SCIENTIFIC REPORT

Reference code: **COST-STSM-ES1404-34644**
Candidate: Miguel Potes, Postdoc researcher at University of Évora, Portugal
Host: Ivan Mammarella, Docent at University of Helsinki, Finland
Period: 22/08/2016 to 26/08/2016

Objective

The STSM has the main goal of analyse the results obtained over several months field experiment of a comparison study performed with two similar equipment's measuring turbulent fluxes in parallel over a boreal lake in Finland. The measurements covered the periods of open water, ice/snow formation, ice/snow cover, ice/snow break and again open water. This mission has also the objectives of a preparation of joint manuscript about the abovementioned results and the collection of the equipment of the candidate institution back to Portugal.

Work Carried Out

During this STSM the evaluation of data obtained from both instruments, an open-path from Évora University and a closed-path from Helsinki University, was carried out. Heat and carbon dioxide turbulent fluxes over the lake Vanajavesi (Finland) were discussed for different times of the year with special attention on ice/snow covered period. The draft of a manuscript was also discussed within the results obtained. The equipment of the candidate institution was dismounted from the lake Vanajavesi and returned to Portugal.

Main Results

First results shown that heat fluxes are comparable between both equipment's. As expected, and illustrated in Figure 1, very low heat and carbon dioxide fluxes were found over ice/snow covered lake (Salgado et al., 2016). Carbon dioxide fluxes shown differences, with a higher range of values found for open-path than for closed-path sensor (see Figure 2). According to Helbig et al. (2016) a bias was found on open-path CO_2 fluxes and to improve the agreement between open and closed-path sensors the fast-response air temperature (instead of slow-response air temperature) should be used in the absorption-to-CO_2 density conversion. This approaches was tested in our datasets and decreases the differences between CO_2 fluxes (improved the agreements between both sensors). Nevertheless, the differences remain significant (see Figure 2)

and a deeper discussion is still open on the possible effects of temperature and water vapor on carbon dioxide flux bias for the open-path sensor.

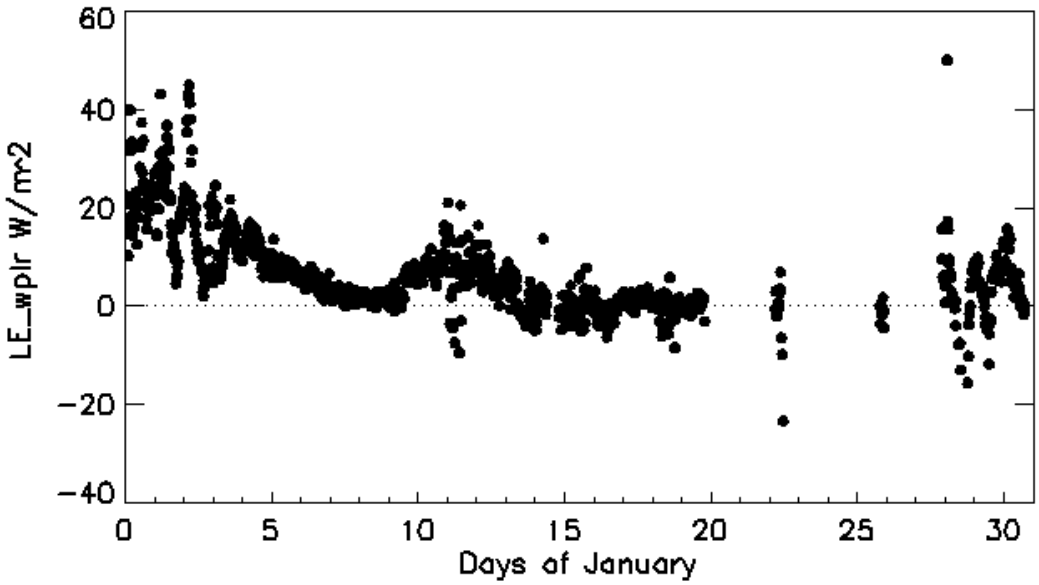

Figure 1: 30 minutes latent heat flux in January with open-path sensor. The lake start freezing on December 30, and was completely frozen by January 5.

