



Soil's heat flux world

Bartosz Zawilski

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SOIL'S HEAT FLUX WORLD

Zawilski B. M.

bartosz.zawilski@cnr.fr

Centre d'Etudes Spatiales de la BIOSphère

18 avenue Edouard Belin, 31400 Toulouse, FRANCE



Context & Objectives

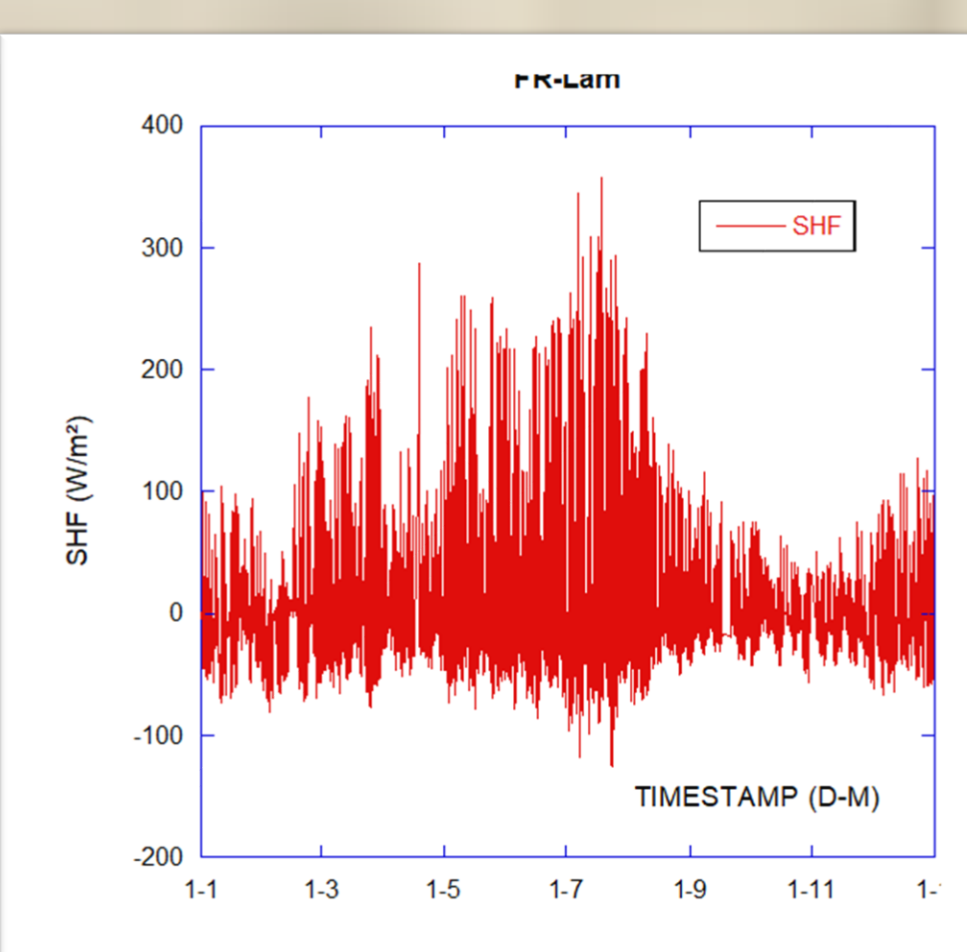
- In the context of global climate warming, soil heat flux is monitored. ICOS mandatory measurements are achieved using self-calibrated heat flux plates HFP01SC.
- Two questions arise:
 - How to check correct soil heat flux plates functioning?
 - Subsequently, why the annual soil heat flux budget is not closed?

OBJECTIVES: Check the soil heat flux plates functioning and complete the soil heat fluxes balance.



