Radiometer Physics
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160 GHz Microwave Scintillometer System RPG-MWSC-160

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RPG-MWSC-160

Radiometer Physics GmbH (RPG) released the first commercially available microwave scintillometer RPG-MWSC-160. It is designed for combined operation with an optical Large Aperture Scintillometer (LAS) to simultaneously observe sensible heat flux H and latent heat fluxes $L_V E$.

Key Features

- High frequency (160.8 GHz, λ=1.86 mm) for sufficient co-spectrum with LAS
- Large aperture (300 mm) for small beam width (0.45° FWHM)
- Tuneable power level (max. >25 mW) allows path length between 500 m and 10 km
- Low weight (~10 kg)
- Low power consumption (~20 W)

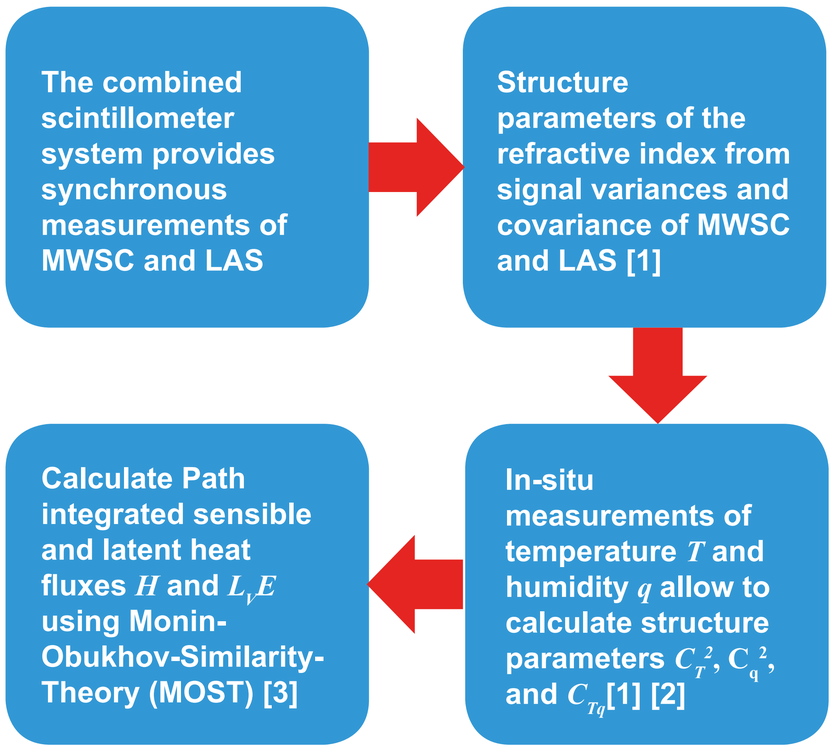
Operating Software

The RPG-MWSC-160 includes a software package for the combined operation of a MWSC/LAS scintillometer system. In combination with the integrated weather station Vaisala® WXT-520 it provides the complete data processing chain from raw signals to heat fluxes.

Output Data

- 1 kHz digital raw data for MWSC and LAS
- Housekeeping data
- (Co)variances of the combined system
- Structure parameters of refractive index Cn^2
- Sensible and latent heat fluxes H and $L_V E$

Data Processing



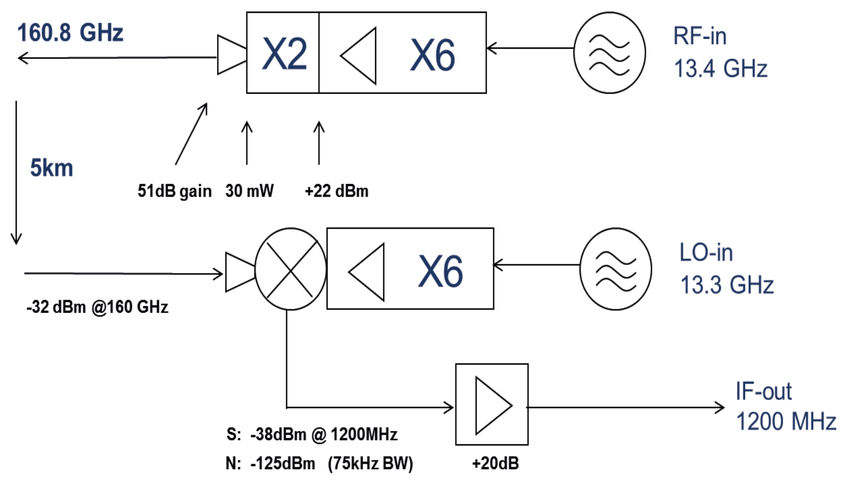
Applications

Measurements of the sensible heat flux H and evapotranspiration $L_V E$ are significant for:

