Hydronomeas

A Decision Support System for the Management of Water Resources

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The Athens Water Resource System (Athens WRS)

The Decision Support System (DSS) *Hydronomeas*

Some application results
The Athens water resource system

- Evinos reservoir
- Mornos reservoir
- R. Asopos
- R. V. Kifissos
- Kopaida
- Marathon reservoir
- Lake Yliki
- R. Asopos
- Kiourka
- Menidi
- Aspropyrgos
- Perissos
- Athens

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Main characteristics of the Athens WRS

- The system supplies water for domestic and industrial use (population 4 million people)
- The hydrosystem has a mean annual inflow of 850 hm³
- Four reservoirs with a total net storage capacity of 1390 hm³
- The reservoir system is characterized by significant losses, due to leakage (lake Yliki) and spill
- Two major conveyance works, a 200 km long gravity aqueduct and a 60 km long aqueduct with pumping
- Four Water Treatment Plants (WTPs) located in the metropolitan area of Athens
Urban water demand of the metropolitan area of Athens

Water demand [hm³]


420 hm³
Questions answered by the DSS

- What is the maximum total withdrawal from the hydrosystem?
- What is the minimum failure probability (or else maximum reliability) in achieving a given set of operational goals?
- What is the minimum cost to achieve a given set of operational goals, for a given reliability level?
- What are the consequences of applying a certain scenario such as:
  - Expansion of the water supply system
  - Failure of a component (e.g. channel damage)
  - Alternative hydroclimatic scenarios
- Which are the optimal reservoir operating rules?
Basic characteristics of Hydronomeas

- Supports the management of complex, multipurpose reservoir systems
- Applies simulation of the water resource system operation and parametric optimization of operating rules
- Utilizes synthetic hydrological time series
- Provides all results in probabilistic terms
- Incorporates all natural, operational, environmental and other restrictions
Visualization of the simulation process
The theoretical potential of the Athens WRS for sustainable groundwater use

- Optimal management policy has been applied
- The reliability level was set to 99%, on an annual basis
- Synthetic inflow series of 2000 years has been used, which incorporated persistent drought periods

![Diagram showing annual water supply vs boreholes usage threshold with annotations: 495 hm³ and 22 hm³]
The expected annual energy consumption for the transportation of water to Athens

- **Current network**
  - Aqueducts: 59 GWh
  - Boreholes: 24 GWh

- **Future network (2006)**
  - Aqueducts: 24 GWh
  - Boreholes: 10 GWh

**Annually saving ~35 GWh**

- Planned network improvements reduce the energy consumption
  - Increase of the discharge capacity of gravity aqueducts
  - Reduction of aqueduct leakages
The system storage development in the next 10 years
The failure probability forecast for achieving a given target

Monthly water demand for Galatsi WTP

Failure probability

Water demand [hm³]

Galatsi WTP

Months
Graphical representation of reservoir operating rules

- Mornos
- Yliki
- Evinos
- Marathonas

Actual system storage 1259 hm³ (7/4/2003)
Motives for optimized water resources management by Hydronomeas

- Save water resources
- Save money (save energy)
- Serve (competitive) users in the best possible way (water consumption, power generation, environment preservation etc.)
- Show the limits of a hydrosystem
- Estimate the reliability of an applied management policy

More information about Hydronomeas: http://www.itia.ntua.gr/hydronomeas/