EMS Annual Meeting Abstracts
Vol. 16, EMS2019-360, 2019

Calibration method and field testing of the Kipp & Zonen XLAS MkII eXtra Large Aperture Scintillometer

Keith Wilson (1), Fred Bosveld (2), Patrick van den Hoek (3), Alwin van Tol (1), and Joop Mes (1)

(1) Kipp & Zonen BV, R&D, Delft, Netherlands (keith.wilson@kippzonen.com), (2) Research and Development of Observations and Data Technology, Royal Netherlands Meteorological Institute KNMI, De Bilt, The Netherlands, (3) Weather and Climate Services Division, Royal Netherlands Meteorological Institute KNMI, De Bilt, The Netherlands

The latest field measurements and testing of an improved and redesigned version of an eXtra Large Aperture Scintillometer (XLAS) are presented. Scintillometry is a remote-sensing technique to measure surface-layer turbulent fluxes, with the eXtra Large Aperture allowing operation over very long path lengths over homogeneous or heterogeneous terrain. For this new instrument up to 12 km path length, on the scale of satellite pixels or modelling grids. The instrument has been characterised in the field, and the maximum operating parameters such as path length determined. Spectral analysis was performed on the raw scintillometer signal to demonstrate the absence of any systematic errors or high frequency noise. On-going research to lower internal electronic noise in the instrument allows more sensitive measurements to be made as the detection limit is lowered. The performance at long range was tested by operating 2 receivers side by side over a path length of 9.8 km at the Cabauw experimental site for atmospheric research (CESAR) in the Netherlands, and comparing the measured refractive index structure parameter, Cn2.
A novel method will be given of calibrating all commercially produced XLAS MkII instruments relatively against a hybrid LAS / XLAS reference instrument over nearly 1 km. This setup was traced to the LAS MkII reference instrument, via the complete reference XLAS in a reversed path configuration.

This XLAS MkII, a commercial 328 mm diameter XLAS manufactured by Kipp & Zonen, Delft, has been completely redesigned for improved performance and ease of operation. The instrument specifications and improvements are also presented here. The weatherproof enclosure and optical mounting is based on a carbon fibre cone, which reduces weight for ease of installation and provides a stiff mounting for the optics to avoid vibration of the measurement beam. The low thermal expansion of carbon fibre also reduces significantly changes in optical alignment and therefore data quality.
The instrument has reduced power use, an intelligent heater, and a brighter LED emitter. Fully digital processing and an in-built data logger with keyboard and display, shows real time data and settings to the user in the field. An additional input for 3 external met sensors allows calculation of the sensible heat flux, H.
The introduction of this new instrument will allow research into turbulent fluxes over a highly heterogeneous landscapes such as urban areas characterized by a complicated land-use mix, which is difficult or impossible with other methods.