Using WaterSim For Education: A Work in Progress

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Introduction

The Decision Center for a Desert City (DCDC) developed WaterSim, a computer simulation model of water consumption and availability in central Arizona, to communicate complex interrelationships among water, climate, and urban growth. Initially WaterSim was presented in ASU's Decision Theater to facilitate discussions among city water managers about the consequences of different growth rates, climate conditions, and policy choices on future water availability.

WaterSim's display consists of input controls to test what-if scenarios and output graphs to report simulation results. The simulation spans the years 2006 through 2030.
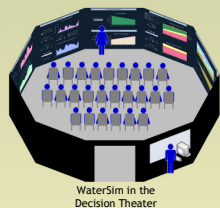
WaterSim in the Decision Theater provides an immersive presentation environment: five screens spanning an arc of 186° permit the simultaneous display of simulation controls and output graphs.

It requires
• dedicated time in the $500 per hour Theater,
• a presenter,
• a computer operator, and
• a limit of 25 guests.

WaterSim in the Decision Theater

Evolution to the Internet

In order to increase WaterSim's reach, DCDC created a user-friendly Web interface (http://watersim.asu.edu) for educators and the general public. This version uses the same simulation, the same input controls, and the same output graphs as WaterSim in the Theater; they are just presented on multiple web pages and formatted to fit on different sizes of computer screen.

It requires
• an Internet connection.

This greatly simplified set of requirements permits WaterSim on the Web to be used at any time and from any place in the world. Since the Web presentation does not require a presenter, additional effort was made to make the Web interface self-explanatory.

WaterSim is a resource for classrooms or conference rooms

WaterSim is a resource for workgroups

WaterSim is a resource for individuals

WaterSim on the Web was announced on August 12, 2007 in the Arizona Republic newspaper. It has also been presented to educators for grades K-12 and higher, e.g., at DCDC's Advanced Water and Climate Education Workshop July 31 to August 1, 2007.

THE ARIZONA REPUBLIC

Choosing a future for Arizona

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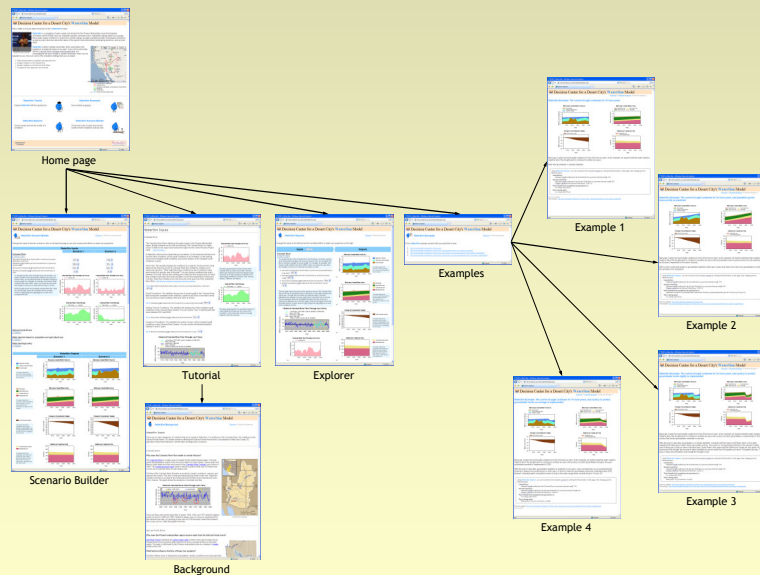
Components of WaterSim on the Web

From its introductory home page, guests can take four paths for exploring WaterSim:

WaterSim Scenario Builder is like having two WaterSim Explorers side-by-side. Each scenario can be created independently and the results of the two simulations are displayed next to one another.

WaterSim Tutorial teaches a guest how to interact with the model. Each feature is described with links to definitions and maps. A guest can experiment with the model using pre-defined conditions located in several drop-down boxes, as well as learn more about the inputs and the issues involved. Additional information about the science behind the simulation is provided by the WaterSim Background page.

WaterSim Explorer is the model in action—a guest can jump right in and see results. Pre-defined conditions are located in drop-down boxes within each input section of the model. A guest can select a variety of alternate conditions and immediately view the results.

WaterSim Examples provides a set of four example WaterSim scenarios. Each scenario includes instructions for reproducing the scenario in WaterSim Explorer.

Home page

Scenario Builder

Tutorial

Explorer

Background

Examples

Example 1

Example 2

Example 3

Example 4

WaterSim Can Reach a Worldwide Audience

The nature of the design of the WaterSim on the Web permits its translation to other languages. For example, http://watersim.asu.edu/Chinese provides a Chinese-language version of WaterSim on the Web.

WaterSim Tutorial page from the Chinese- language version of WaterSim on the Web

Usage Patterns for WaterSim on the Web

Usage statistics collected from August 12, 2007, to the end of 2007 show that, while guests primarily come from the Phoenix Metropolitan Area, they also visit the website from throughout the world. WaterSim on the Web continues to collect these statistics.
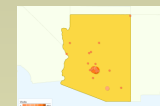
1,167 visits came from 24 cities in Arizona
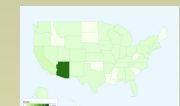
1,487 visits came from 41 states of the United States

1,566 visits came from 25 countries/territories

These usage statistics also show the pages that guests visit and where they spend the most time. For example, the contour maps below show that the Background page is visited infrequently, but visitors to that page tend to spend significant time on the page. Scenario Builder is both one of the most-visited pages as well as one where guests tend to spend time. The Examples were surprisingly underutilized both from a count of visits as well as from time spent reading them.
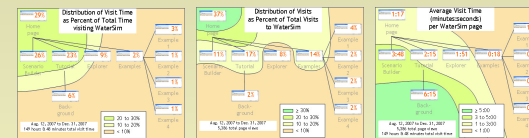
Support for Education Research

Another set of usage statistics, collected from December 11, 2007, onwards, shows the simulation options that guests set during their visit and the time that elapses between guest actions. These statistics are collected for the benefit of future research into website visitor behavior patterns.
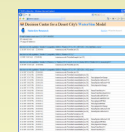
WaterSim usage page showing the pages that guests have visited and the simulation options that they have set

Future Directions

WaterSim on the Web is currently used in the introductory Natural Sciences class NATS 101 (Environmental Science) at the University of Arizona. WaterSim is used to model water availability under different conditions. Anecdotal results from this class report that, while students were successful using WaterSim, they had trouble getting started.

From the usage statistics described above, one can see that guests are spending time on the explanatory Tutorial page, although they appear to not be using the Examples pages. Future directions for WaterSim include efforts to make the displays—both in the Theater and on the Web—more intuitive.
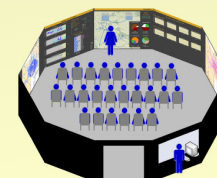
Potential new interface for WaterSim in the Decision Theater

Acknowledgments