Jornadas Med 2019
Mediterranean Institute for Agriculture, Environment and Development

Reservoir evaporation estimation in a Mediterranean climate. Comparing direct and indirect methods

IRRIGATED AGRICULTURE

C. Miranda Rodrigues[1], R. Salgado[2], M. Potes[2], R. C. Guimarães[1], M. Moreira[1]

1 Departamento de Engenharia Rural, ICAAM, Escola de Ciência e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora

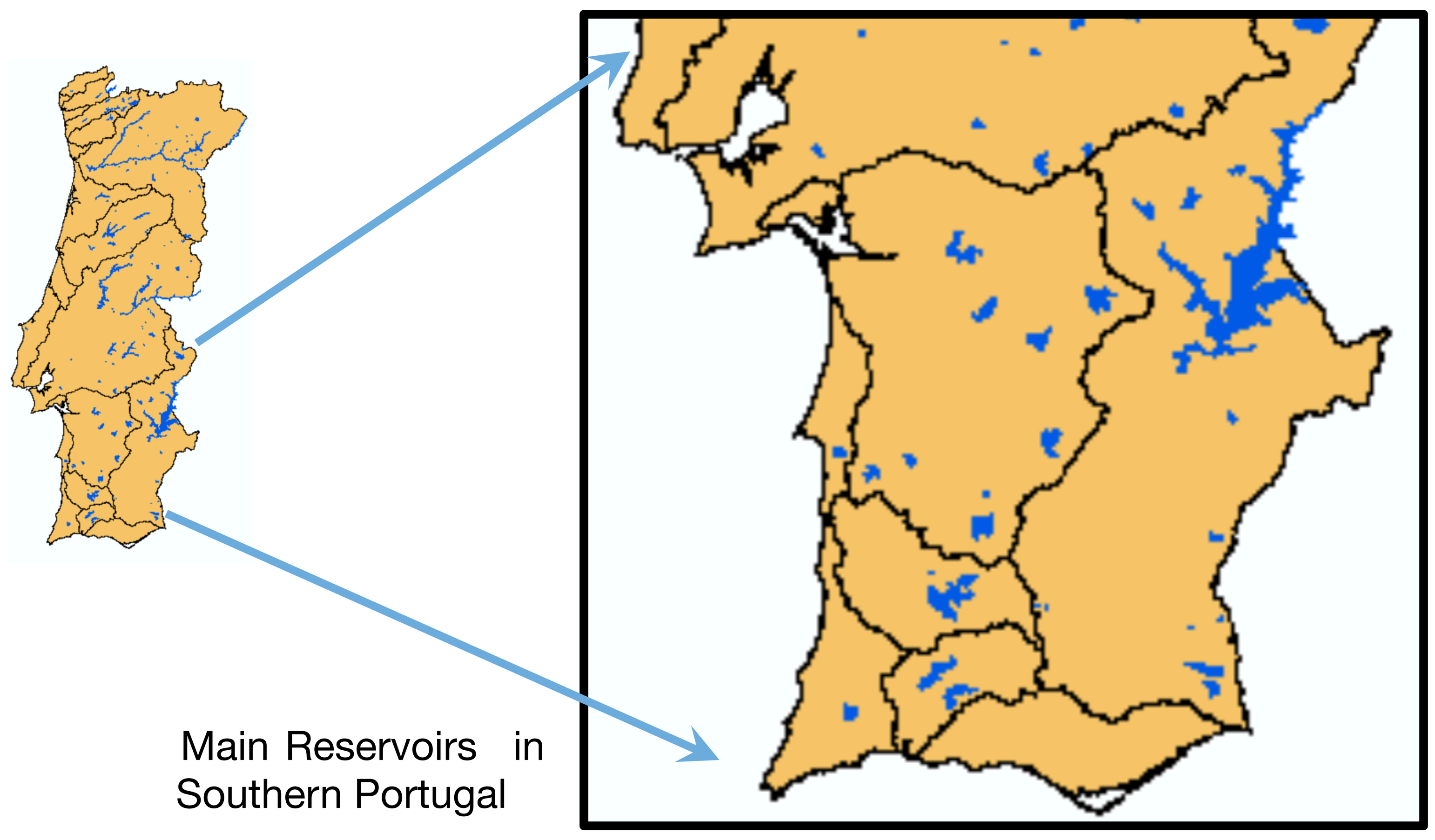
2 Departamento de Física, ICT, Escola de Ciência e Tecnologia, Universidade de Évora, 7000 Évora Colégio António Luís Verney, Ap. 94, 7006-554 Évora

1. Introduction and objectives

Reservoir evaporation in semi-arid region facing scarcity, namely Southern Portugal, is one of the most important contribution to the losses of water in collective irrigation systems and water resources management. Irrigation crops depend on water availability, total and in year variability.

