

PROCEEDINGS

**2007 USCID Fourth International
Conference on Irrigation and Drainage**

The Role of Irrigation and Drainage in a Sustainable Future



USCID

The U.S. society for irrigation and drainage professionals

The Role of Irrigation and Drainage in a Sustainable Future

*USCID Fourth International Conference on
Irrigation and Drainage*

Sacramento, California
October 3-6, 2007



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USCID

The Mission of the United States Committee on Irrigation and Drainage is to foster sustainable, socially acceptable and environmentally responsible irrigation, drainage and flood control systems and practices for providing food, clothing and shelter to the people of the United States and the World.

USCID is a nonprofit professional society whose members share an interest in the planning, design, construction, operation and maintenance of irrigation, drainage and flood control works; agricultural economics; water law; and environmental and social issues affecting irrigated agriculture.

USCID is the United States member of the **International Commission on Irrigation and Drainage** (ICID), an association of more than 70 countries. Founded in 1950, ICID is a non-governmental organization dedicated to the sound and responsible management of water resources. Its central purpose is to promote the development and application of the sciences and techniques of irrigation, drainage, flood control and river channel stabilization.

USCID publishes the *USCID Newsletter*, proceedings of USCID meetings and special reports; organizes and sponsors periodic technical meetings and Conferences; and distributes ICID publications.

Since 1986, USCID has organized a number of regional, national and international meetings throughout the U.S. These meetings address contemporary issues affecting irrigated agriculture, offering a multi-disciplinary evaluation of problems and solutions.

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Preface

The papers included in these Proceedings were presented during the **USCID Fourth International Conference on Irrigation and Drainage**, held October 3-6, 2007, in Sacramento, California. The Conference was held in conjunction with the 58th International Executive Council Meeting of the International Commission on Irrigation and Drainage. An accompanying book presents abstracts of each paper. The theme of the Conference was *The Role of Irrigation and Drainage in a Sustainable Future*.

Developing and managing the world's water resources has become more complex and more challenging than ever before. In addition to the fundamental need for water to support life and the environment, humans use water as an essential input in producing food and fiber and in many other productive processes. The demand for water is increasing as the world's population moves beyond six billion and as standards of living improve across Asia and in many regions. Higher incomes lead to increasing demands for goods and services that involve water in their production. In addition, we are belatedly realizing that human uses of water can degrade water quality and damage the environment. As a result, the pressure on our finite water resources is immense.

Irrigation is the principal use of water in many regions. Around the world, farmers are being challenged to produce more food with less water, while also reducing harmful impacts on the environment and sharing water with cities and industries. These goals can be achieved with improved management of irrigation and drainage systems.

USCID's Fourth International Conference provided a forum to discuss the many issues related to the role of irrigation and drainage in a sustainable future. Oral presentations were made during 15 concurrent Technical Sessions; additional papers were presented during a Poster Session.

Papers were accepted in response to a call for papers. The authors are professionals from academia; many foreign government agencies, as well as federal, state and local U.S. government agencies; water and irrigation districts; and the private sector. More than two dozen countries are represented.

USCID and the Conference Chairman express gratitude to the authors, session moderators and participants for their contributions.

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CANAL CONTROL ALTERNATIVES IN THE IRRIGATION DISTRICT 'SECTOR BXII DEL BAJO GUADALQUIVIR,' SPAIN

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ABSTRACT

Improved water management and efficient investment on the modernization of the irrigation districts in most countries are imperative to satisfy the increasing demand of water. The automation and control of their main canals is one mean to increase the efficiency and flexibility of the irrigation systems.

In 2005, we monitored one canal in the irrigation district 'Sector BXII del Bajo Guadalquivir'. This is a representative irrigation canal of the irrigation districts in Southern Spain. This canal is divided into four pools and supplies an area of 5,150 ha. We used ultrasonic sensors and pressure transducers to record water levels upstream and downstream each canal pool. With the measured data and the hydraulic model SIC (Simulation of Irrigation Canals), we evaluated two canal control alternatives (local upstream control and distant downstream control) using a Proportional-Integral (PI) control algorithm. First, we calibrated and validated SIC under steady-state conditions. Then, we calibrated the proportional and integral gains of the PI algorithm. The obtained results show that only the distant downstream controller can quickly and automatically adjust the canal dynamics to unexpected water demands, with efficiency and no spills at the canal tail, even for sudden and significant flow variations.

Keywords: irrigation canal, local upstream control, distant downstream control, PI controller, water saving.

INTRODUCTION

Irrigation is the largest water user in the World. In Spain, irrigation uses about 75% of the available water. In addition, irrigation is now competing for water with the industrial, urban, recreational, and environmental sectors. Therefore, in order to save water and to provide better water delivery services, the irrigation sector must implement intelligent management and operation of the irrigation systems.

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