ACQUAOUNT System Dynamics Model (SDM)

A System Dynamics Model (SDM) models how water, climate, and socio-economic factors interact providing insights you can use both for on-the-fly operational choices and for shaping long-term strategy. It can faithfully recreate how the natural water-use system works, by quantifying:

- **Water demand**, **consumption** and **supply**
- The direct, measurable effects of **management rules** and **policies** on that system

In other words, the SDM gives you a virtual replica of the bio-physical system showing not only how much water is used and where it comes from, but also how different regulations or operating strategies will change those flows.

The System Dynamics Model (SDM) at the heart of ACQUAOUNT can be extended beyond simple water-in/-out accounting to explore how both climate change and socio-economic shifts will reshape water availability, demand, and policy effectiveness over time providing decision-makers with a sandbox for Integrated Water Resources Management (IWRM).

CLIMATE CHANGE SCENARIOS

- Variable Precipitation Patterns: By feeding the SDM with downscaled climate projections (e.g. wetter winters, drier summers), you can simulate how reservoir levels, aquifer recharge and surface-water flows respond under multiple greenhouse-gas trajectories (RCPs).
- Extreme Events Stress-Testing: The model can impose sequences of droughts or intense storms to assess system resilience: Will existing storage and irrigation rules hold up under a once-in-fifty-year drought? Under back-to-back dry years?

SOCIO-ECONOMIC DYNAMICS

- Population and Land-Use Change: As rural populations grow or shrink, and as cropping patterns shift (e.g. from cereals to high-value orchards), the SDM tracks evolving seasonal water demands, helping planners anticipate where new conveyance or storage infrastructure will be needed.
- Economic Growth & Pricing Policies: By linking water tariffs, subsidies or restrictions within the model's policy-module, you can see how farmers' choices (e.g. switching to drip irrigation, planting drought-tolerant varieties) propagate through regional water balances and even local employment figures.

INTEGRATED WATER RESOURCES MANAGEMENT (IWRM) INSIGHTS

This project is part of the PRIMA Programme supported by the European Union Grant agreement n°: [2021] [ACQUAOUNT] [Call 2020 Section Water IA]

- Trade-off Analysis: The SDM allows you to overlay social objectives (e.g. maximizing rural income, ensuring environmental flow requirements) onto physical water-balance outcomes, quantifying the compromises between agricultural productivity, ecosystem health, and urban supply.
- Adaptive Policy Testing: New management rules—such as dynamic allocation based on reservoir storage thresholds, or seasonal restrictions triggered by groundwater levels—can be "turned on" in the model to observe their consequences before committing them in the real world.

By combining these modules, the ACQUAOUNT SDM becomes a powerful "what-if" engine: you can project 2050 and 2100 water stress under both high-emissions and low-emissions pathways, gauge how a 10% tariff increase might curb irrigation withdrawals, or test whether a proposed canal expansion remains viable if summer rainfall drops by 20%. This holistic, quantitative perspective is exactly what IWRM requires to craft robust, forward-looking water strategies in an uncertain future.

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