

New streamlined, reduced-cost CO₂/H₂O Flux Sensor & Node open a new era for Eddy Covariance measurements and applications

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INTRODUCTION

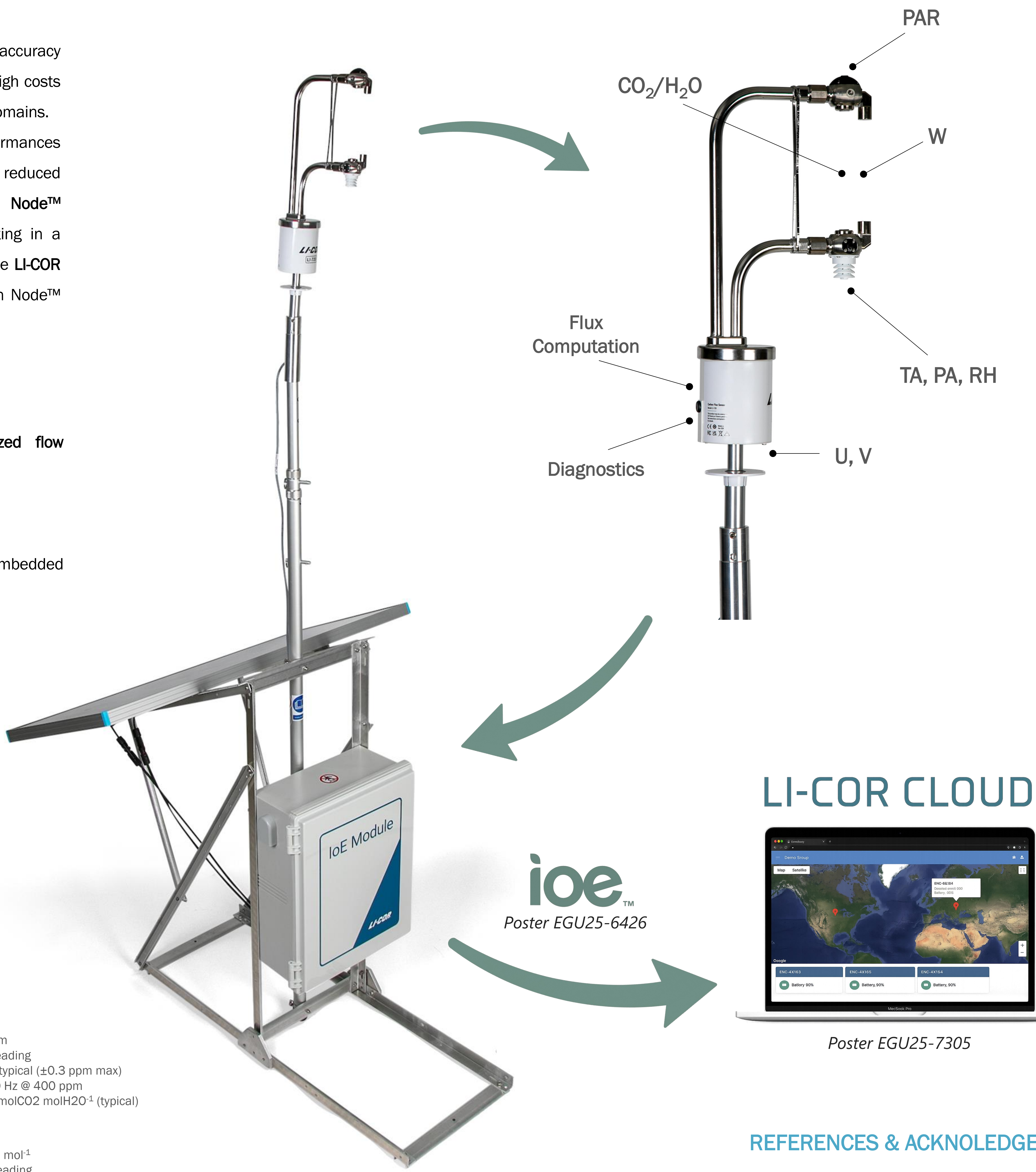
The Eddy Covariance method has the temporal resolution and accuracy required for direct CO₂ flux measurements from ecosystems, but its high costs and the complexity hinder applicability in regulatory and commercial domains. The LI-720 is a new CO₂/H₂O flux sensor, designed to achieve performances comparable to traditional high-end EC systems but at significantly reduced costs, maintenance needs, and power consumption. The Carbon Node™ combines the LI-720 with a power/IoT communication box, resulting in a wireless, lightweight instrument which delivers flux data directly to the LI-COR Cloud™, a cloud-based data analysis/synthesis platform. The Carbon Node™ represents the most streamlined flux system available to date.

