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Call for Collaboration:

Non-closure of the surface energy balance is a frequently observed phenomenon of hydrometeorological measurements when using the eddy covariance (EC) method to estimate sensible heat (H) and latent heat (LE) fluxes (Stoy et al., 2013; Mauder et al., 2017).

One of the most accredited hypotheses is that, for the most part, the lack of closure is due to a systematic underestimation of H and LE related to synoptic scale transport phenomena that are not captured with traditional EC systems. Under this assumption, in the past few years several methods have been proposed to correct EC-derived H and LE measurements, so as to better or completely close the energy balance.

Among others, Matthias Mauder and his group have paid significant attention to this issue and, in time, have proposed several correction methods. The main practical difference across the various methods is the way the residual energy is partitioned between H and LE. However, a conclusive evaluation of the performance of these methods has not been performed yet, mainly due to the difficulty of accessing independent H or LE data needed to validate the correction. Most of the proposed methods do rely on the energy imbalance itself to compute the correction factors. Therefore, they achieve a perfect closure by definition and cannot use the energy balance closure as a metric of performance. Correction methods that are not informed by the known energy imbalance have also been developed, but to date they appear to significantly underestimate the correction when EC measurements are taken close to the canopy (De Roo et al. 2018).

Matthias Mauder has worked with LI-COR to implement four of the existing methods in Tovi® Software, so they are now available to you in Tovi as of Version 2.5. Namely the methods are those after Mauder et al. (2013), Charuchittipan et al. (2014) and the two methods proposed in De Roo et al. (2018).

Time to collaborate!

Together with Matthias, we invite the community to perform an evaluation of EC-derived energy fluxes correction methods. We are therefore looking for researchers who are interested and able to collaborate with us on this activity. What we need is people who:

- Observe systematic energy imbalance at their site for extended periods (at the very least one month, one year or more is preferred).
- Perform accurate radiation and soil heat flux measurements at a spatial scale comparable to the footprint of the EC system. High quality measurements of “available energy” are a prerequisite of correction methods based on energy imbalance.
- Have access to independent means to evaluate the performance of the correction. Examples of independent means are: (1) lysimeter-based evapotranspiration measurements (2) LE estimations constrained by water balance considerations (3) land-surface models or physically based hydrometeorological models.
- Are willing to share their data and work on a synthesis activity and, hopefully, a corresponding paper.

In order to greatly simplify the process and assure that the across-site synthesis is fully consistent, documented and replicable, we ask participants to use EddyPro® Software to process the raw EC data and compute H and LE fluxes and Tovi® Software to ingest computed fluxes, perform a preliminary (to be

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prescribed) Quality Screening and then apply all 4 correction methods under evaluation. Using the exact same code, which was vetted by Mauder and co-authors, to compute the correction at all sites will avoid biases and errors due to different/inaccurate implementations of the methods. Using the same data formats will hugely simplify and streamline the following synthesis activity.

If you are interested in collaborating with us, please send an email to dave.johnson@licor.com with an expression of interest, briefly describing the EC site and the independent data you propose to use for the evaluation. Please also indicate the length of the available dataset and whether you are already an EddyPro® and/or Tovi® user.

We hope to hear from you soon!

References:

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