Geophysical Research Abstracts
Vol. 17, EGU2015-15712, 2015
EGU General Assembly 2015

(Why) do we need optimal management of water systems?

Luciano Raso (1) and Peter-Jules van Overloop (2)
(1) IRSTEA, Montpellier, France, (2) Delft University of Technology, Delft, The Netherlands

Controlling water systems, such as a reservoir or a canal, is about designing its operational rules. Design of water system operation rules follows, traditionally, two approaches: optimization and simulation. In simulation, the analyst tests and selects rules by what-if analysis based on effects of model simulations on different objectives indicators. In optimization, the analyst selects operational objective indicators, finding operation rules as an output. Simulation is less complex and it can offer sufficiently good results. Why do we want to use advanced optimization methods, then? In this presentation I will present three stories from the research literature showing why optimal control methods for water systems are worth the (research) effort. These applications demonstrate that optimization is able to find solutions that simulation based design generally overlook.

The first story shows how optimization methods are used to overcome a political impasse. The Maggiore Lake, at the border between Italy and Switzerland, is a controlled lake used as irrigation reservoir, but this poses a risk of flood. Discussions on what action to take ended up in a deadlock. Shifting the debate from positions to a debate on interests can open up opportunities, enhancing the possibilities to find an agreement.

The second story shows how optimization methods can produce (apparently) counter-intuitive rules that would be hard to find by simulation. Ijmuiden Canal, in The Netherlands, is controlled in order to keep a constant water level. A real time control technique application allowed saving a large amount of energy, maintaining the same level of safety in the canal.

The third story shows the importance of selecting the right objective function. Manantali, on the Senegal River, is a reservoir used for energy production. Manantali reduces water availability for flood recession agriculture, which was the traditional water use on this river. While release rules obtained by simulation try to reduce spillage, rules from optimization try to maximize energy production directly. This results in an optimal release policy that increases both energy and water for flood recession agriculture.