Evaporation is the component of the reservoir water balance less known by technical and scientific community. So, it is a major research subject.

The objective of this research is to compare the results of the indirect methods with the direct methods measures.



Main Reservoirs in Southern Portugal

2. Eddy Covariance

The Eddy Covariance Method (EC) is a non-invasive technique and the most common technique used to assess turbulent fluxes over all types of surfaces. To estimate water reservoir evaporation by EC, a fast-response instrumentation (20 Hz) is setup above water surface, usually on a floating platform, and variables such as u, v and w components of wind speed, sonic temperature and absolute humidity (H_2O), are measured. Turbulent fluxes of latent heat (evaporation) (LE) are calculated as covariances between fluctuation of vertical wind (w') and H_2O concentration expressed as water vapour density ($\rho_{w'}$).

$$LE = \lambda \overline{W' \rho_{w'}}$$

λ is the latent heat of evaporation

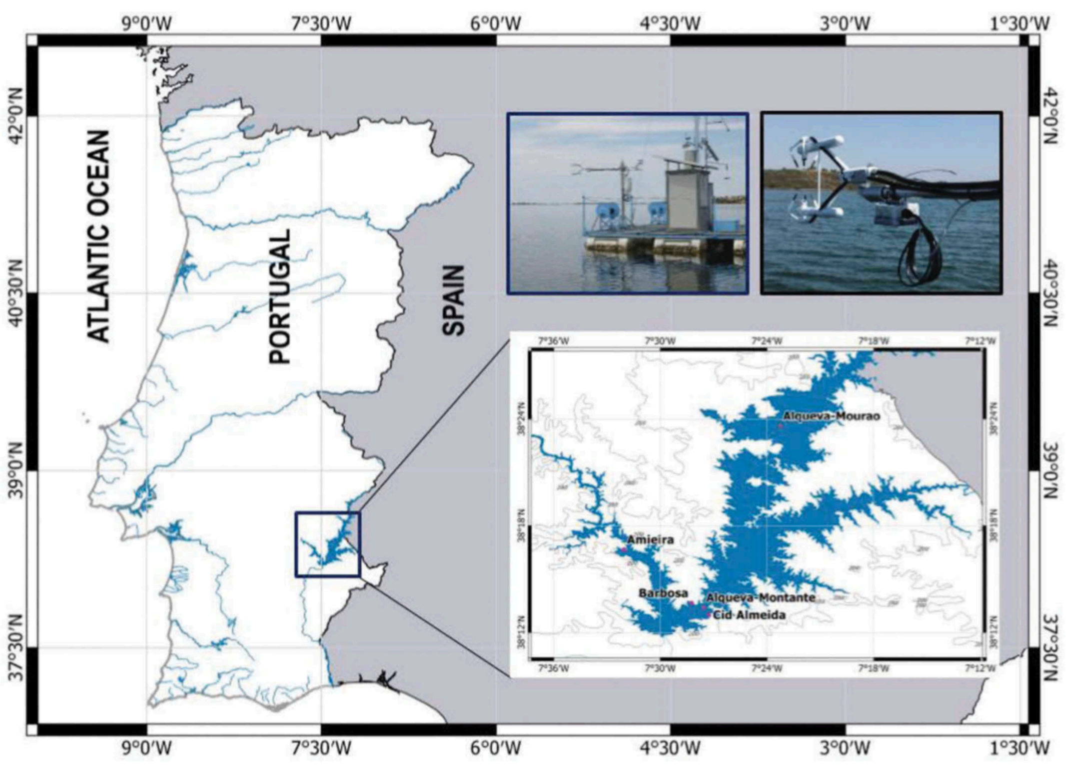
EC system (IRGASON; Campbell Scientific) installed on a floating platform at Alqueva reservoir, within the framework of the ALEX project (www.alex2014.cge.uevora.pt)

