

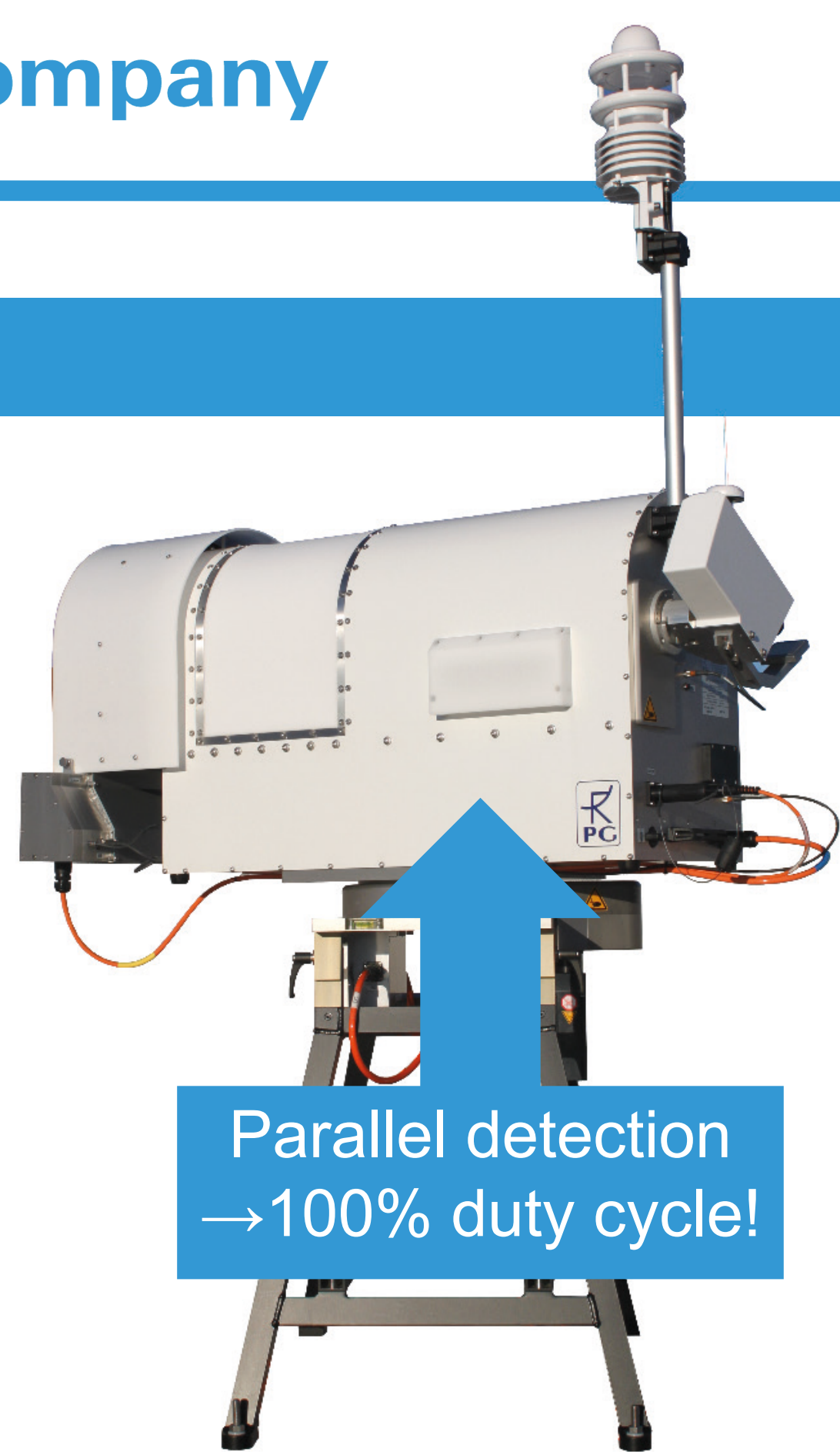
### Tropospheric Profiling

Zenith observation at 14 channels to retrieve:

Vertical profiles of:

- Temperature
- Humidity
- Cloud water (approximation)

- 1 s time resolution, 0-10 km height
- Significantly enhanced performance with new instrument Generation 5 (G5)



Parallel detection  
→ 100% duty cycle!

