

# Autonomous All-Weather Microwave Sensor for Planetary Boundary Layer Observations



## Rotating Universal Radiometer

- ▶ Passive microwave radiometer
- ▶ Rotating instrument samples all angles in a vertical plane
- ▶ Many radiometric bands can be combined
- ▶ Sealed enclosure, IP67
- ▶ Precipitation protection & observation

## Enhanced observing capabilities

- ▶ All weather observations, including precipitation
- ▶ Dual polarization observations
- ▶ Up to 90% improvement in temperature profile RMSE\*
- ▶ Up to 35% improvement in humidity profile RMSE\*
- ▶ Up to 64% improvement in retrieved IWV RMSE\*
- ▶ Up to 74% improvement in retrieved LWP RMSE\*
- ▶ Up to 94% improvement in vertical resolution\*
- ▶ Better resolution of inversions in boundary layer\*

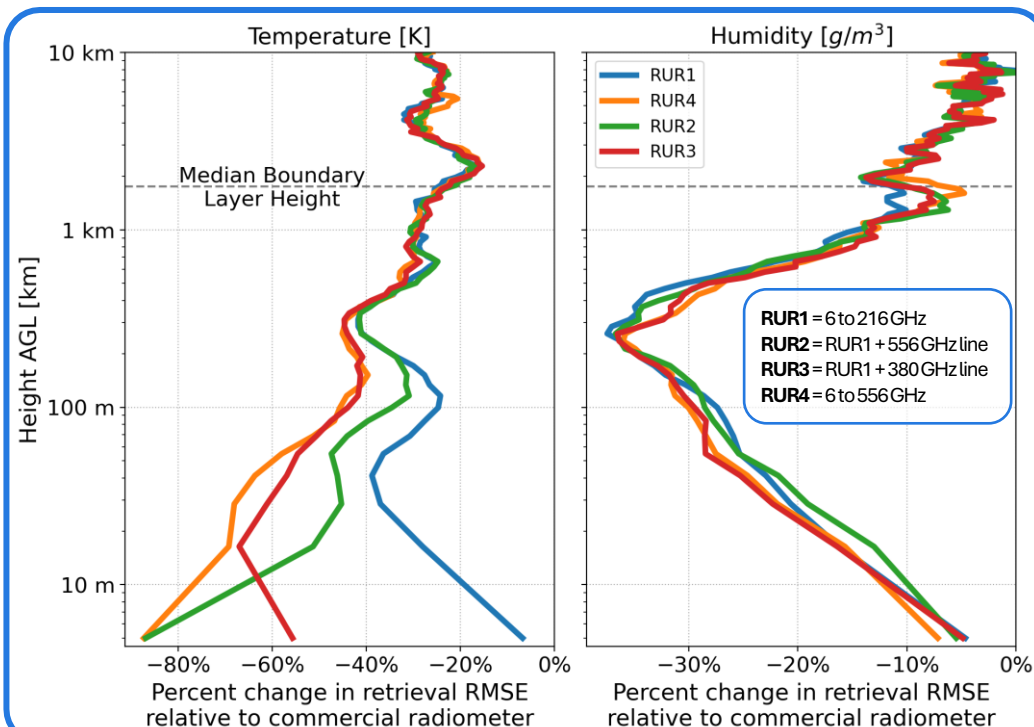
\*Compared to a commercial radiometer  
See reverse for details



## Simplified operations

- ▶ Autonomous calibration
- ▶ No LN2 targets required
- ▶ No thermal stabilization required
- ▶ Low power consumption
- ▶ Reduced upkeep costs

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## Improvements to integrated water vapor retrievals

