SLS40

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Laser Scintillometer for Towers

Photo courtesy of Central Research Institute of Electric Power Industry, Japan

The Scintec SLS40 Scintillometer measures turbulence, heat flux and momentum flux by purely optical means. In combination with other meteorological sensors the system can determine latent heat flux or evaporation.

The SLS40 is specifically designed for operation on towers or other platforms prone to vibration. Vibration effects are compensated by using the signal of four instead of two optical detectors.

Each SLS Series Scintillometer consists of a laser transmitter pointing at a receiver. Temperature fluctuations in the air cause variations of the light intensity captured at the receiver. The scintillometer evaluates such variations to yield turbulence information.

The line averaging over the optical path results in spatially representative data and outstanding temporal resolution – a critical edge over data collected from conventional point sensors. The scintillometer provides high sensitivity and accuracy – without mechanical flow distortion or any moving part.

The proprietary displaced-beam technique of the SLS Series Scintillometers opens up access to mechanical turbulence quantities (momentum flux, kinetic-energy dissipation rate) without need to feed in any external wind data.

Features

- heat flux, momentum flux by purely optical means
- suitable for stable and unstable conditions
- measures C_n^2, C_T^2, ℓ_0
- crosswind option available
- spatially averaging technique
- high temporal resolution
- low statistical noise
- no flow distortion
- easy installation and operation
- Signal Processing Unit performs all calculations
- 6 GB built-in data storage
- remote access
- beam-displacement calibration
- window heating

Applications

- turbulence studies
- air quality and atmospheric dispersion
- spatially-averaged wind measurements
- optical propagation conditions
- defence weather
- surface energy balance
- evapotranspiration monitoring
- agrometeorology, forestry
- satellite data ground truth

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SLS40

Surface Layer Scintillometers

Data output

Data output includes (but is not limited to):

- structure parameter of refractive index fluctuations (C_n^2)
- inner scale of refractive index fluctuations (ℓ_0)
- structure parameter of temperature fluctuations (C_T^2)
- dissipation rate of turbulent kinetic energy
- sensible heat flux
- momentum flux
- Obukhov length
- path-averaged wind speed perpendicular to the beam axis (with crosswind extension)
- mean, standard deviation, minimum and maximum of intensity
- correlation coefficient of intensity
- data quality code

Description	Specifications	Remarks
Optical wavelength	670 nm +- 10 nm	visible (red)
Mean output power	1 mW	laser safety class 2M (IIIa)
Beam divergence	3.5 x 10 mrad	
Path length	50 - 250 m	others optional
Integration time	1 s to 60 min	
Supply voltage and current	12 V, 15 W	for transmitter, receiver, SPU
Data output	Ethernet, RS232	6 GB storage
Operating temperature	-20 to +50 °C (-5 to +120 °F)	
Dimensions	65 x 11 x 11 cm / 60 x 11 x 11 cm 33 x 23 x 18 cm	transmitter / receiver SPU
Weights	3.0 kg / 2.9 kg / 8.0 kg	transmitter / receiver / SPU

Measurement ranges [1]	from	to	unit	Depends on
Structure constant C_n^2	1×10^{-16}	3×10^{-12}	$m^{-2/3}$	path length
Inner scale ℓ_0	2	16	mm	path length
Structure constant C_T^2	1×10^{-4}	3	$K^2\ m^{-2/3}$	path length[2]
Kinetic-energy dissipation rate ε	2×10^{-4}	1	$m^2\ s^{-3}$	path length[2]
Sensible heat flux	2 -2	600 -120	$W\ m^{-2}$ $W\ m^{-2}$	path length and height, Obukhov length[2]
Momentum flux	-4×10^{-3}	-1.2	$N\ m^{-2}$	path length and height, Obukhov length[2]
Wind speed	0.01	10	$m\ s^{-1}$	with Crosswind Extension

[1] Typical values for path 100 m long and 2 m high; [2] Values for normal temperature and pressure

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