WaterStrategyMan
EVK1-CT-2001-00098

MANUAL OF THE INTEGRATED DECISION SUPPORT SYSTEM

Chapter Two

Water Availability Scenarios

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Chapter 2 – Water Availability Scenarios

This chapter presents the graphical user interface of the availability module of the WSM DSS. The time series output of the module concern natural recharge for renewable groundwater and surface runoff for reservoirs and river reaches. They can be computed in two ways, according to real observations at existing monitoring stations or through the estimation of a water balance based upon monthly meteorological data and the soil characteristic of the region. The first approach, *Discharge Scenarios*, is based on historical observations and implies the definition of Average (Normal) Years of discharge and recharge. Scenarios are formulated through the creation of customized new years which have a monthly positive or negative rate with respect to the normal one. The second algorithm starts from the generation of rainfall, temperature and evapotranspiration scenarios and performs a water balance at watershed level for each sub-basin identified by the river reach nodes of the Water Management Scheme.

The interface windows of the two approaches are loaded from the same menu, the *Water Availability*, accessible from the *Create Scenario* menu of a Water management Scheme, in the Navigation Panel.

The *Discharge Scenarios* interface includes a tree view with the menus for Water Year Definitions and Sequence, and a second window showing the relevant data according to the selected node.

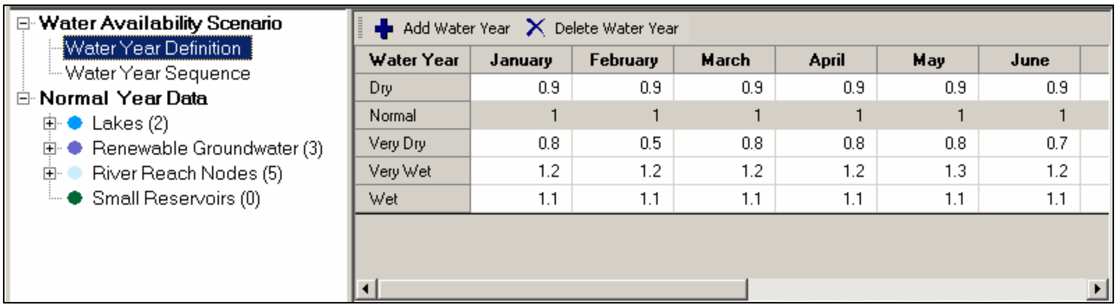

Figure 1. Defining Water Years based on Average (Normal) years)

The Water Year Definition menu loads a table where new water years can be defined by editing the monthly rates with respect to the normal year. A coefficient of 0.9 for the January-Wet means that all the values of river discharge and natural groundwater recharge are supposed to be at the 90% of the historical measured data that characterize the first month of the normal year.

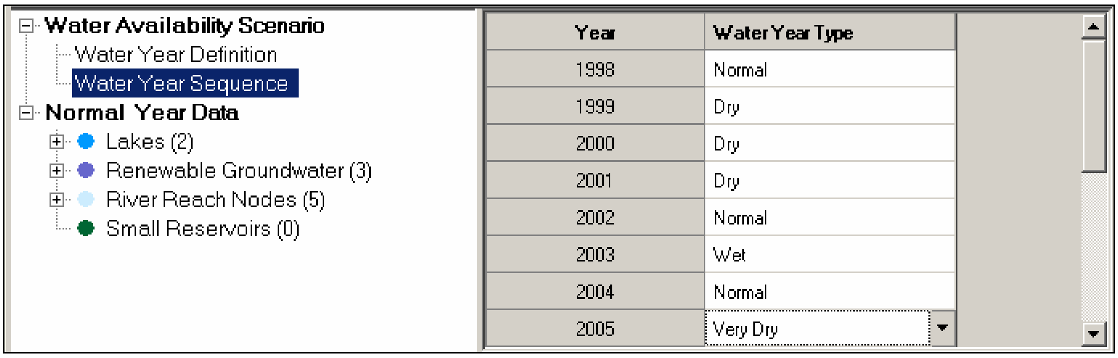

Figure 2. Building the Availability Scenario

Once the user has generated the types of water years that best approximate the possible regional conditions of water availability, for instance dry, very dry or wet conditions, he can build up the sequence of water years, which represents the availability scenario, by choosing the type of water year for each simulation year through dedicated drop down buttons.