UNIQUE FEATURES OF THE LI-720

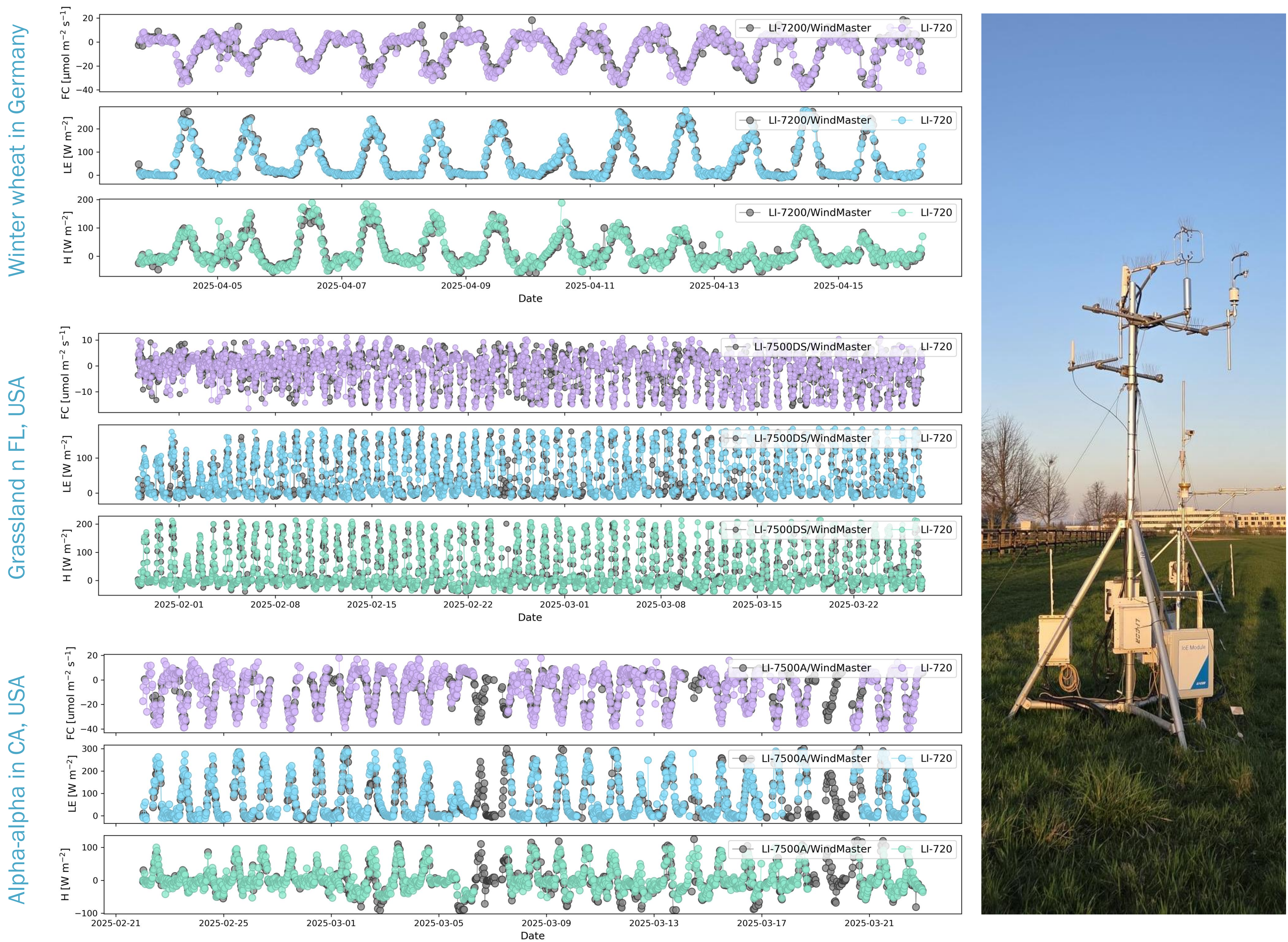
- Co-located wind and CO₂/H₂O measurements with **minimized flow disturbance**
- Very low power consumption (~1.5 W)
- Measures biometeorological variables such as TA, PA, RH and PAR
- Compute fluxes using standard processing algorithms with embedded custom code
- Provides raw data output via RS232 and flux output via SDI-12
- GPS for location and time keeping

