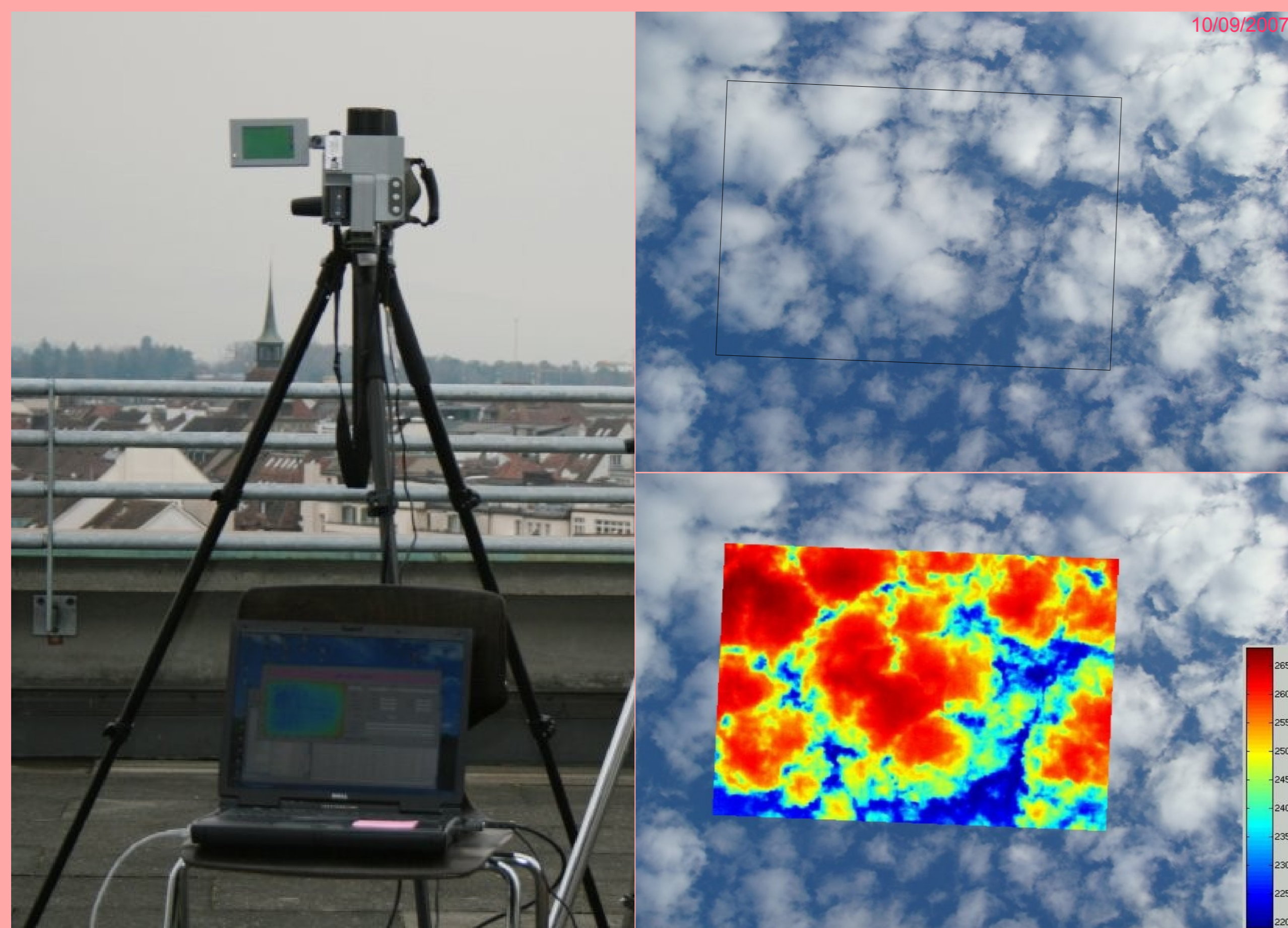


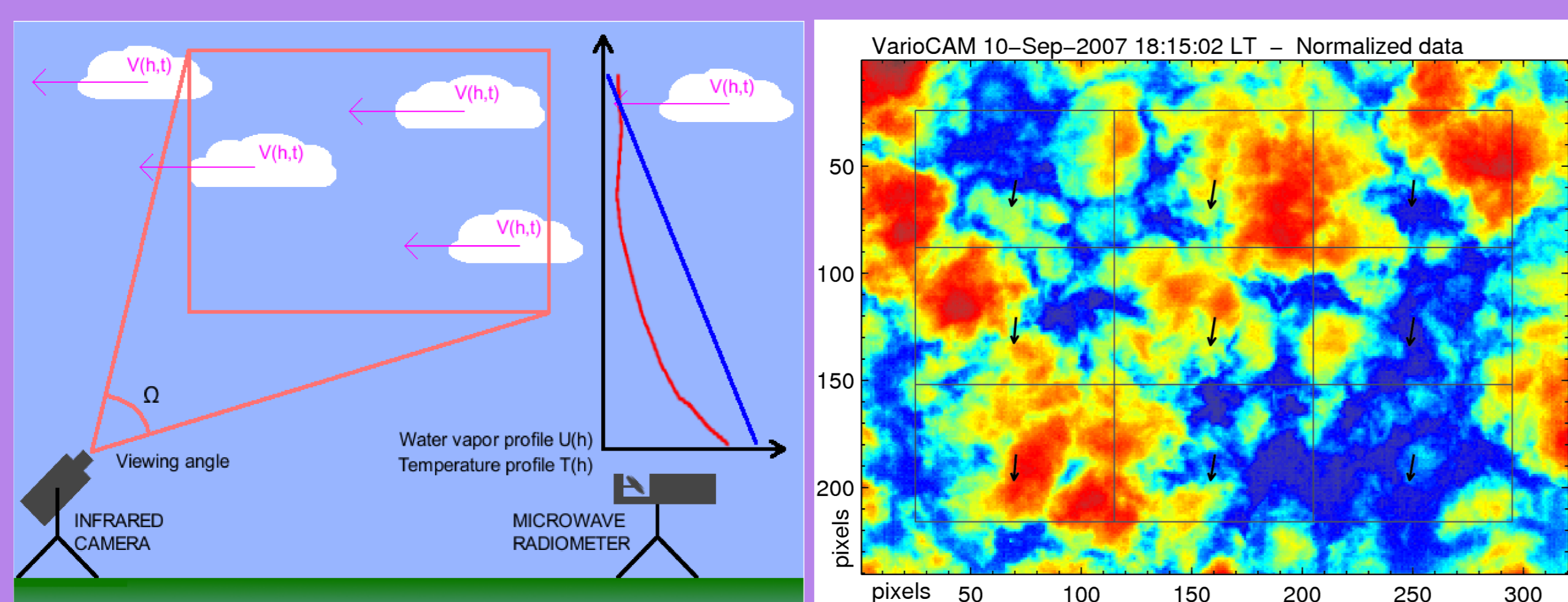
## 1. Introduction

Winds in the troposphere are an important part of the climate system<sup>(1)</sup>. A new means to monitor winds in a continuous and unattended manner can be a valuable tool for weather prediction models. The aim of this study is to show the feasibility of using a ground-based commercial infrared (IR) camera to monitor wind velocity and direction at cloud-base height.



