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Measurement of carbon and water balances of semiarid scrubs using transient-state closed chambers

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The measurement of canopy photosynthesis and transpiration is crucial to understand the carbon and water cycles, specially, in water-limited ecosystems. When the objective is to quantify fluxes of carbon at whole-plant level, scaling up from leaf to canopy by using multi-layer models is always a tricky approach, because of the complexity in obtaining model parameters within the canopy. Here we present a transient-state closed chamber, large enough to measure medium-size plant gas exchanges in a semiarid shrubland. Additionally, a series of tests were carried out to evaluate physical and physiological plant responses to potential environmental modifications caused by the chamber. As results, leakage had a minimal impact on flux calculations (0.9 % min^{-1}), and chamber´s walls adsorption of water was not detected. Furthermore, the artificial turbulence generated by fans into the chamber to facilitate air mixing did not alter the transpiration rate. The optimal duration of the calculation window was 60 s, which was the sufficient time interval to avoid the disturbance of the enclosed plant. Maximum increases in air and plant temperature were 0.6 ºC min^{-1} and 0.9 ºC min^{-1}, respectively. Therefore, the minimal effects that the chamber generated over the physiological processes of the enclosed plant indicate that this chamber is suitable for accurate measurements of gas exchanges at whole-plant scale in typical species that conform semiarid shrubland ecosystems.