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Results of first field tests of the improved open-path and enclosed models of CO_2 and H_2O flux measurements systems

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In 2014-2015, improved open-path and enclosed-path flux measurement systems were developed, based on established LI-7500A and LI-7200 gas analyzer models, with the focus on improving stability in the presence of contamination, refining temperature control and compensation, and providing more accurate gas concentration measurements. In addition to optical and electronic redesign, both systems incorporate automated on-site flux calculations using EddyPro® software run by a weatherized remotely-accessible microcomputer, SmartFlux 2, with fully digital inputs. The ultimate goal of such development was to reduce errors in CO_2 and H_2O hourly fluxes and in long-term carbon and water budgets.

Field tests of both systems were conducted over six periods, each 5-14 months long, at 6 sites with diverse environments, setups, and types of contamination, using 26 gas analyzers. The open-path LI-7500RS system performed significantly better than the original LI-7500A model in terms of contamination-related drifts in mean concentrations. Improvements in CO_2 drifts were strong, with RS models often drifting few-to-tens of times less than the original. Improvements in H_2O contamination-related drifts were particularly significant, with modified models often drifting many tens of times less than the original.

The enclosed-path LI-7200RS system performed substantially better than the original LI-7200 in terms of the drifts in H_2O, sometimes drifting few-to-tens of times less than the original. Improvements in CO_2 contamination-related drifts were modest, being similar or just a bit better than the original.

Results from field tests suggest that both RS systems can help improve flux data coverage and potentially reduce site maintenance:

(i) Frequency of cleaning and site visits for service and maintenance should decrease, especially for the open-path design

(ii) Amount of highest quality data with smallest error bars on fluxes is expected to increase for both open-path and enclosed-path designs

(iii) Amount of total data coverage over long periods of deployment should also increase substantially

The presentation will describe details and results from field tests of these models in comparison with older models and control reference instruments.