Geophysical Research Abstracts
Vol. 18, EGU2016-2338, 2016
EGU General Assembly 2016

A Method for Precision Closed-Loop Irrigation Using a Modified PID Control Algorithm

Martin Goodchild, Karl Kühn, Malcolm Jenkins, Kazimierz Burek, and Andrew Dutton
Delta-T Devices Ltd, Cambridge, United Kingdom (martin.goodchild@delta-t.co.uk)

The benefits of closed-loop irrigation control have been demonstrated in grower trials which show the potential for improved crop yields and resource usage. Managing water use by controlling irrigation in response to soil moisture changes to meet crop water demands is a popular approach but requires knowledge of closed-loop control practice. In theory, to obtain precise closed-loop control of a system it is necessary to characterise every component in the control loop to derive the appropriate controller parameters, i.e. proportional, integral & derivative (PID) parameters in a classic PID controller. In practice this is often difficult to achieve. Empirical methods are employed to estimate the PID parameters by observing how the system performs under open-loop conditions. In this paper we present a modified PID controller, with a constrained integral function, that delivers excellent regulation of soil moisture by supplying the appropriate amount of water to meet the needs of the plant during the diurnal cycle. Furthermore, the modified PID controller responds quickly to changes in environmental conditions, including rainfall events which can result in: controller windup, under-watering and plant stress conditions. The experimental work successfully demonstrates the functionality of a constrained integral PID controller that delivers robust and precise irrigation control. Coir substrate strawberry growing trial data is also presented illustrating soil moisture control and the ability to match water deliver to solar radiation.