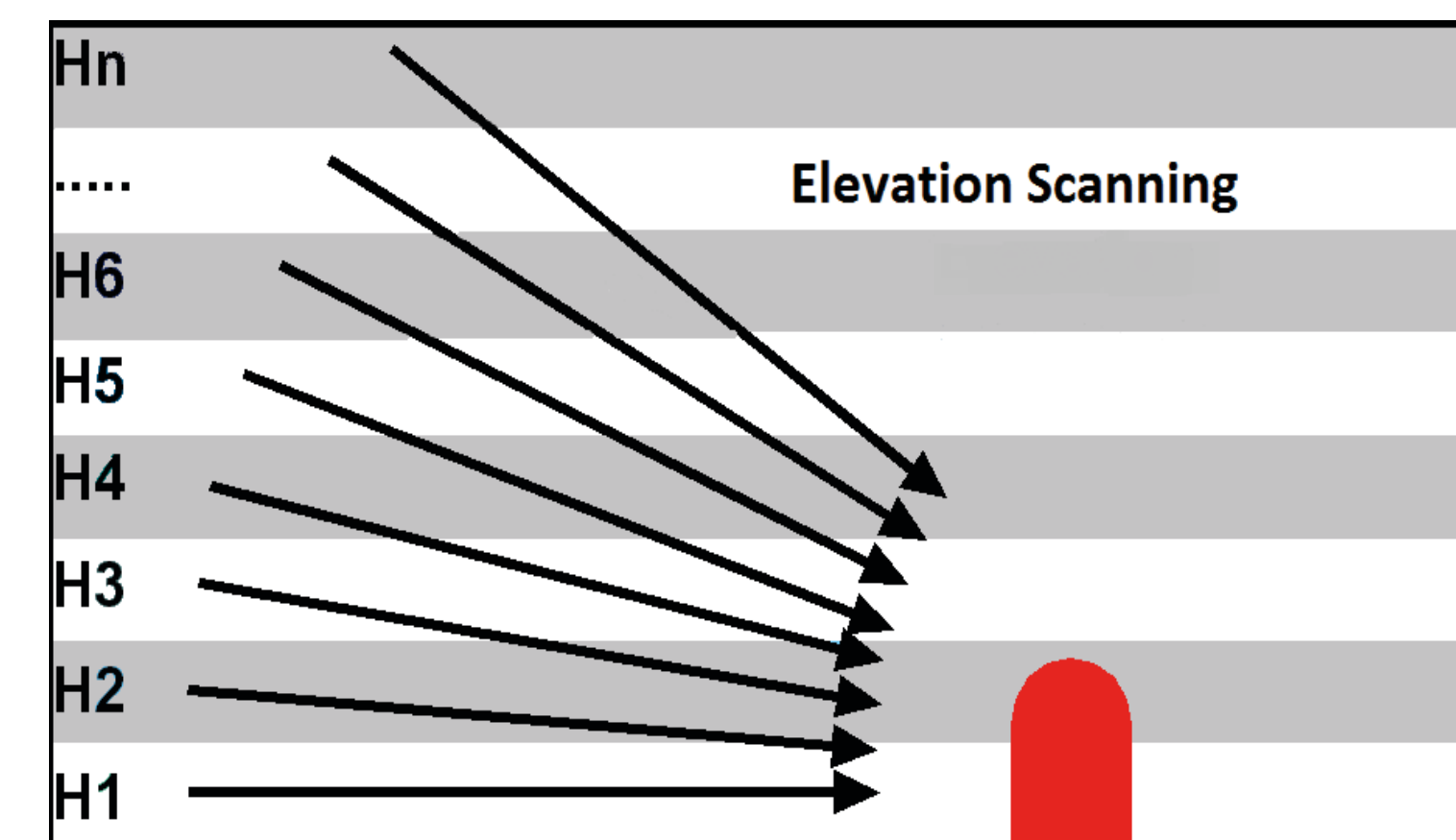
### Boundary Layer Profiling

Boundary layer temperature profile:

- 50 m vertical resolution, 0.25 K RMS
- 2 minutes time resolution
- Better than radio-sounding in lower 200 m

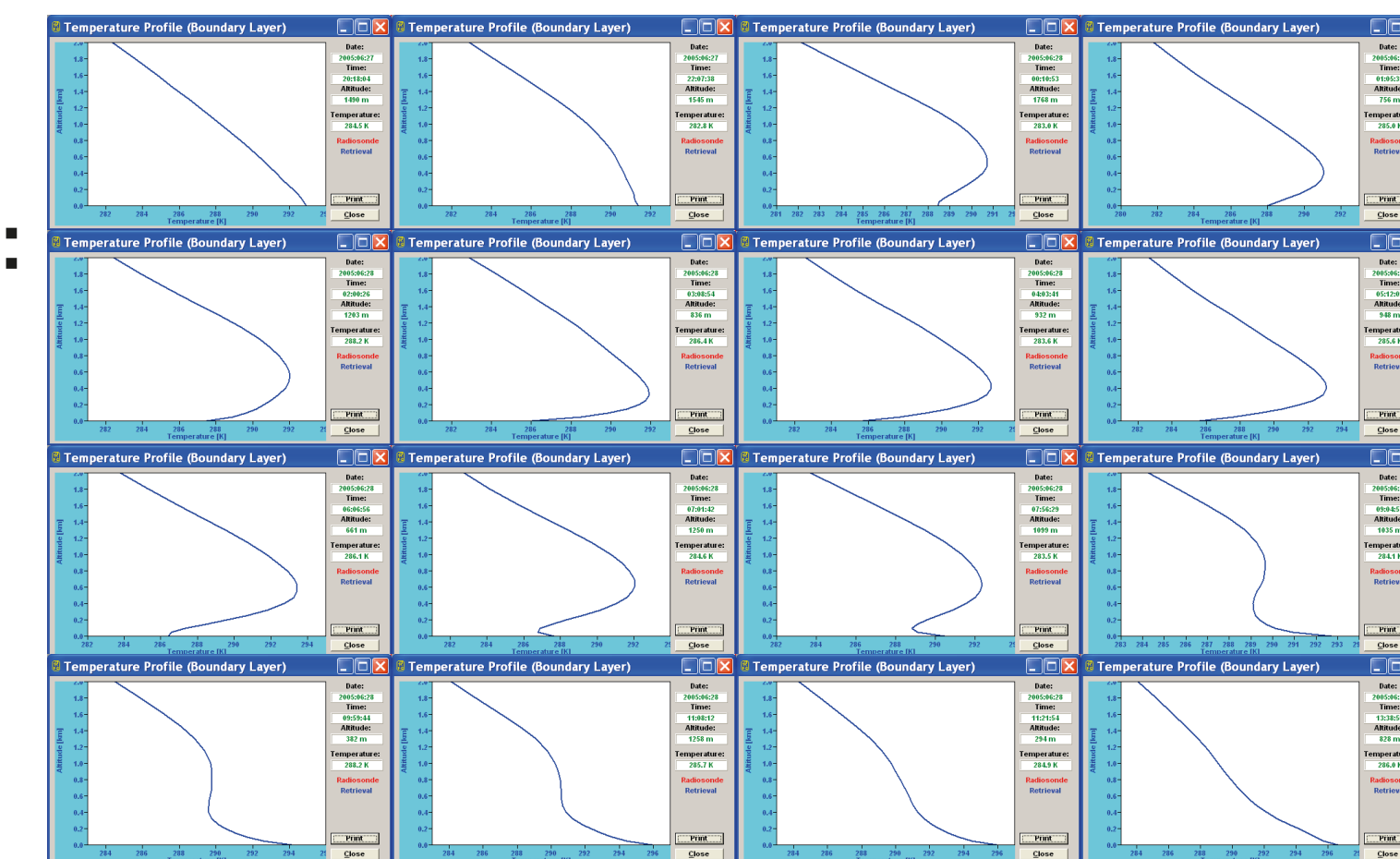
Retrieved from elevation scans:

- limited range of high opacity channels
- 6 angles between 90° and 5°
- multi-frequency retrieval
- change in TB with elevation: 4 K maximum at 58 GHz
- Resolving BL-inversions

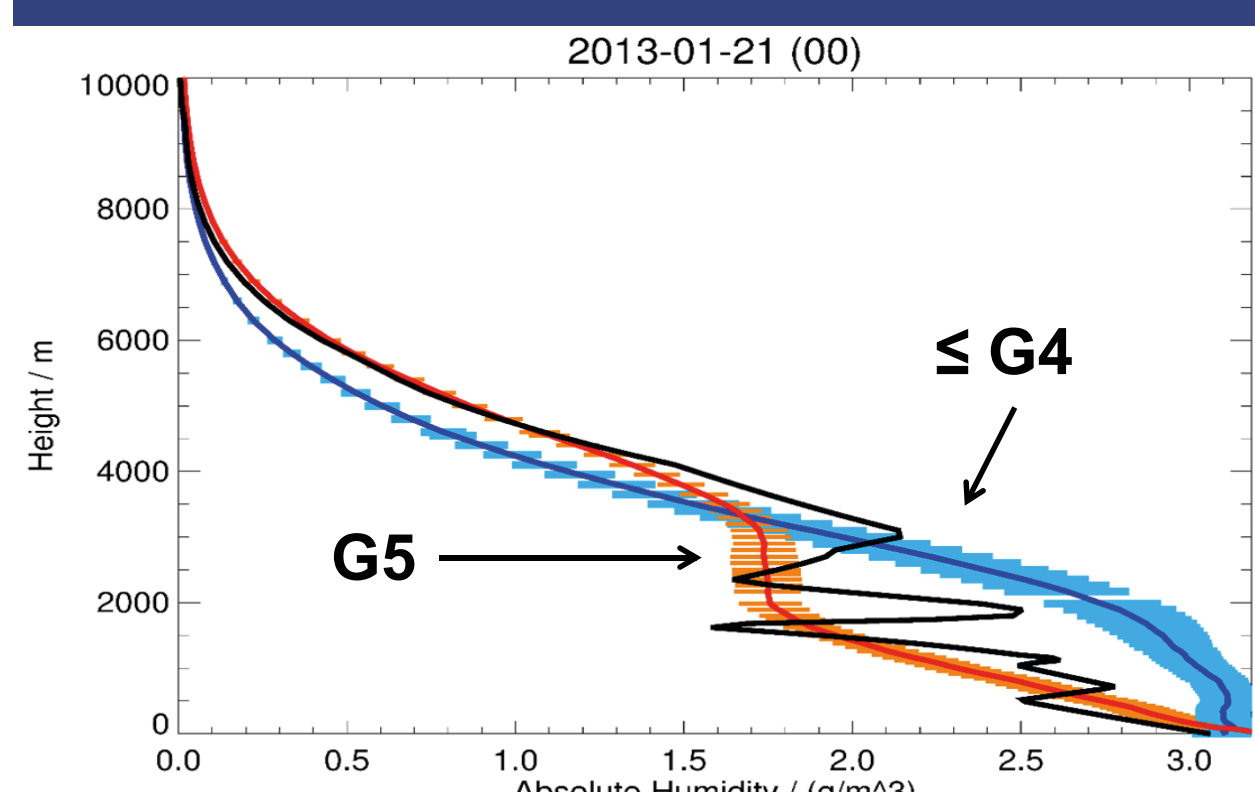


Based on technological advantage:

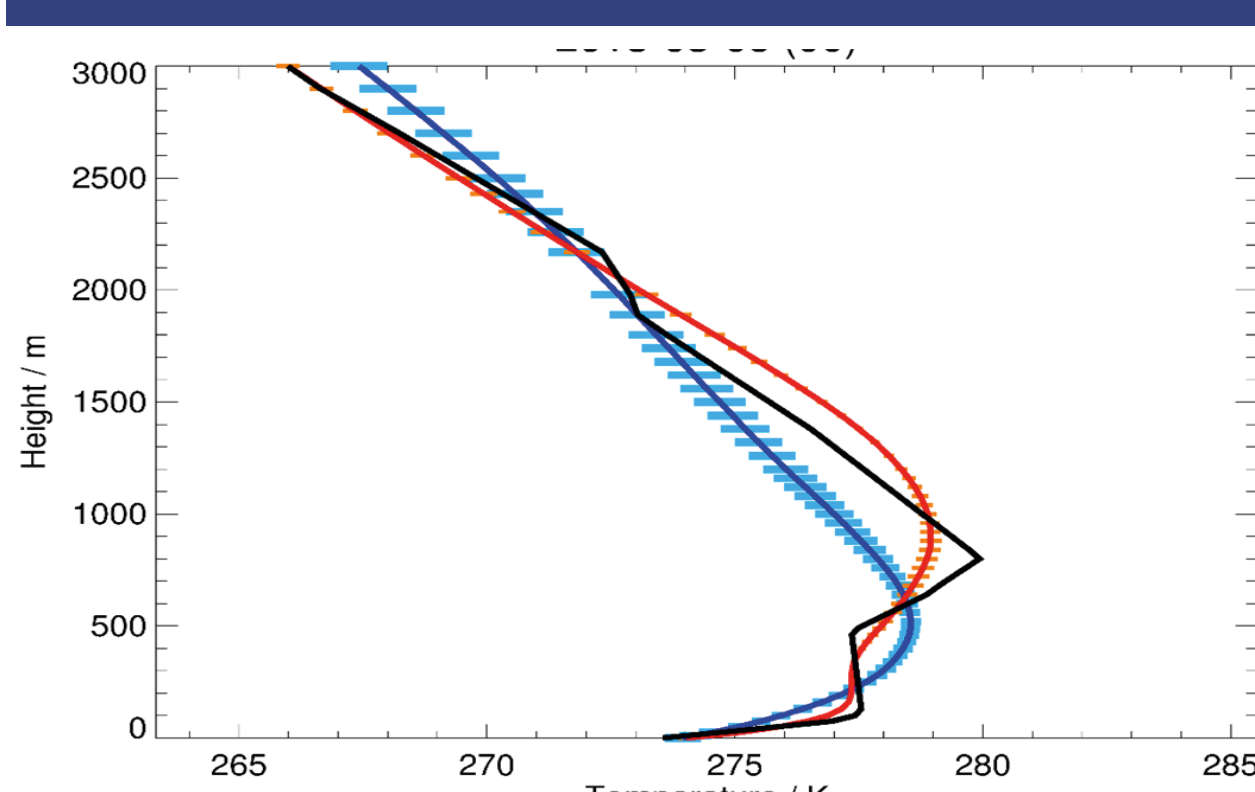
- Broad band-passes at saturated channels (> 56 GHz) to reduce noise
- Large optics for narrow beam