3. Indirect Methods

- standard class-A pan measurements;
- mass transfer ; $$E = NU_2\left(e_s - e_a\right)$$
- energy balance; $$E = \frac{R_n - \Delta Q}{\rho_w\left[\lambda\left(1+\beta\right) + c_{pw}\left(T_s - T_b\right)\right]} \times 86.4 \times 10^6$$
- combination approach. $$E = \left(2\alpha - 1\right)\left(\frac{s}{s+\gamma}\right)\left(\frac{R_n - \Delta Q}{\lambda \rho_w}\right) \times 86.4 \times 10^6 - \frac{\gamma}{s+\gamma}\left[0.26\left(0.5 + 0.54U_2\right)\left(e_a^* - e_a\right) \times 10^{-2}\right]$$

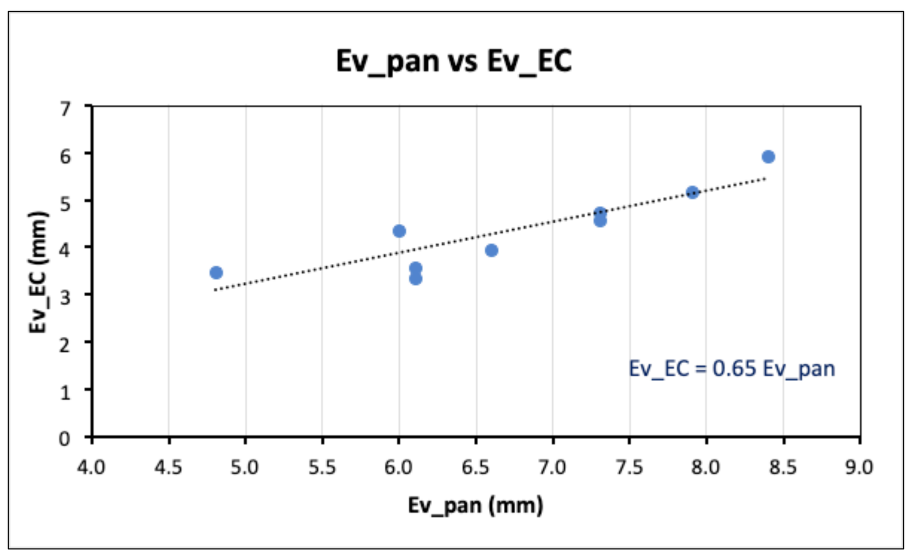
4. Case study

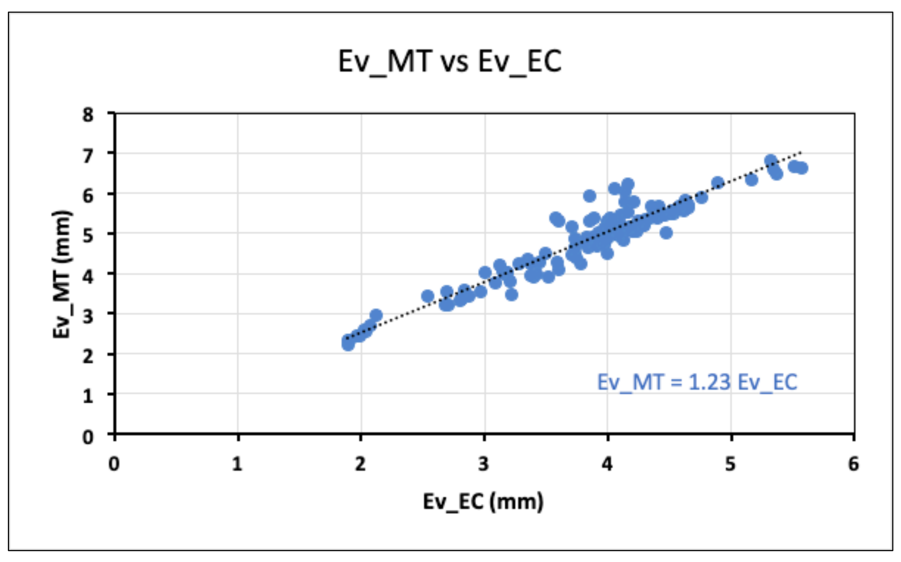
Atmospheric, water and EC variables were continuous measured on a floating platform over water, Jun to Oct 2014. Water temperature was measured at several depths.