Soil Heat flux plates functioning

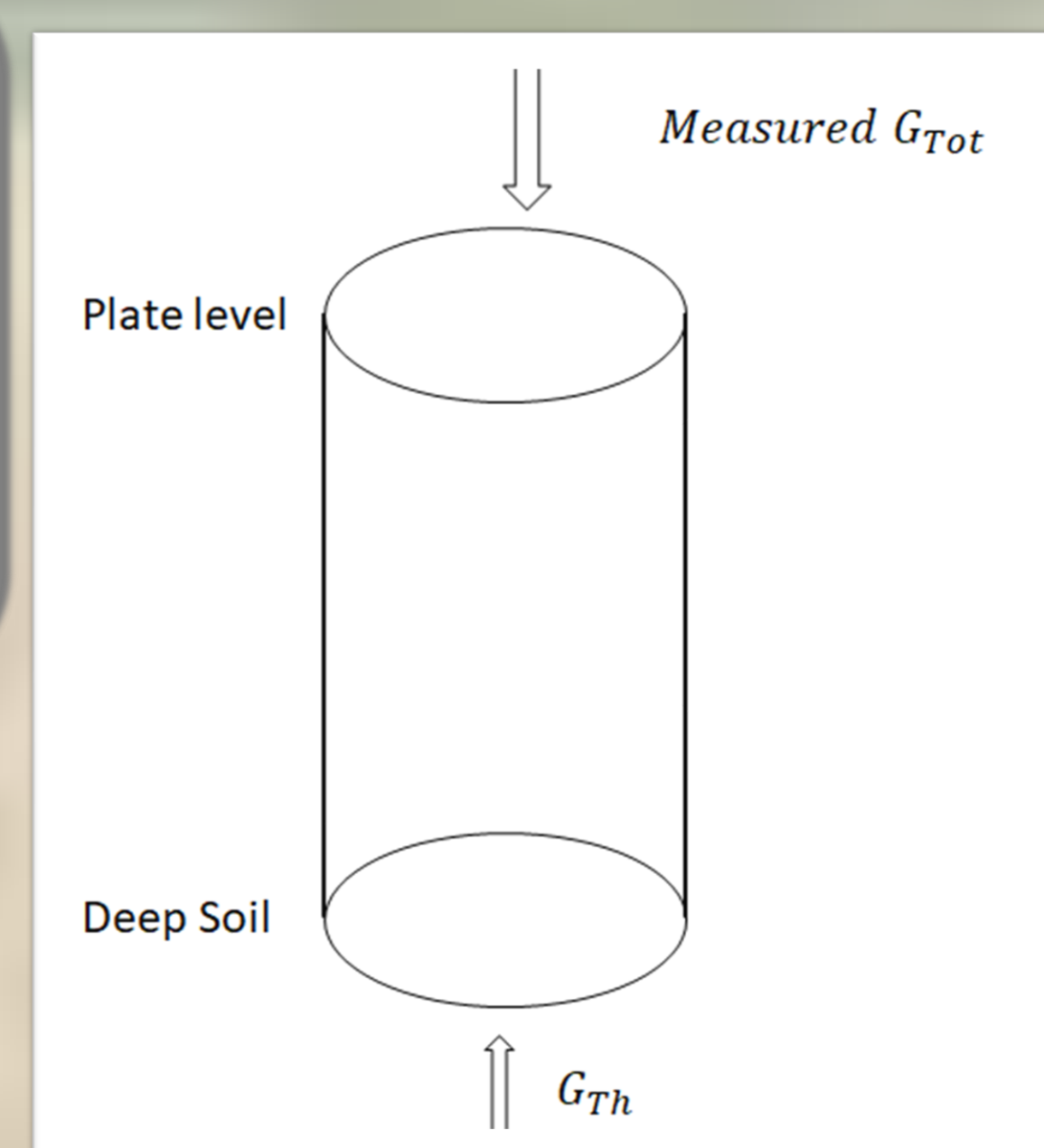
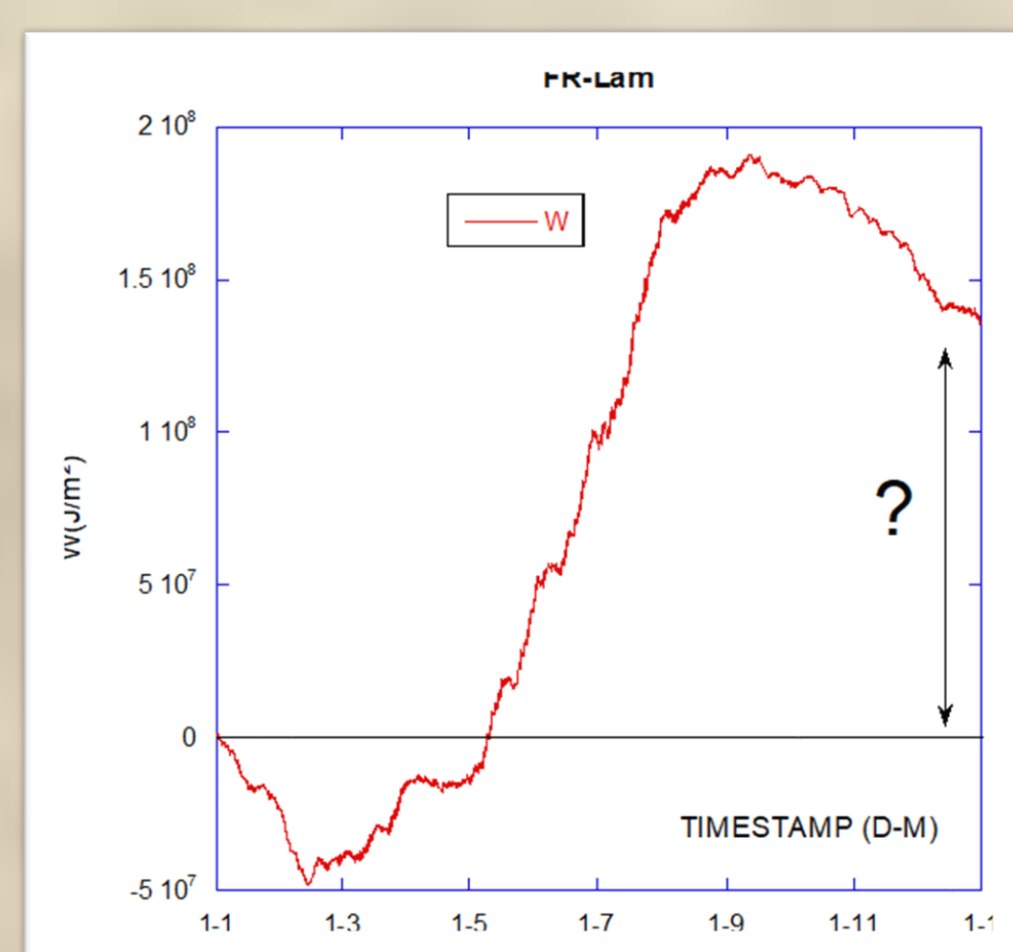
- To check correct SHFP functioning is not so evident and an **annual integration** may be of great help. Annual integration should be **close to zero** as, by energy conservation, in the case of homogeneous soil with the same soil temperatures and moisture at the beginning and the end of the year, theoretically, the heat flux integration is equal to the geothermal energy flux integration. Heat propagate by radiation (concern only separation surfaces) by advection (concern only fluids) and by conduction. SHFP measure only conduction. Zawilski, B. M. <https://doi.org/10.5194/gi-11-223-2022>, 2022.