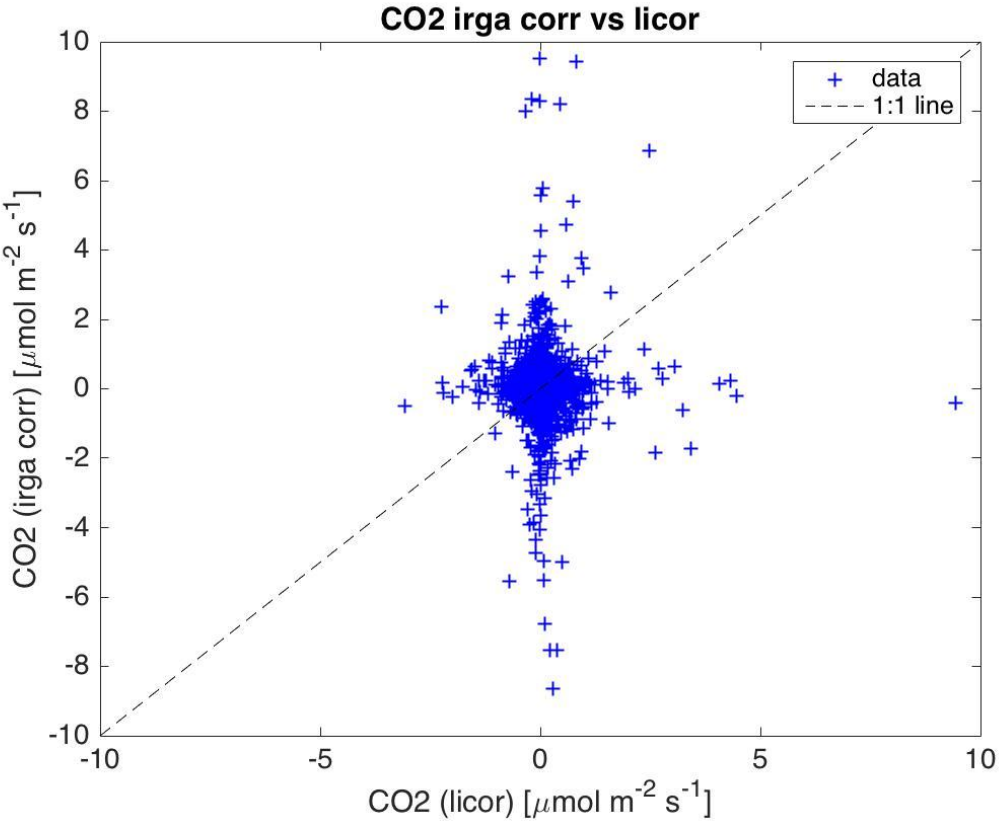

Figure 2: Scatter plot between CO2 flux obtained with open-path sensor with fast-response air temperature and closed-path sensor. For the period in January, February and March).

Foreseen Publications

The resulting dataset from the comparison study will be used to produce a joint manuscript between both institutions. In terms of heat and carbon dioxide flux computations from both equipment's using the same method and taking in account the new corrections for the open-path sensor.

Future Collaboration

It was discussed the possibility to have parallel measurements (with same instruments) in a Portuguese reservoir with very different features and purposes. These can be very interesting for the ongoing exploration of the carbon dioxide bias for the open-path sensor because higher values of temperature and water vapour can be found in this reservoir (Salgado et al., 2014).

Confirmation by the host Institution of the successful execution of the STSM

The host institution, represented by Ivan Mammarella, confirms that the main goal of the STSM was achieved.

References

Helbig, M., Wischnewski, K., Gosselin, G.H., Biraud, S.C., Bogoev, I., Chan, W.S., Euskirchen, E.S., Glenn, A.J., Marsh, P.M., Quinton, W.L. and Sonnentag, O. 2016. Addressing a systematic bias in carbon dioxide flux measurements with EC150 and the IRGASON open-path gas analysers. Agric. For. Meteorol., 228–229, 349–359.

Salgado, R., Potes, M., Albino, A., Rodrigues, C.M. and ALEX 2014 Scientific Team. 2014. Eddy covariance flux measurements over a man made lake during the ALEX 2014 field campaign in South Portugal. 2014 AGU Fall Meeting, San Francisco, USA.

Salgado, R., Potes, M., Mammarella, I. and Provenzale, M. 2016. Measurements of Mass, Momentum and Energy fluxes over a ice/snow corvered lake. 2016 EGU Generall Assembly, Vienna, Austria.