

Non-rainfall moisture inputs in the Knersvlakte: Methodology and preliminary findings

Roger Brown^{1*}, Anthony J Mills² and Chris Jack¹

¹ *Climate System Analysis Group, EGS Department, University of Cape Town, Private Bag, Rondebosch 7701, South Africa*

² *Department of Soil Science, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa*

Abstract

Dew, fog/mist and water vapour adsorption, the 3 vectors by which non-rainfall water can be added to soil water, may play a critical role in ecosystem function in arid zones. This paper explores a methodology for overcoming the challenges of measuring small daily inputs of non-rainfall water in the harsh environment of the Knersvlakte on the West Coast of South Africa. An automatic micro-lysimeter (MLS) – an experimental arrangement of a sensitive electro-mechanical load cell, suitable electronic amplification and signal conditioning, and a microcontroller was developed. A microcomputer was employed for overall system control and data logging. Initial field work took place between late September and November 2006 on Arizona Farm, 30 km north of Vanrhynsdorp. In March 2007, subsequent work began at the Ratelgat BIOTA observatory. Manual soil weight sampling corresponded well with theoretical dew maximums, with measured maximum and minimum dew/fog of 0.4 mm and 0.08 mm (± 0.08 mm) (both in September 2006). Measurements from the first prototype MLS were marred by large (± 0.24 mm) error figures, signal dropout from the analog to digital converter, and insufficient range at the required resolution. The subsequent prototype (field tested in March 2007 and still in use) provides much smaller errors (± 0.05 mm). Calibration testing at Ratelgat indicates maximum overnight dew/fog contributions of 0.35 mm (± 0.05 mm), which corresponds with theoretical calculations as well as field measurements in other arid zones. Maximum dew/fog derived soil water occurs between 07:00 and 09:15. Surprisingly, soil weight, as a consequence of dew/fog inputs, starts to increase shortly after 17:20. These are preliminary findings and longer term testing and validation are ongoing at present. The role of quartz pebbles and small succulent plants in the interception of non-rainfall water is still to be explored.

Keywords: non-rainfall water, dew, fog, micro-lysimeter, Knersvlakte, West Coast