## 2. Measurement setup

- Camera on a tripod, pointing at the sky, 90° elevation
- Infrared picture of the sky taken every 6 sec
- Nearby profiling microwave radiometer ASMUWARA<sup>(2)</sup>



## 3. Method

(A) IR pictures to wind direction, angular velocity [°/sec]

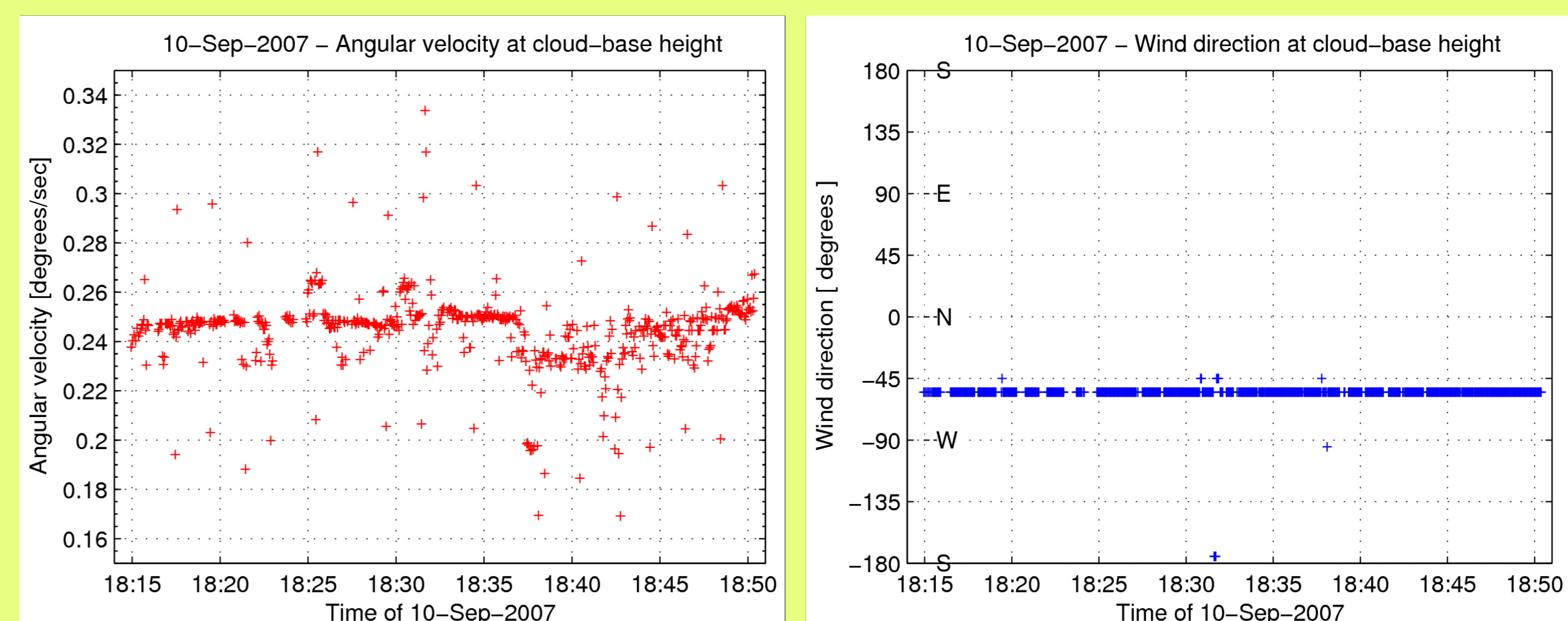
- Filtering of the pictures, division into 9 subwindows
- Cross-correlation between consecutive pictures
- Extraction of the **displacement vector**  $\vec{V}$
- Direction of  $\vec{V}$  gives **wind direction**
- Length of  $\vec{V}$  gives **angular velocity**

(B) Angular velocity to metric velocity [m/s]

- The microwave radiometer provides the temperature profile  $T(h)$  and the water vapor profile  $U(h)$
- $U(h)$  is used to correct for water vapor emissions
- $T(h)$  links cloud-base temperature to cloud-base height
- Height and angular velocity yields **metric velocity**

