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Metrological analysis of long-term surface fluxes, meteorological and soil measurements from comprehensive datasets characterizing 2 cropland sites: from experimental to operational instrumentation.

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As shown by the development of international measurements networks like Fluxnet, Neon or ICOS, the necessity for long term measurements of energy and matter fluxes between surface and atmosphere is now well established to improve our understanding and representation of 1) the processes behind these exchanges, 2) effects of climate and ecosystem management on water use and greenhouse gases budgets, 3) the mitigation activities against climate change.
In this study, we present a metrological analysis of a 10-years comprehensive dataset on two cropland sites in southwestern France (Béziat et al., [1]) with specific crops rotation, different management and similar climate. The objective of these stations is to measure, compare, and model the crop-atmosphere exchanges of CO_2, water vapor, and N2O in order to provide greenhouse gases budgets according to site specificities (Ceschia et al. [2], Tallec et al., [3]).
Each flux site is equipped with eddy covariance systems, various radiation sensors including PRI, NDVI and global/diffuse incoming radiation, a 4-levels profile of water vapor and CO_2 atmospheric concentrations, air temperature and humidity, and wind speeds. In addition, soil profiles for temperature and water content measurements are settled up. Automatic chambers are deployed to provide CO_2 and N2O fluxes quasi continuously since 2012 and additional ecosystem variables are also collected.
The data quality is evaluated by: 1) using cross-verification of the measurements and 2) comparing spatial and temporal statistics in the dataset. We also propose an original method to provide continuous time-series of flux measurements in case of sensors failure or malfunctioning. This original gap-filling uses the complementary of instruments at the two stations, vertical atmospheric profiles and an adaptation of the Reischtein et al. (2005) method, which includes crop functioning period and LAI dynamics.

[1] Béziat et al., 2009, Agr. Forest Meteorol., 149, 1628-1645.
[2] Ceschia et al., 2010, Agr. Ecosyst. Environ., 139, 363-383.
[3] Tallec et al., 2013, Agr. Forest Meteorol., 168, 69-81.