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Model Hosting for continuous updating and transparent Water Resources Management

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Numerical models have become a standard tool for water resources management. They are required for water volume bookkeeping and help in decision making. Nevertheless, numerical models are complex and they can be used only by highly qualified technicians, which are often far from the decision makers. Moreover, they need to be maintained. That is, they require updating of their state, by assimilation of measurements, natural and anthropic actions (e.g., pumping and weather data), and model parameters. Worst, their very complexity implies that are they viewed as obscure and far, which hinders transparency and governance.

We propose internet model hosting as an alternative to overcome these limitations. The basic idea is to keep the model hosted in the cloud. The model is updated as new data (measurements and external forcing) becomes available, which ensures continuous maintenance, with a minimal human cost (only required to address modelling problems). Internet access facilitates model use not only by modellers, but also by people responsible for data gathering and by water managers. As a result, the model becomes an institutional tool shared by water agencies to help them not only in decision making for sustainable management of water resources, but also in generating a common discussion platform. By promoting intra-agency sharing, the model becomes the common official position of the agency, which facilitates commitment in their adopted decisions regarding water management. Moreover, by facilitating access to stakeholders and the general public, the state of the aquifer and the impacts of alternative decisions become transparent.

We have developed a tool (GAC, Global Aquifer Control) to address the above requirements. The application has been developed using Cloud Computing technologies, which facilitates the above operations. That is, GAC automatically updates the numerical models with the new available measurements, and then simulates numerous management options as required. To this end the application generates as many computing virtual machines as needed, customizing their size (CPU, memory...) accounting for all the particular requirements of every numerical model.

Results are presented from a quantitative point of view (i.e. groundwater as a resource), and also from a qualitative perspective (i.e. the use of solute concentrations in groundwater as an environmental vector). In both cases detailed mass balances time series are obtained which can be used jointly with all the input and output model data to solve water conflicts between the different actors using and/or affecting the groundwater of the aquifer.