Water balance in irrigation districts. Uncertainty in on-demand pressurized networks

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In on-demand pressurized irrigation distribution networks, applied water volume is usually controlled opening a valve during a calculated time interval, and assuming constant flow rate. In general, pressure regulating devices for controlling the discharged flow rate by irrigation units are needed due to the variability of pressure conditions. A pressure regulating valve PRV is the commonly used pressure regulating device in a hydrant, which, also, executes the open and close function. A hydrant feeds several irrigation units, requiring a wide range in flow rate. In addition, some flow meters are also available, one as a component of the hydrant and the rest are placed downstream. Every land owner has one flow meter for each group of field plots downstream the hydrant. Ideal PRV performance would maintain a constant downstream pressure. However, the true performance depends on both upstream pressure and the discharged flow rate.
Theoretical flow rates values have been introduced into a PRV behavioral model, validated in laboratory, coupled with an on-demand irrigation district waterworks, composed by a distribution network and a multi-pump station. Variations on flow rate are simulated by taking into account the consequences of variations on climate conditions and also decisions in irrigation operation, such us duration and frequency application. The model comprises continuity, dynamic and energy equations of the components of both the PRV and the water distribution network. In this work the estimation of water balance terms during the irrigation events in an irrigation campaign has been simulated. The effect of demand concentration peaks has been estimated.