHz



Detailed Instrument Specifications

Parameter	Specification
Frequencies	23.8+31.4 (36.5, 72.5, 82.5, 90, 150 optional)
Channel bandwidth	200 MHz @ 40 GHz, 2 GHz @ 72 to 90 GHz
Beam width (HPBW)	< 4° ($\leq 2^\circ$ at 72 GHz and above)
Radiometric resolution	0.1 RMS @ 1.0 sec integration time
Side-lobe level	<-30dBc
Polarisation	1 linear
Brightness temperature accuracy	0.5 K
Absolute system stability	0.5 K
Radiometric range	0 – 800 K
System noise temperatures	< 350 K typical, < 600 at 70 to 90 GHz
Receiver/antenna thermal stability	Accuracy < ± 0.015 K
Integration time	≥ 1 second for each channel
Absolute calibration	Automatic sky-tipping, liquid nitrogen
Internal calibration	Gain: internal Load + noise diode injection
Gain nonlinearity error correction	Automatic, four point method
Brightness calculation method	Based on exact Planck radiation law
Steering / azimuth positioner	0° to 360° (0.1° resolution), full s/w control
Steering / elevation scanning	0° to 180° (0.6° steps), full software control
High-Resolution steering	Hardware + software extension for astro-tracking (rasterizing the sun, satellite tracking) (resolution: <0.3° elevation, 0.1° azimuth)
Pointing speed	Elev. 45°/s (0.6° res.), azi. 20°/s (0.1° res.)
Data interface	RS-232, 115 kBaud, fibre optical
Data rate	9.5 kByte/s, RS-232
Instrument control	Industrial PC (Pentium) or Web-Interface
Housekeeping	All system parameters, history documentation
LWP accuracy	< 25 g/m ² RMS
IWV accuracy	< 0.3 kg/m ² RMS
Rain protection	Blower/heater system to keep radome dry
Dew protection	Heater with 1.8 kW, triggered by rain sensor and rel.humidity sensor (or s/w control)
Operating humidity range	0 – 100 %
Operating temperature range	-40°C to +50°C
Operating humidity range	0 – 100 %
Power consumption	<200 Watts average, 400 Watts peak
Input voltage	100-230 V AC, 50 to 60 Hz
Weight	70 kg for radiometer module (stand: 30 kg)
Extendibility (master-slave mode)	Any single-polarization std. radiometer
Customization	Frequencies and bandwidth adaptable