Annual



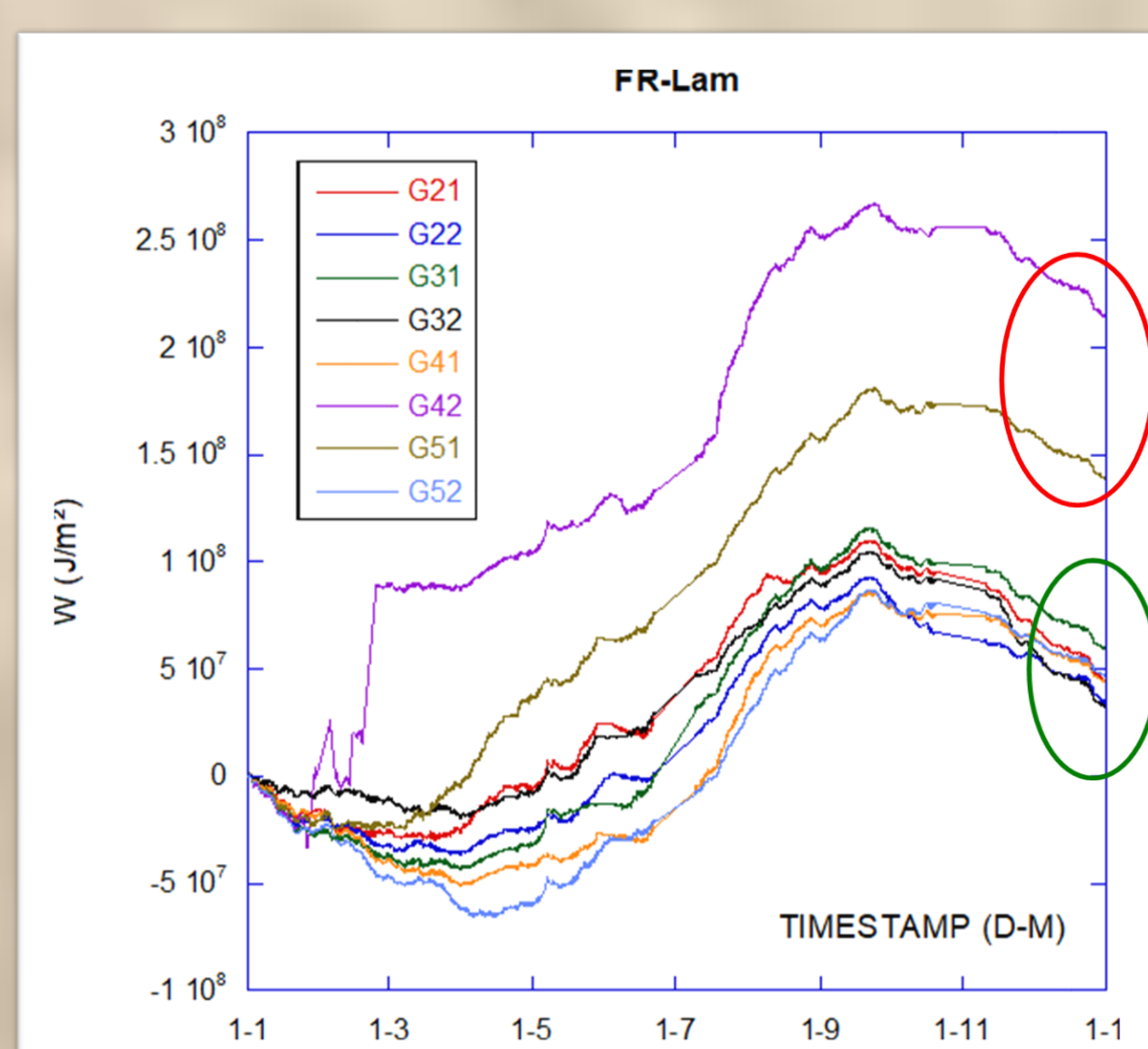
Integration



$$\Delta E = \int_{t_0}^{t_1} (G_{Tot} - G_{Th}) dt$$



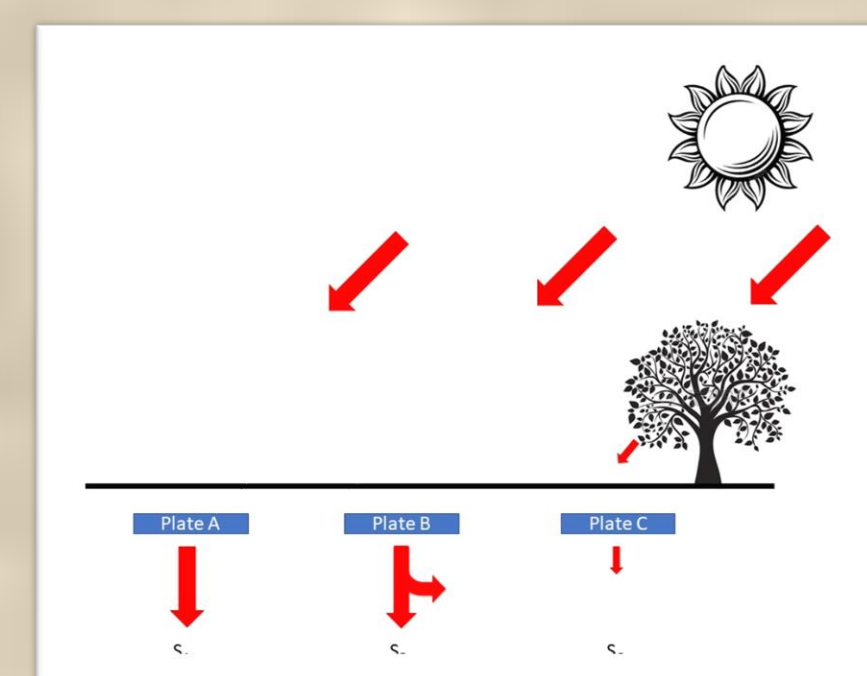
$$\int_0^{365 \text{ Days}} (G_{Tot} - G_{Th}) dt = 0$$



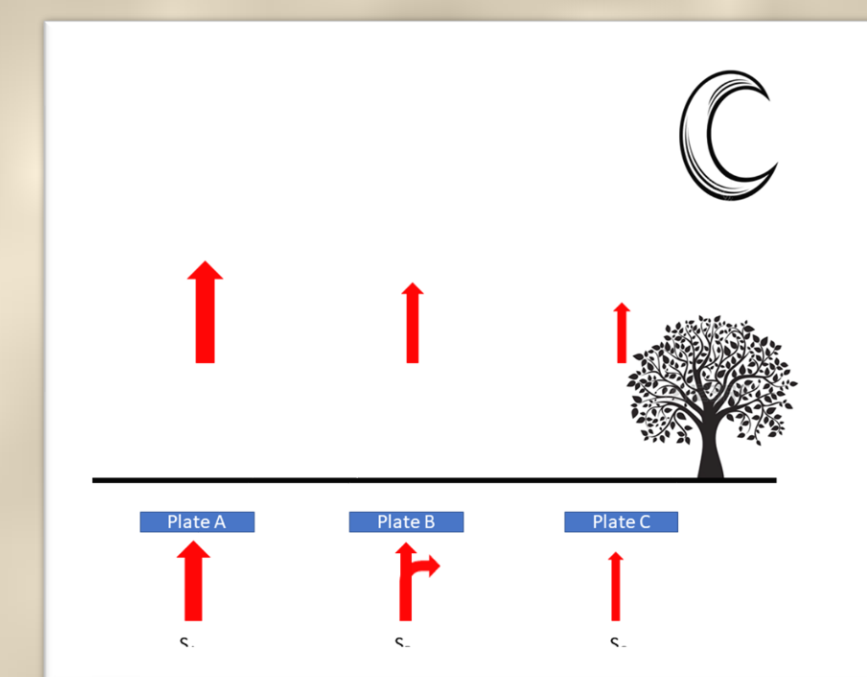
Localized unbalances

- Annual soil heat flux integration is not nil and geothermal energy does not explain this unbalance.
- Particularly important unbalance may be attributed to the soil or the sunshine inhomogeneities boundaries proximity.