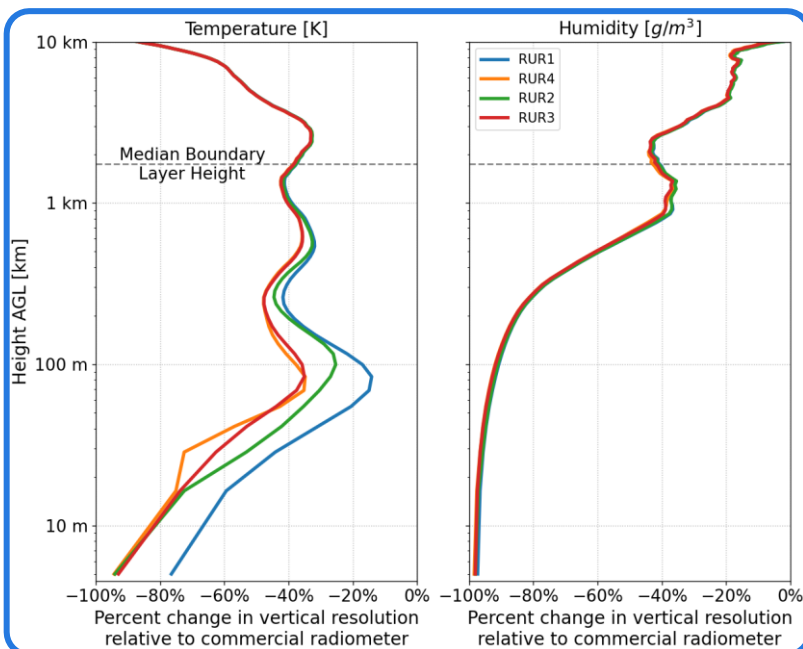
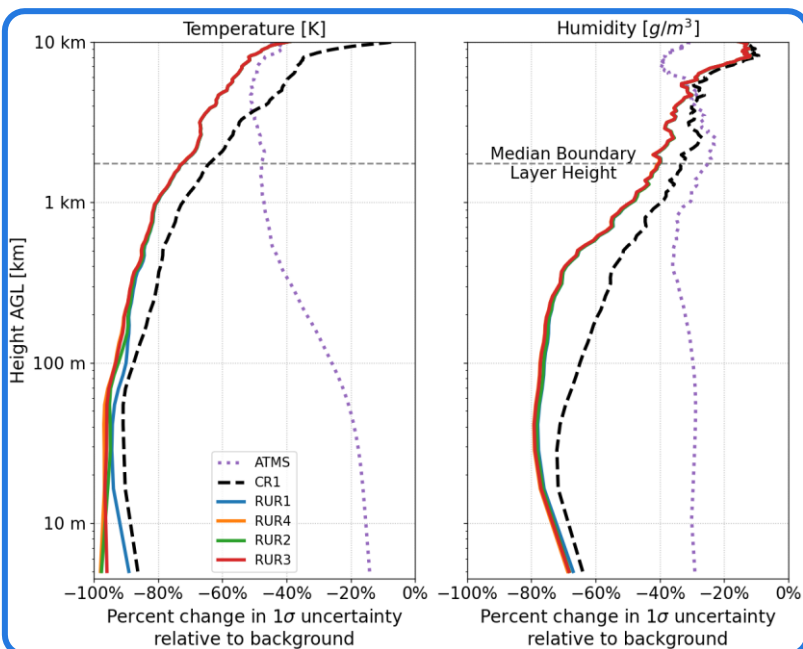
| IWV RMSE [g/m <sup>2</sup> ] | Clear Sky | Cloudy Sky |
|------------------------------|-----------|------------|
| CR1                          | 112       | 243        |
| RUR1                         | -22%      | -63%       |
| RUR2                         | -22%      | -64%       |
| RUR3                         | -23%      | -64%       |
| RUR4                         | -27%      | -64%       |

## Improvements to cloud liquid water path retrievals

| CLWP RMSE [g/m <sup>2</sup> ] | Cloudy Sky |
|-------------------------------|------------|
| CR1                           | 8.4        |
| RUR1                          | -74%       |
| RUR2                          | -73%       |
| RUR3                          | -73%       |
| RUR4                          | -74%       |



- ▶ CR1 = Commercial radiometer, 22-30 GHz + 51-58 GHz
- ▶ RUR1 = 6 to 216 GHz
- ▶ RUR2 = RUR1 + 556 line
- ▶ RUR3 = RUR1 + 380 line
- ▶ RUR4 = 6 to 556 GHz



- ▶ All results for clear sky unless otherwise stated
- ▶ Clear sky retrievals done on 1000 radiosonde profiles from Lindenberg, DE
- ▶ Cloudy sky retrievals done on 1000 profiles from the ECO1280 nature run
- ▶ Integration time is 100 ms for CR1, and 210 ms for RUR\*
- ▶ US Patent: US 11,852,596 B2

\*Equivalent to 25.5 sec of observations



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## A rotating lens stays mostly free of precipitation



accumulation on a stationary lens



accumulation on a rotating lens

