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Publication Date

2007-10-10

Soil Moisture, Salinity, and Nitrate Control for Soil and Groundwater Protection in Support of Wireless Sensor Networks and Optimal Irrigation Strategy

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Introduction: Reclaimed Water is Reused for Agricultural Irrigation in California

Reclaimed Water is Reused for Agricultural Irrigation in Palmdale, CA

Merced Backyard Test Bed



Problem Description: Contaminant Control is Necessary for Pollution Prevention

Palmdale Test Bed

Merced "Backyard" Test Bed

- A **control algorithm** is required to maximize the reclaimed water input while protecting groundwater.
- Real-time **parameter estimation** for the simulation models is executed using on-line data from sensors
- Novel **multi-level sensing stations (pylons)** are deployed at varying spatial densities over a portion of a 30 acre test plot.
- A **test bed** for salinity and nitrate control is set up in Merced
- An **Automatic irrigation control system** is used to adaptively autonomously manage the flow rate using a feedback-control simulation-optimization program
- **Multi-level sensing stations** (soil moisture, temperature, salinity, and nitrate sensors) are deployed to monitor soil conditions in 1-D

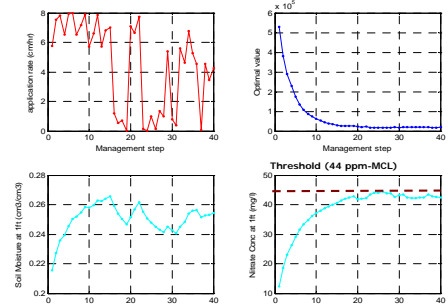
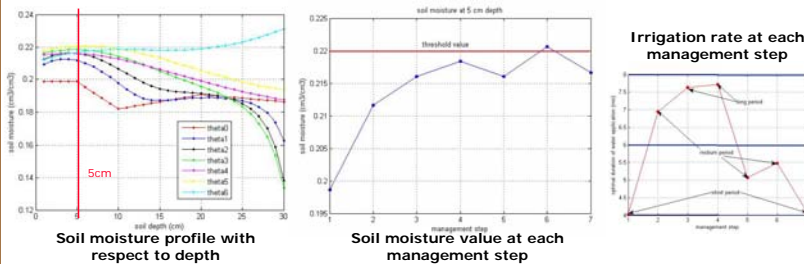
Proposed Solution: Automatic Feedback Control Scheme with Wireless Sensor Networks

Soil Moisture Control in Palmdale

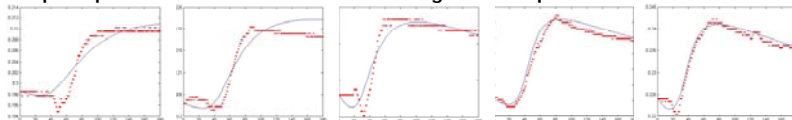
Salinity and Nitrate Control in Merced

- Soil moisture control was performed in May 2007.
- The objective of irrigation control was **to determine the application rate** such that soil moisture level at 5cm is maintained under 22% while maximizing reclaimed water usage

Salinity and nitrate in soils are controlled in Merced such that salinity and nitrate level at certain depth are maintained under threshold value while maximizing reclaimed water usage



Adaptive parameter estimation at each management step



Salinity Sensor (EC-TE)