## 4. Results

- Case study 10-Sep-2007 in Zimmerwald (CH)
- Single cloud layer



Angular velocity  
baseline **0.248°/sec**

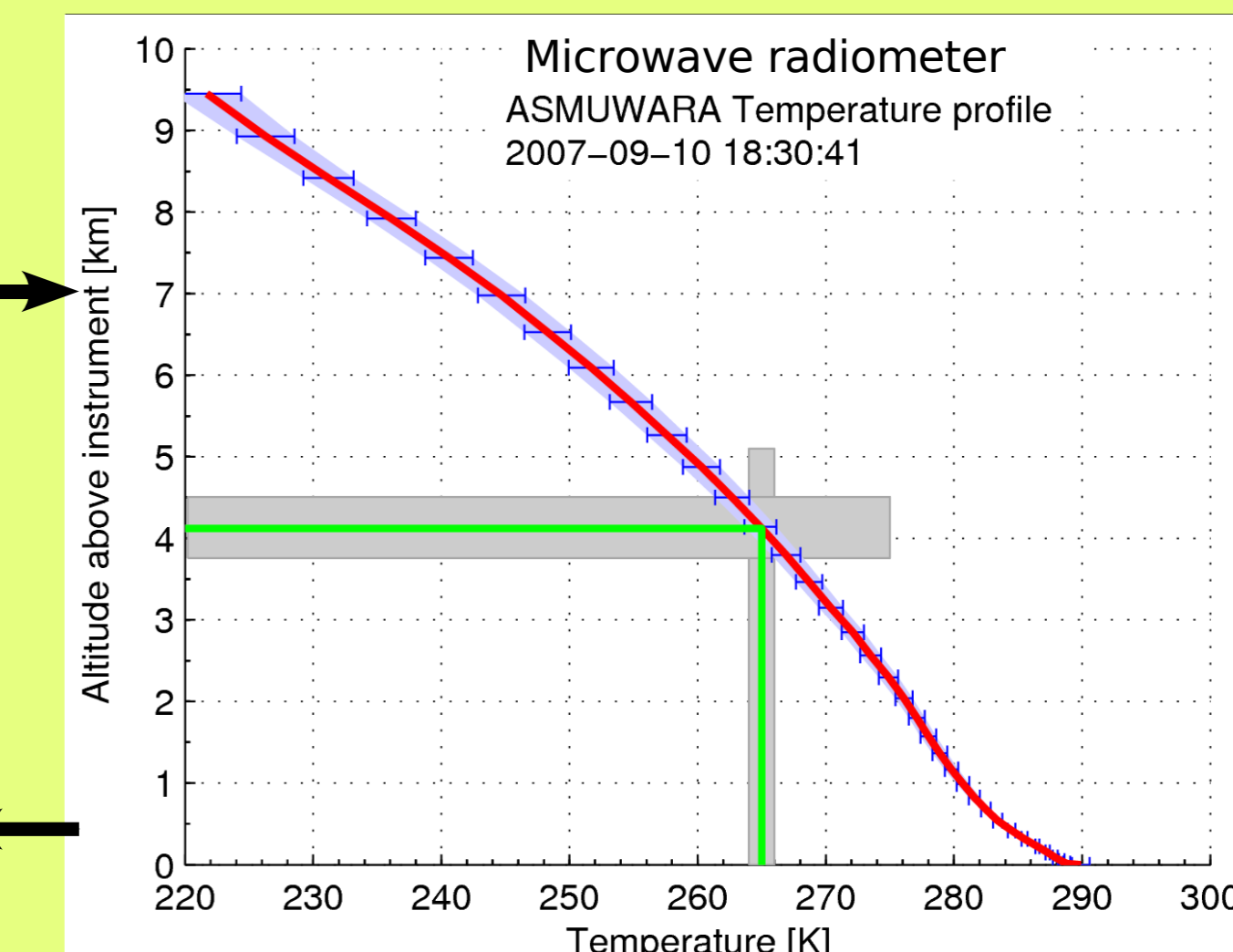
Wind direction  
**-50° (North-West)**

Temperature of  
cloud-base **267 – 269 K**

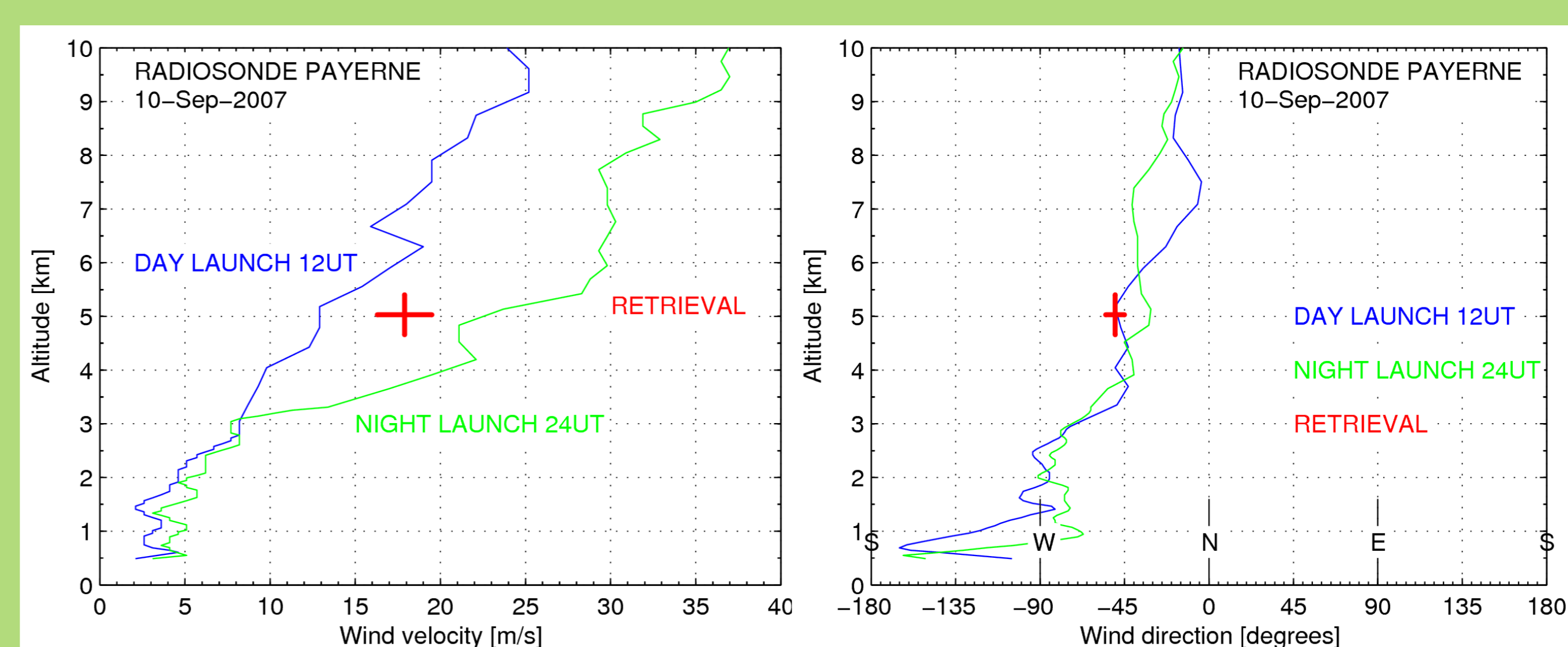
- Water-vapor  
contribution **3 K**

Cloud-base height  
**4130 ± 370 m**

Wind velocity  
**17.9 ± 1.6 m/s**



## 5. Comparison with radiosondes



- Radiosondes launched from Payerne (30km from site) before- (at 12UT) and after (at 24UT) our measurements show good agreement

## 6. Conclusion

- Case study 10-Sep-2007 shows good results
- Method requires clouds moving with the wind
- Need for measurements with different atmospheric conditions, e.g. several cloud layers, with the possibility of producing a wind profile
- Promising technique

\*Corresponding author, brocard@iap.unibe.ch

References: (1) IPCC 2007, Working Group I Report, *The Physical Science Basis*, www.ipcc.ch

(2) Martin et al., 2006, ASMUWARA, a ground-based radiometer system for tropospheric monitoring, *Meteorologische Zeitschrift*, 25, 11-17