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Standardized Automated CO_2/H_2O Flux Systems for Individual Research Groups and Flux Networks

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In recent years, spatial and temporal flux data coverage improved significantly, and on multiple scales, from a single station to continental networks, due to standardization, automation, and management of data collection, and better handling of the extensive amounts of generated data. With more stations and networks, larger data flows from each station, and smaller operating budgets, modern tools are required to effectively and efficiently handle the entire process.

Such tools are needed to maximize time dedicated to authoring publications and answering research questions, and to minimize time and expenses spent on data acquisition, processing, and quality control. Thus, these tools should produce standardized verifiable datasets and provide a way to cross-share the standardized data with external collaborators to leverage available funding, promote data analyses and publications.

LI-COR gas analyzers are widely used in past and present flux networks such as AmeriFlux, ICOS, AsiaFlux, OzFlux, NEON, CarboEurope, and FluxNet-Canada, etc. These analyzers have gone through several major improvements over the past 30 years. However, in 2016, a three-prong development was completed to create an automated flux system which can accept multiple sonic anemometer and datalogger models, compute final and complete fluxes on-site, merge final fluxes with supporting weather soil and radiation data, monitor station outputs and send automated alerts to researchers, and allow secure sharing and cross-sharing of the station and data access.

Two types of these research systems were developed: open-path (LI-7500RS) and enclosed-path (LI-7200RS). Key developments included:

- Improvement of gas analyzer performance
- Standardization and automation of final flux calculations onsite, and in real-time
- Seamless integration with latest site management and data sharing tools

In terms of the gas analyzer performance, the RS analyzers are based on established LI-7500/A and LI-7200 models, and the improvements focused on increased stability in the presence of contamination, refining temperature control and compensation, and providing more accurate fast gas concentration measurements. In terms of the flux calculations, improvements focused on automating the on-site flux calculations using EddyPro® software run by a weatherized fully digital microcomputer, SmartFlux2. In terms of site management and data sharing, the development focused on web-based software, FluxSuite, which allows real-time station monitoring and data access by multiple users.

The presentation will describe details for the key developments and will include results from field tests of the RS gas analyzer models in comparison with older models and control reference instruments.