Day



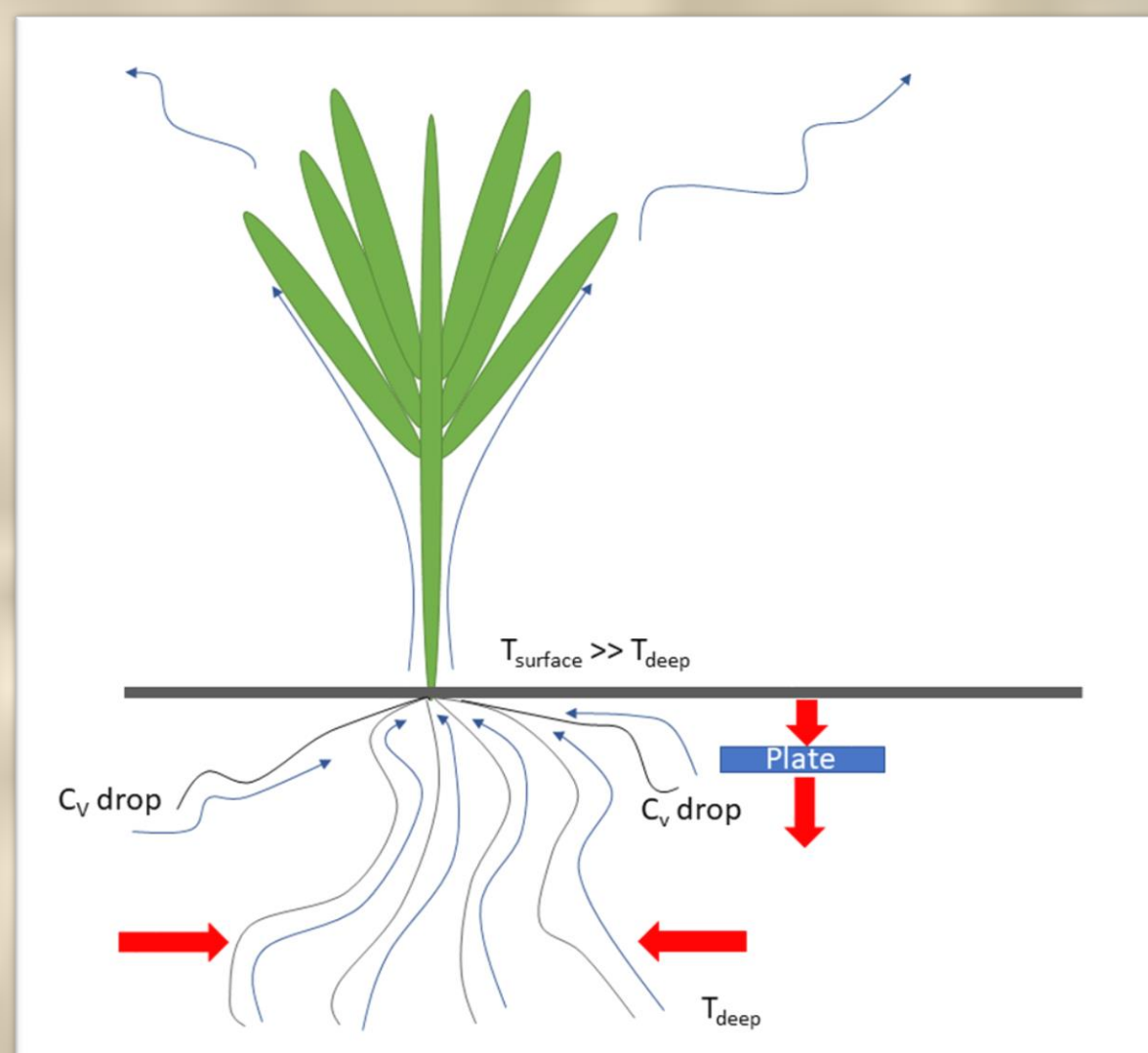
Night



Systematic unbalances

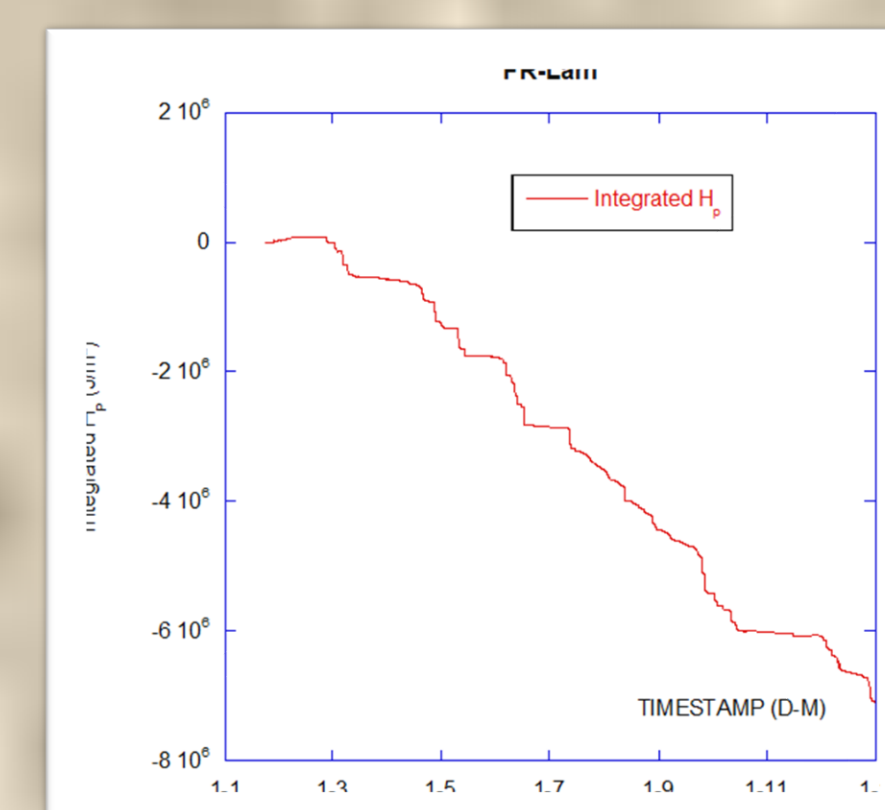
- Systematic unbalance may be, in part, attributed to the advective fluxes.
 - Evapotranspiration causes advective fluxes.
 - Rainfall water infiltration causes surface cooling but also advective fluxes.

Evapotranspiration

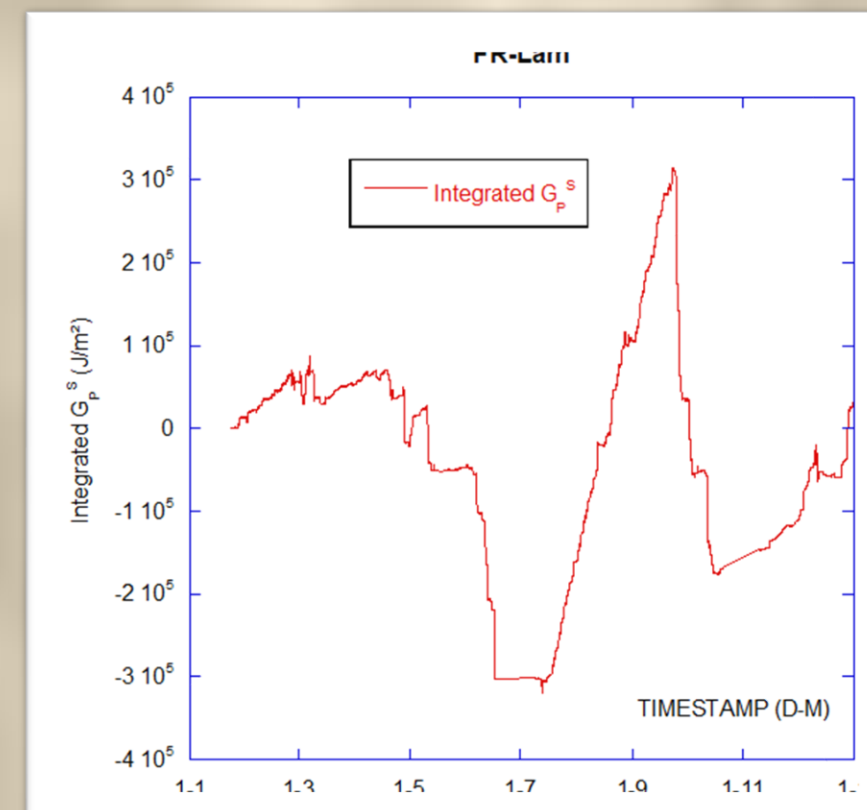


Rainfall ?

Surface cooling
Not yet an
unbalance



Water infiltration
Not causing notable
unbalance



Conclusion

- Soil Heat Flux Plates functioning can be checked by an annual integration.
- Important unbalance may be observed due to boundaries proximity of inhomogeneities and also due to the unmeasured advective fluxes.

Acknowledgments

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