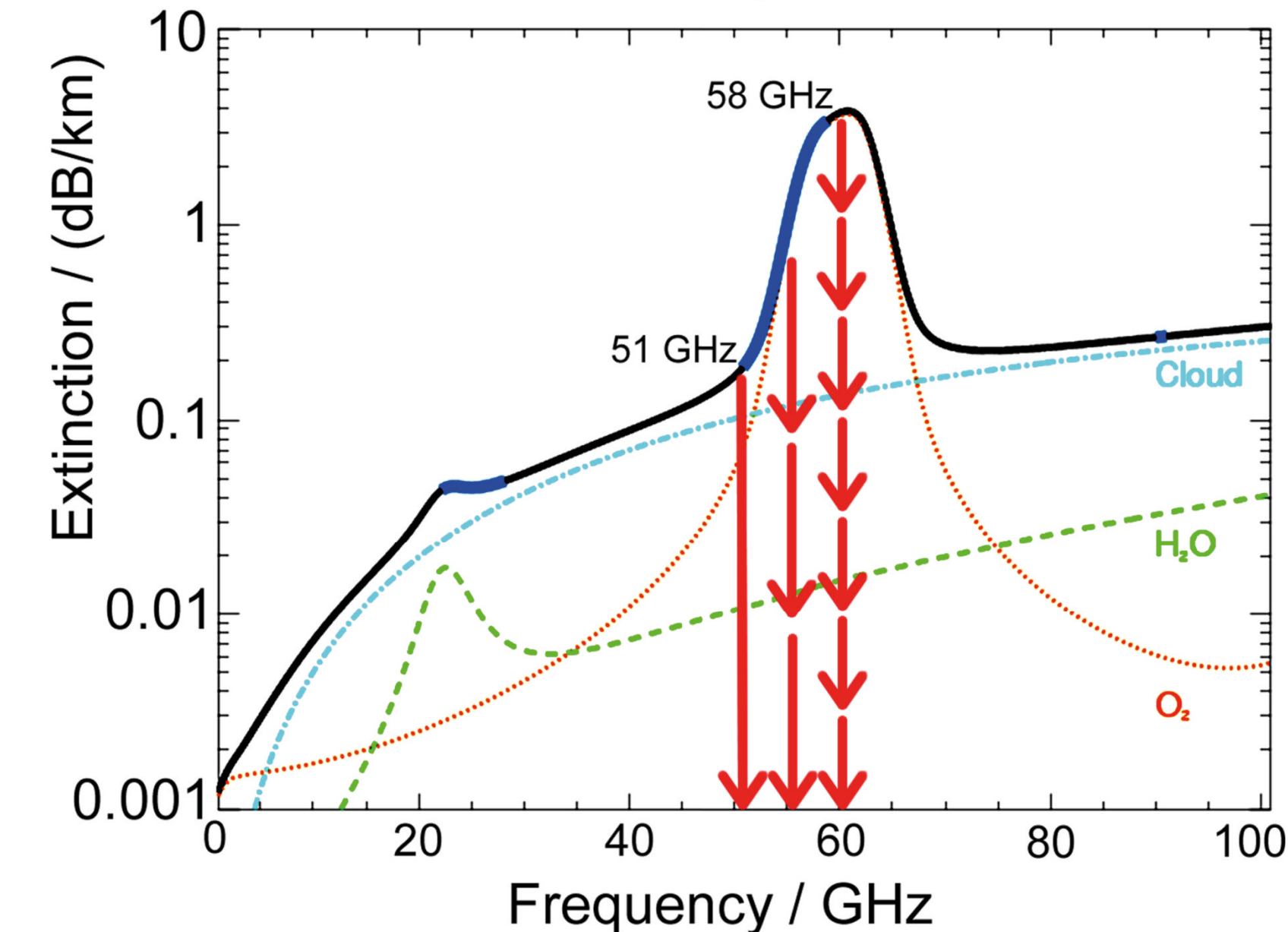
### Absolute humidity profile



### Temperature profile



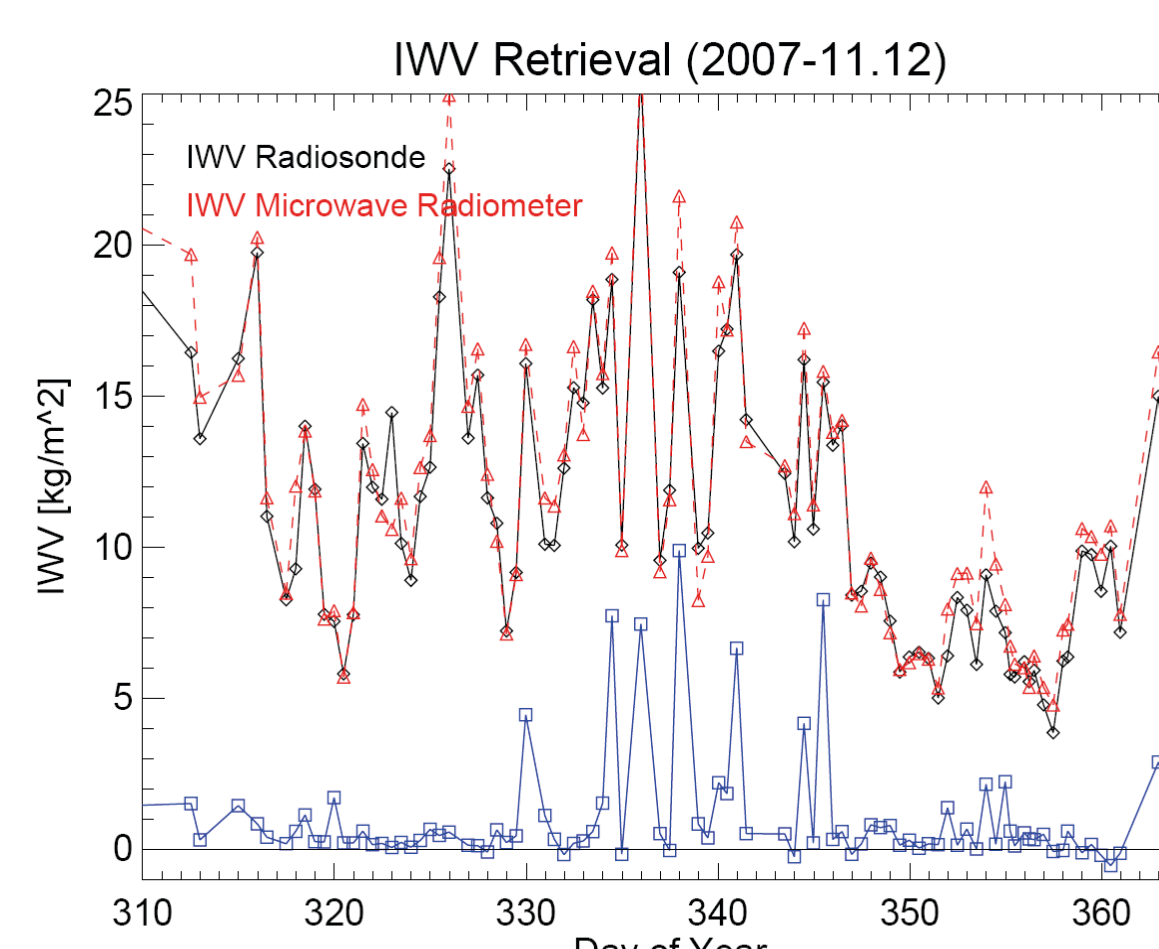
### Microwave Absorption / Emission



Microwave absorption/emission spectra with HATPRO channels (blue) along water vapour and oxygen features

### Integrated Water Vapor & Cloud Liquid

Line-of-sight observations of integrated values: LWP, IWV, attenuation, and path delay at 1s resolution