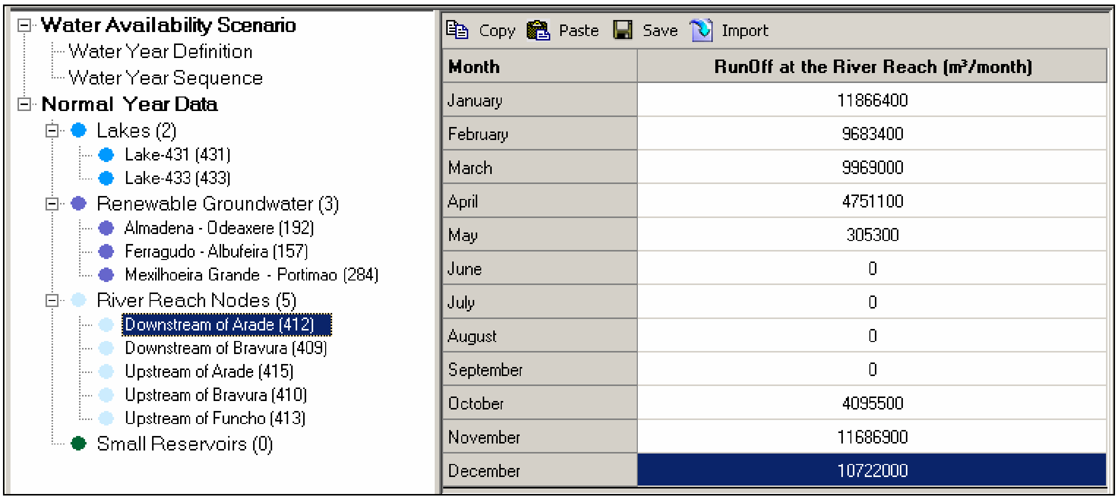

Figure 3. Entering Normal Year Data for river reaches

The historical Normal year data can be imported from text files in the table of the GUI for each lake, renewable groundwater, small reservoir and river reach node of the water supply system. On the opposite, if some imported data have been modified by hand, the node-related table can be copied or saved as a text file.

The graphical interface of the approach based on climatic and soil data, includes a map window and a number of menus guiding and assisting the user in the generation of Weather Scenarios first and in the water balance then.

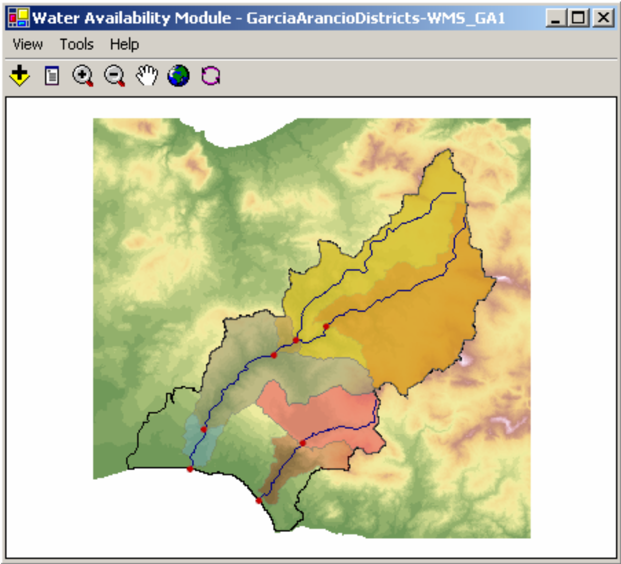

Figure 4. The sub-basins generated by the pro-processor of the availability module using climatic data

The module has a pre-processor, running in the interface loading phase, which reads the river water bodies and the cross sections in the region, located by the river reach nodes. Then the module generates the maps of the corresponding upstream sub-basins based on the information of the Digital Elevation Model. Then it makes also statistics on the input climatic raster maps and aggregates these data to the watershed level. The opening view of the module shows the generated river basins over the DEM (Figure 20).

