Validation of wind profiles retrieved by the new Long-Range Windcube with Wind Profiler Radar and Radiosonde measurements at the Lindenberg GRUAN site

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ASI6: Atmospheric measurements from local to regional scale: The role of field experiments

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The wind field is one of the most important atmospheric parameter. Its accurate knowledge is crucial for the improvement of Numerical Weather Prediction (NWP) models. Moreover, in the tropical regions the wind and mass fields are uncoupled due to weak or absent Coriolis force. This means that the wind observations are necessary to obtain an accurate tropical wind analysis.


“The best analysis overall was achieved when DWL wind profiles and temperature and moisture observations … were assimilated simultaneously, which illustrates that both mass and momentum observations are necessary to improve the analysis accuracy”.
Experiences of techniques and signal processing, assessment and operational use of new active ground-based remote-sensing systems like windprofiler radar, sodar and cloudradar.

Doppler Wind Lidar systems, developed by LEOSPHERE, are being largely deployed worldwide for applications in the wind energy industry.

Based on the operating experience an extended version (up to 5 km range in horizontal configuration) is now available.

Such a new equipment however needs to be validated with independent operational instruments in order to be used as an operational meteorological instrument.
Motivation 3

Windcube is a Plug and Play Instrument
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Windcube WLS200: Intercomparison period  DOY 110-130
19/04/2011 - 10/05/2011

Windcube WLS70: Intercomparison period  DOY 157-179
06/06/2011 – 29/06/2011
Methods 2

- Data exchange MOL-RAO ⇔ Leosphere

at MOL-RAO:

- validated against
  - the 482 Mhz Windprofiler,
  - daily launched radiosoundings,
  - and NWP models outputs

- Intercomparisons
  • For all measurements at the same time (model and radiosonde interpolated)
  • Daily time series
  • Illustrated profiles
  • Summarized differences →
    - Days
    - Periods
Methods

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

InterComparison TimeSeries Windspeed Profiller–Model–Balloon

* Profiler LII old solution (time corr 12 min)
* Profiler LII Matrix solution (time corr 12 min)
* Model
* Model
* Balloon (+ 75 m)

Windprofiler (Leosphere) CNR >= -23

Altitude (Windprofiler): 740.000 m asl
Altitude (Model): 681.000 m asl
Altitude (Windcube): 704.000 m asl

Lindenberg Meteorological Observatory – Richard Aßmann Observatory (2011)
Methods

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Methods

Cosmo-EU

Inter Comparison Profiles: Wind speed: Profiler-Model-Balloon

- Profiller LIN old solution (time corr 12 min)
- Profiller LIN Matrix solution (time corr 12 min)
- Model (1)
- Model (2)
- Balloon

- Balloon, time interpolated
- Windcube (Leosphere)

DateTime (Profiler): 26.04.2011 04:12 Z
DateTime (Model): 26.04.2011 04:14 Z (LMED)
DateTime (Radiosonde 1): 25.04.2011 22:54 Z
DateTime (Radiosonde 2): 26.04.2011 04:57 Z
DateTime (Windcube): 26.04.2011 04:10 Z / 04:20 Z
Methods

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Windspeed, winddirection, u, v, w,
RMS vector difference
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Results 1

Lindenberg Meteorological Observatory – Richard Aßmann Observatory (2011)
Results

Advantages of two independent systems:

- NWP (Cosmo-EU)
- Measurements (Windcube and Profiler)
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Conclusions

Summary:

**WLS200 (Windspeed):**
- + no Bias, small RMS-Differences
- - Data gaps in warm periods
- - Parasitic lasing disturbs certain heights

**WLS70 (Windspeed):**
- + less data gaps in warm periods
  (+ no Parasitic lasing (??))
- - Bias + 0.5 m/s

We need

1. consistent further development
2. permanent inter comparisons

+ Windcubes with advantages in CBL
Conclusions

Future work:

- Intercomparisons

(1) Wind Lidar system, developed by Halo Photonics ↔ Lindenberg Measurements (since 8 August)

(2) Windcube WLS200 + Halo Photonics ↔ Lindenberg Measurements

in October 2011
Thanks for your attention!