

Yutthana Phankamolsil 2008: Modeling of Irrigation Water Use in Paddy Land by Object-Oriented Approach and Artificial Intelligence Techniques. Doctor of Engineering (Irrigation Engineering), Major Field: Irrigation Engineering, Department of Irrigation Engineering. Thesis Advisor: Assistant Professor Ekasit Kositsakulchai, Dipl. Docteur. 331 pages.

In this research, “jIrAIs” model, a tool for simulating irrigation water use in paddy land, was developed. Both bio-physical processes and farmer behavior were taken into consideration. The object-oriented approach (Java language) and Repast toolkit were selected as tools for model development. The model simulates water circulation in soil-water-plant-atmosphere system and tasks in irrigation water management. Surface water flow was calculated by the diffusion wave equation, while soil-water flow was described by Richards’s equation. Both equations were solved using numerical methods. Regulators in irrigation system controlled by fuzzy rules and field water management were simulated by agent-based modeling technique. For model verification, jIrAIs results were compared with those from other well-known models, i.e. GSSHA, SWAP. After that, the model was applied for evaluating water management performance in the Upper Chao Phraya Irrigation Project. The jIrAIs model demonstrated spatial variability in term of water use and cropping pattern. The simulation results showed that cropping intensity and irrigation water use in the upper part of study area were more than those in the lower part; rice had sufficient water and irrigation supply was closed to crop water requirement. In the lower part, not only risks of water shortage were observed, but excess water was also found. In conclusions, jIrAIs model can mutually simulate processes of human decision-making and of natural phenomena. However, artificial intelligence techniques are rapidly developed. Further research is still indispensable for better representation of real world.

Student’s signature

Thesis Advisor’s signature

____ / ____ / ____