- Irrigation and water management
- Forest fire warning
- Weather forecasting
- Radiation budget studies
- Hydrology

Design

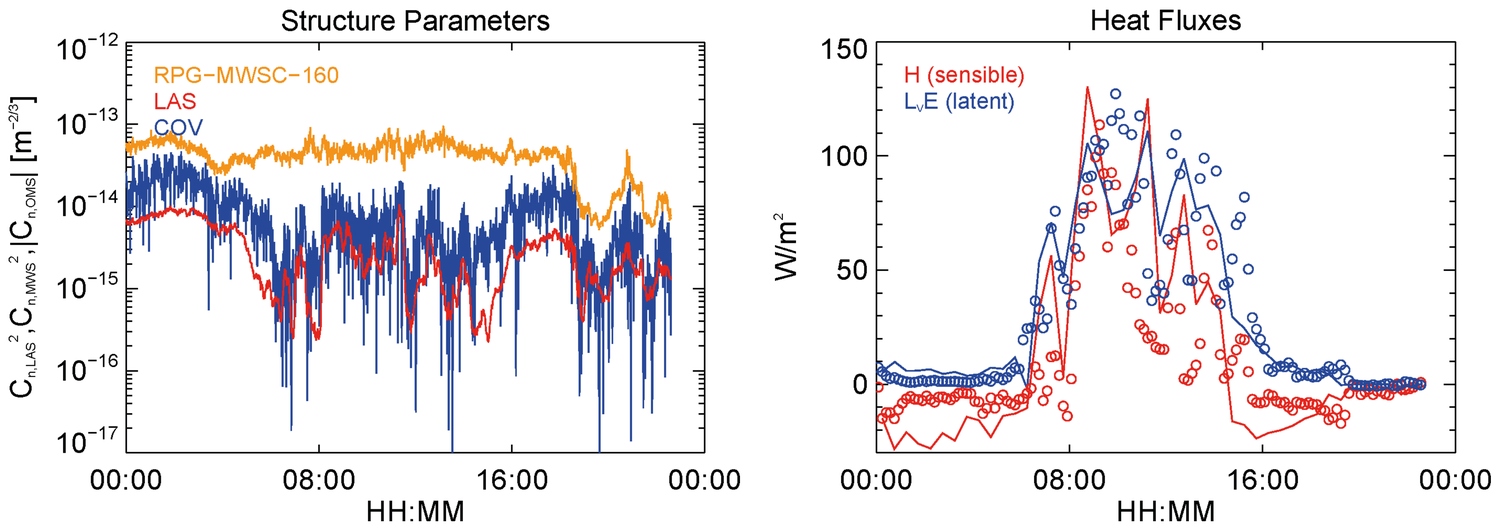
The RPG-MWSC-160 uses hardware developments from space projects. The prototype instruments were developed by RPG and Wageningen University (The Netherlands) within the OMS (Optical and Microwave Scintillation) project.



Measurement

The RPG-MWSC-160 has successfully been tested in combination with different LAS systems within two comprehensive field campaigns in Sonora (Mexico) and Lindenberg (Germany). The two campaigns cover two different applications: short path length / low observation height (Mexico: $L=880m,\ z=2.75m$) over a homogeneous surface and long path length / high observation height (Lindenberg: $L=4800m,\ z=45m$) over a heterogeneous landscape.

Structure Parameters and Heat Fluxes



*Measurement time series for a long path over heterogeneous landscape (September 8, 2013, Lindenberg, Germany). Left: refractive index structure parameters for **RPG-MWSC-160**, optical **LAS**, and for the signal covariance (**COV**) of both instruments (OMS method, Lüdi et al. [1]). Right: estimates of path integrated **sensible heat flux H** and **latent heat flux $L_V E$**. Circles give measurements from an Eddy Covariance station (EC).*

References

[1] A. Lüdi, F. Beyrich, and C. Mätzler, "Determination of the Turbulent Temperature–Humidity Correlation from Scintillometric Measurements," Boundary-Layer Meteorol., vol. 117, no. 3, pp. 525–550, Dec. 2005.
[2] H. C. Ward, J. G. Evans, O. K. Hartogensis, A. F. Moene, H. A. R. De Bruin, and C. S. B. Grimmond, "A critical revision of the estimation of the latent heat flux from two-wavelength scintillometry," Quarterly Journal of the Royal Meteorological Society, p. n/a–n/a, 2013
[3] D. Li, E. Bou-Zeid, and H. A. R. D. Bruin, "Monin–Obukhov Similarity Functions for the Structure Parameters of Temperature and Humidity," Boundary-Layer Meteorol., vol. 145, no. 1, pp. 45–67, Oct. 2012.

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