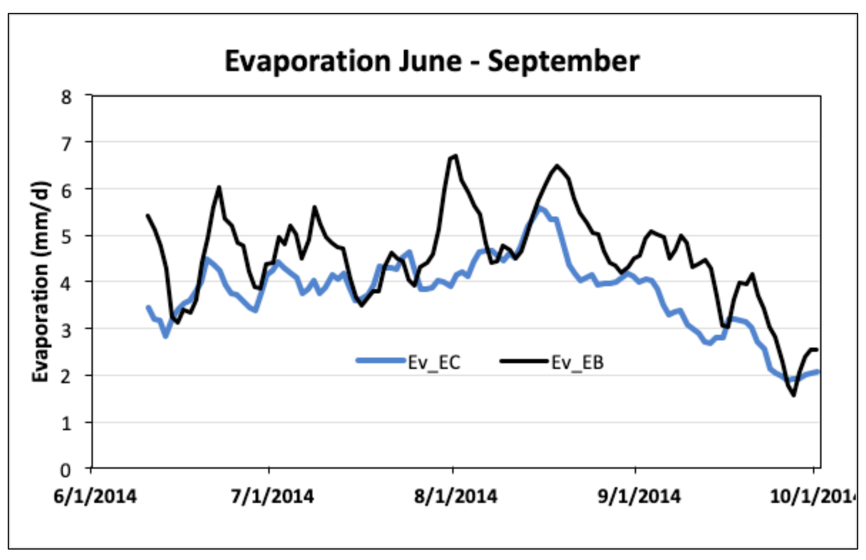


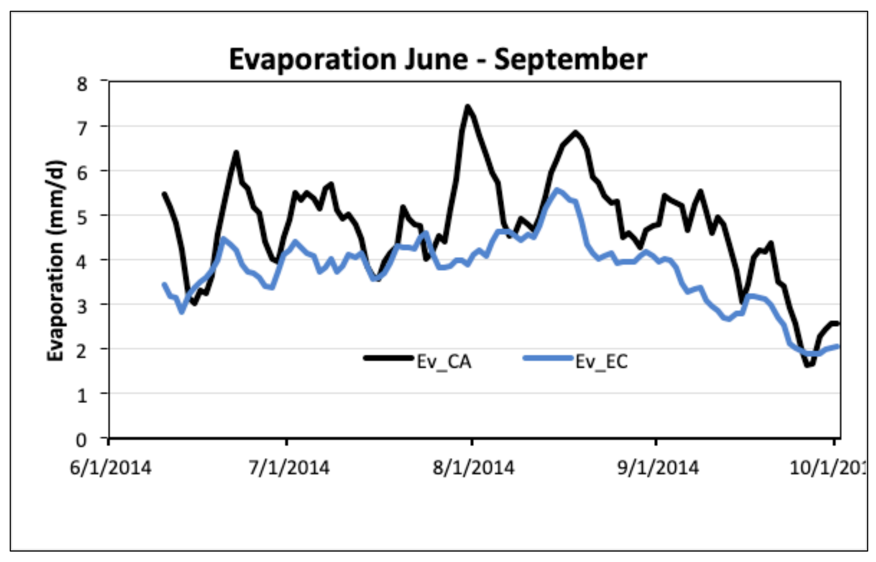
Alqueva reservoir: geographic location, floating platforms and meteorological stations (Potes *et* al. 2017)

5. Results









6. References

M. Potes, R. Salgado, M. J. Costa, M. Morais, D. Bortoli, I. Kostadinov & I. Mammarella (2017) Lake–atmosphere interactions at Alqueva reservoir: a case study in the summer of 2014, Tellus A: Dynamic Meteorology and Oceanography, 69:1, 1272787

Instituto de Ciências Agrárias e Ambientais Mediterrânicas
Knowledge connecting land, food and people

7. Acknowledgements

ALEX2014
ALqueva hydro-meteorological EXperiment