SPECS

WIND MEASUREMENT			
Axes:	U, V, W		
Range:	0-30 m s ⁻¹		
Offset at Zero Wind:	±0.06 m s ⁻¹		
RMS Noise:	< 0.1 m s ⁻¹ @ 5 m s ⁻¹ , < 0.15 m s ⁻¹ @ 15 m s ⁻¹		
TSONIC Accuracy:	±0.2 °C max offset at 20 °C		
BIOMET MEASUREMENT			
PAR			
Range:	0-3000 μmol m ⁻² s ⁻¹		
Accuracy:	±5% of reading		
Cosine correction:	up to 75° angle of incidence		
AIR TEMPERATURE			
Range:	-40-60 °C		
Accuracy:	±1.5 °C		
AIR PRESSURE			
Range:	50-110 kPa		
Accuracy:	±0.5 kPa (typical)		
AIR RELATIVE HUMIDITY			
Range:	0-100% (non-condensing)		
Accuracy:	±1% typical		
CO₂ MEASUREMENT			
Range:	0-1500 ppm		
Accuracy:	< 1.5% of reading		
Zero Drift (per °C):	±0.15 ppm typical (±0.3 ppm max)		
RMS Noise:	1 ppm @ 10 Hz @ 400 ppm		
Sensitivity to H ₂ O:	±2.00E-05 molCO ₂ molH ₂ O ⁻¹ (typical)		
H₂O MEASUREMENT			
Range:	0-60 mmol mol ⁻¹		
Accuracy:	< 1.5% of reading		
Zero Drift (per °C):	±0.03 mmol mol ⁻¹ typical (±0.05 mmol mol ⁻¹ max)		
RMS Noise:	0.05 mmol mol ⁻¹ @ 10 Hz @ 10 mmol mol ⁻¹		
Sensitivity to CO ₂ :	±0.02 molH ₂ O molCO ₂ ⁻¹ (typical)		



SAMPLE FIELD DEPLOYMENTS (*)



Comparison between LI-720 and traditional EC systems for carbon dioxide (FC), latent heat (LE) and sensible heat (H) fluxes at 3 agricultural sites. Results are shown without any QC-based data exclusion

Several Carbon Nodes™ are currently deployed at multiple sites, monitoring diverse ecosystems in varying climatic conditions across the US and Europe. Results show satisfying agreement against reference EC systems with **typical mean biases < ±7%** for carbon dioxide and energy fluxes, and **marginally larger random errors**, hardly detected by traditional methods (e.g. Finkelstein and Sims, 2001). The Carbon-Node™, powered by the LI-720 sensor and combined with the LI-COR Cloud™, provides the first end-to-end solution for quantifying carbon budgets with automated Quality Control, Gap Filling, Footprint Analysis and Flux Spatialization (see also Posters EGU25-7305 and EGU25-6426).

REFERENCES & ACKNOLEDGEMENTS

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