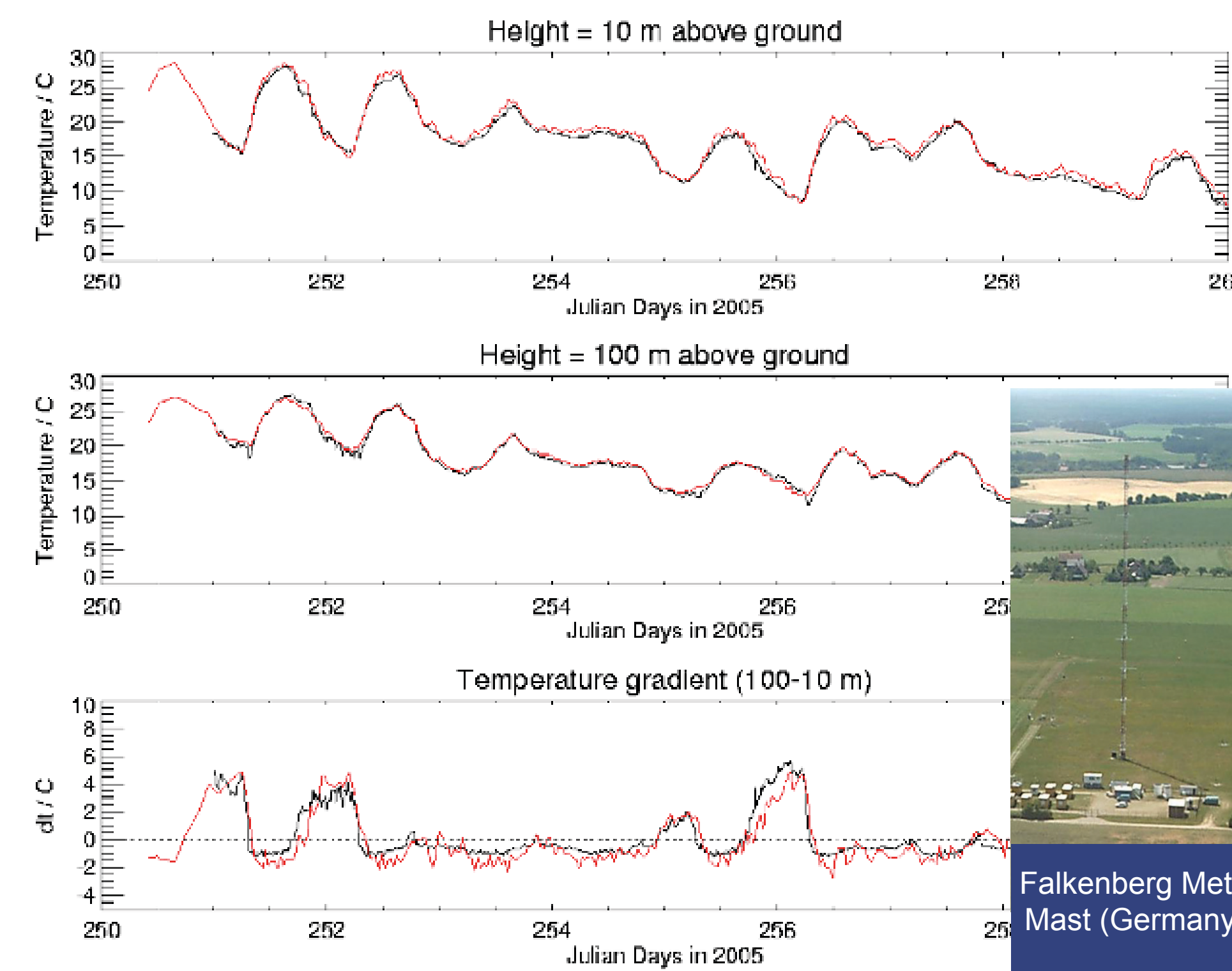


**IWV**

- Accuracy: ±0.12 kg/m<sup>2</sup>
- Noise: 0.04 kg/m<sup>2</sup> RMS

**LWP**

- Accuracy: ±10 g/m<sup>2</sup>
- Noise: 2 g/m<sup>2</sup> RMS

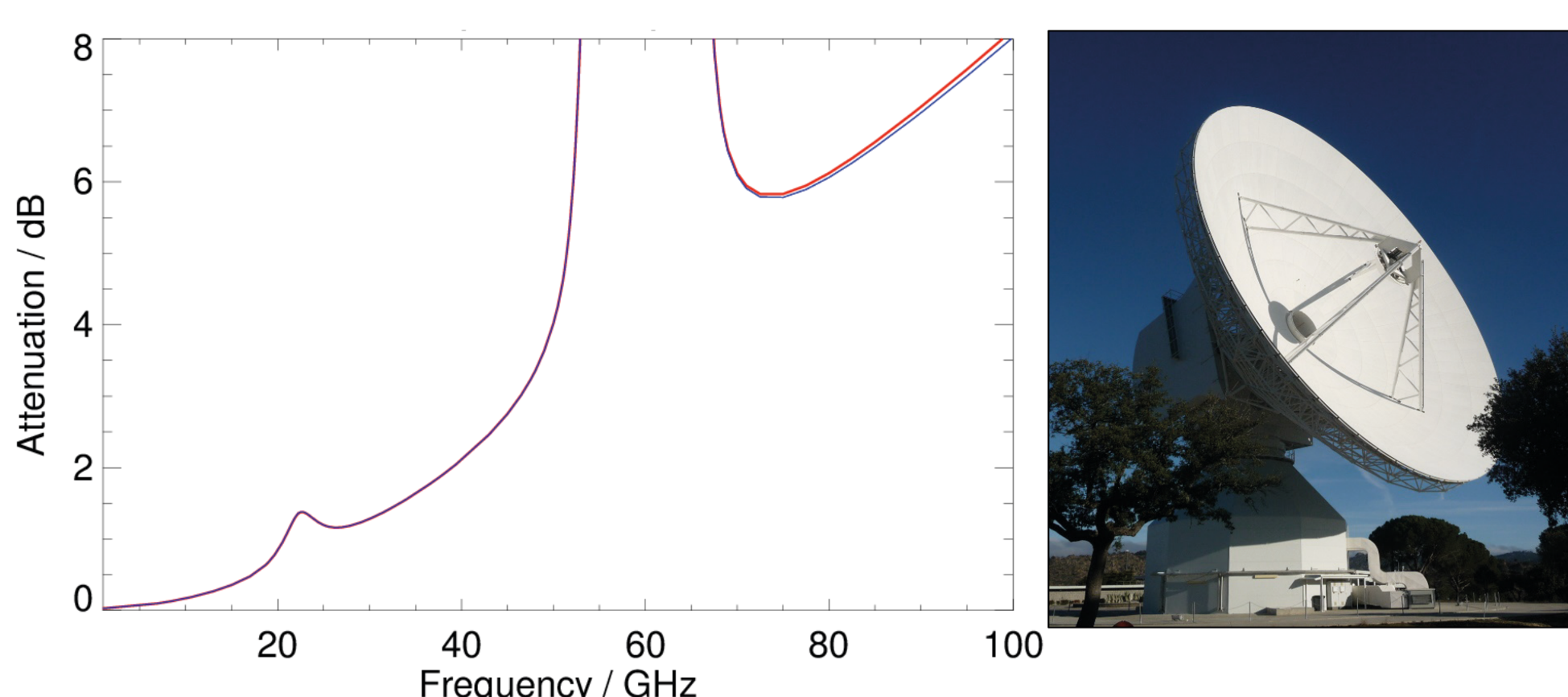


Falkenberg Met. Mast (Germany)

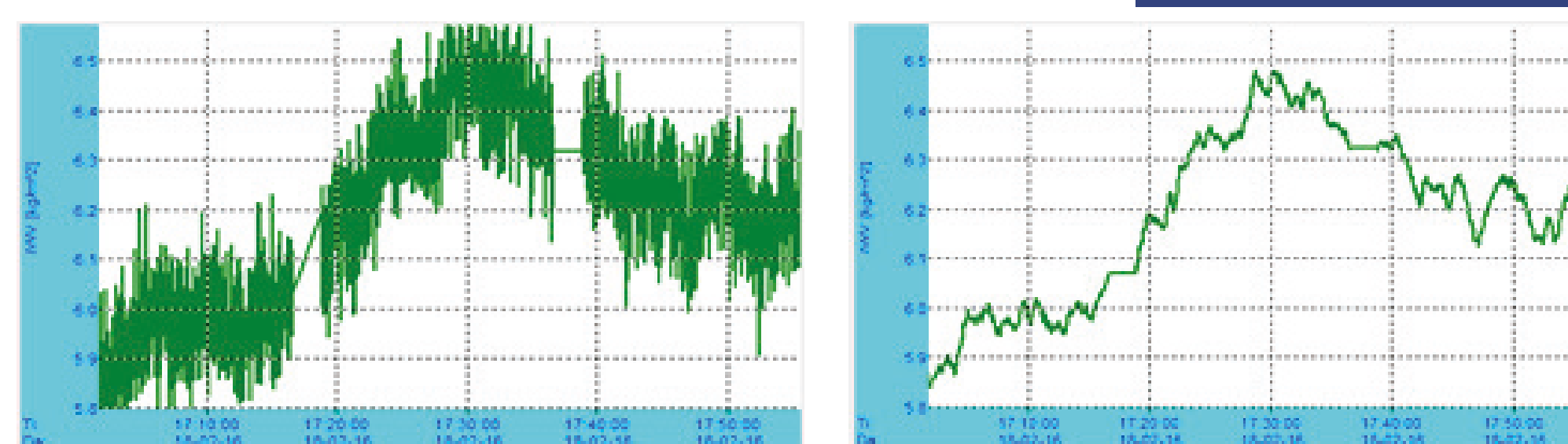
### Atmospheric Attenuation

Precise estimates of **Total Attenuation** by atmospheric molecules (H<sub>2</sub>O, O<sub>2</sub>, N<sub>2</sub>):

- Large spectral range: 1-100 GHz
- Real-time observations!
- Retrieved from direct multi-channel ANN (Artificial Neural Network) retrievals
- **Accuracy:** 0.0025 dB RMS @13GHz  
0.0050 dB RMS @27GHz



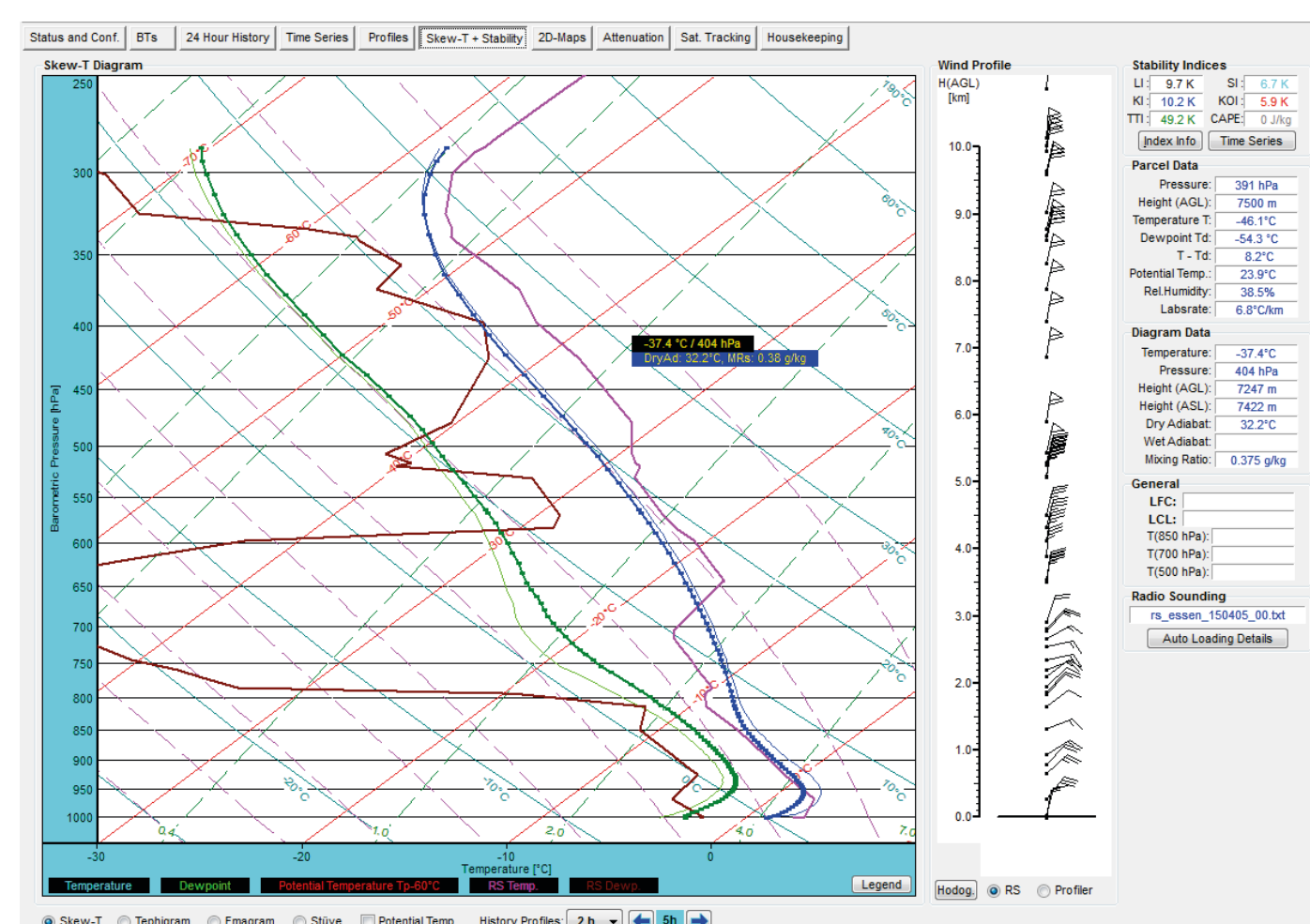
Attenuation spectrum between 1 GHz and 100 GHz retrieved from HATPRO observations (blue) compared to "true" values (red).



IWV time series with 1s (left) and 30s (right) sampling. **Even relative humidity fluctuations of 20 g/m<sup>2</sup> become visible!**

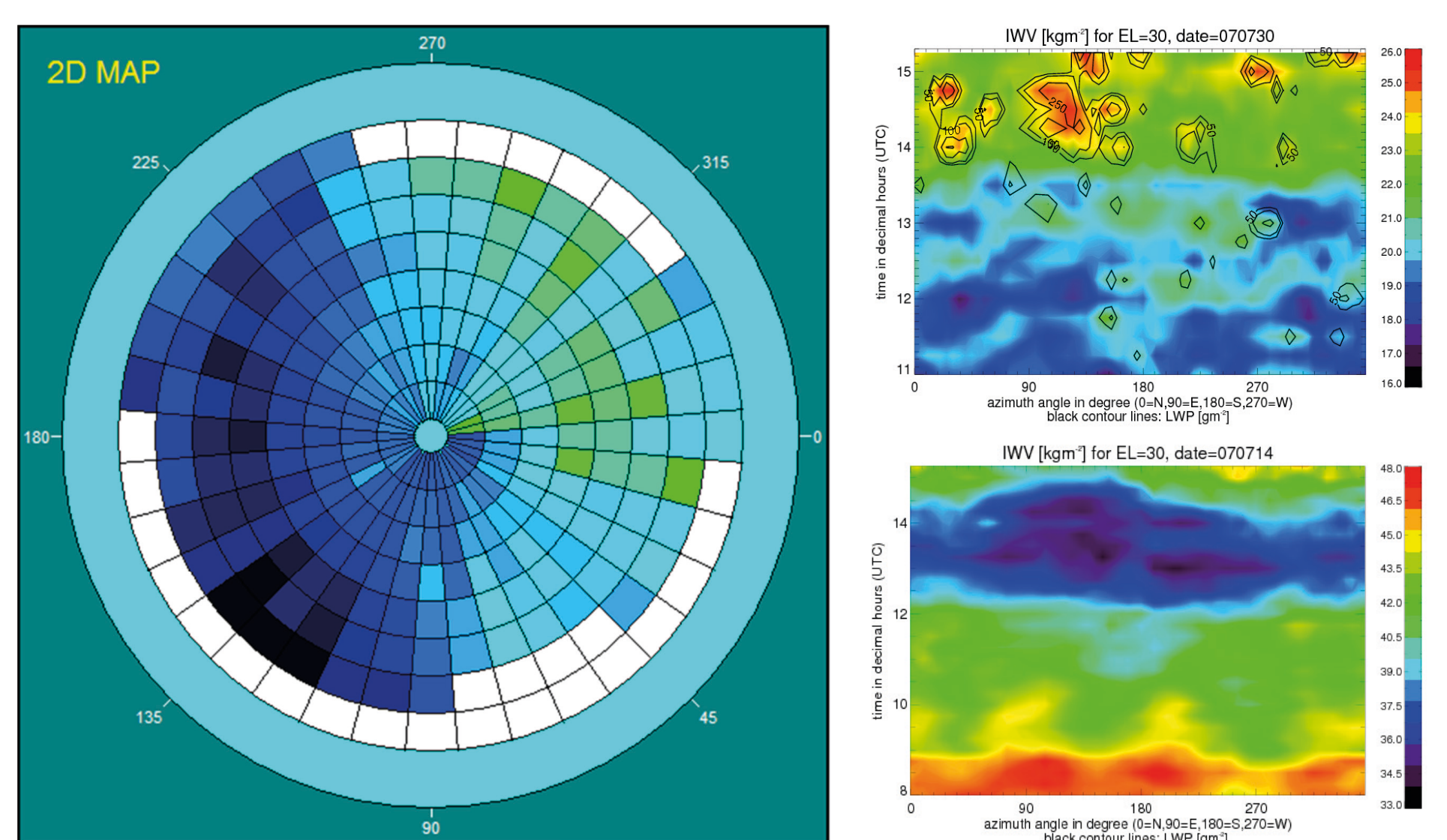
### Thermodynamics

Thermodynamic diagrams and **stability indexes** for **Now-casting** applications (severe weather etc.)



Radiosonde profiles and wind profiler data can be uploaded and displayed

### Full Sky Scanning



- Observe homogeneous IWV/LWP fields
- investigate advection, cloud fraction,...
- Rapid full sky scanning:**
- 300 samples in less than 5 minutes (equals 10×10 degree resolution)
- 0.4s integration time for 14 channels.
- Conical scans** (constant elevation):
- Hovmöller plots (azimuth vs time)

### Deployment Examples