The data maps involved in the statistics are: twelve monthly maps of rainfall, temperature and reference evapotranspiration (ET_o), which represent the Average Years, maps of the soil moisture capacity, hydraulic conductivity and land use. They can be loaded and visualized from the *View* menu.

Based on the average years of climatic data, aggregated at watershed level, the user is prompted to build the weather scenarios. First of all, he can use the average year or define a new year, Base Year, by increasing or decreasing the monthly average values. In this latter case, he can create dry, very dry or wet years as he does for the discharge scenarios. This operation is carried out in the Base Year Window. Then a dedicated wizard, formed by a few windows, allows him to build the sequence of years one by one, or to assign a yearly or monthly trend to the customized starting Base Year, or to repeat it as it is for the entire duration of the scenario. The windows of the wizard that are responsible for that are the *Custom Sequence* and the *Trend Definition* (Figures 21 and 22)

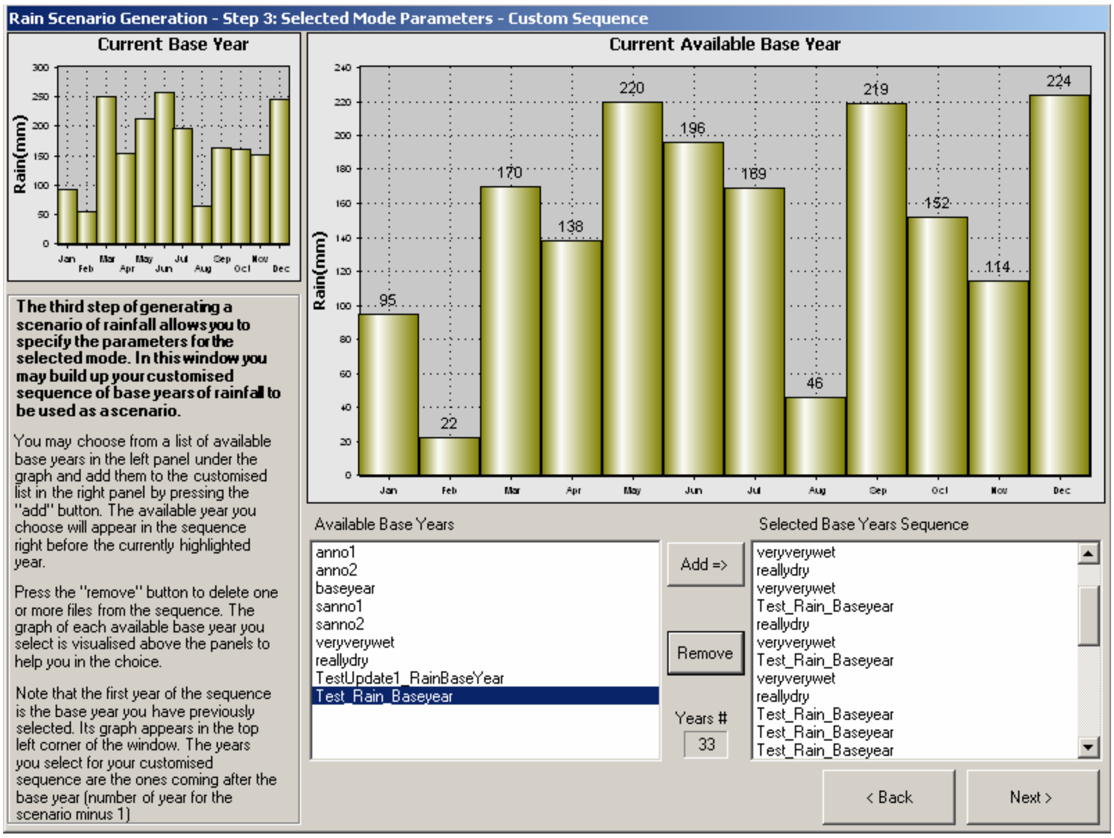

Figure 5. Displaying available base years to be selected and added to the scenario sequence

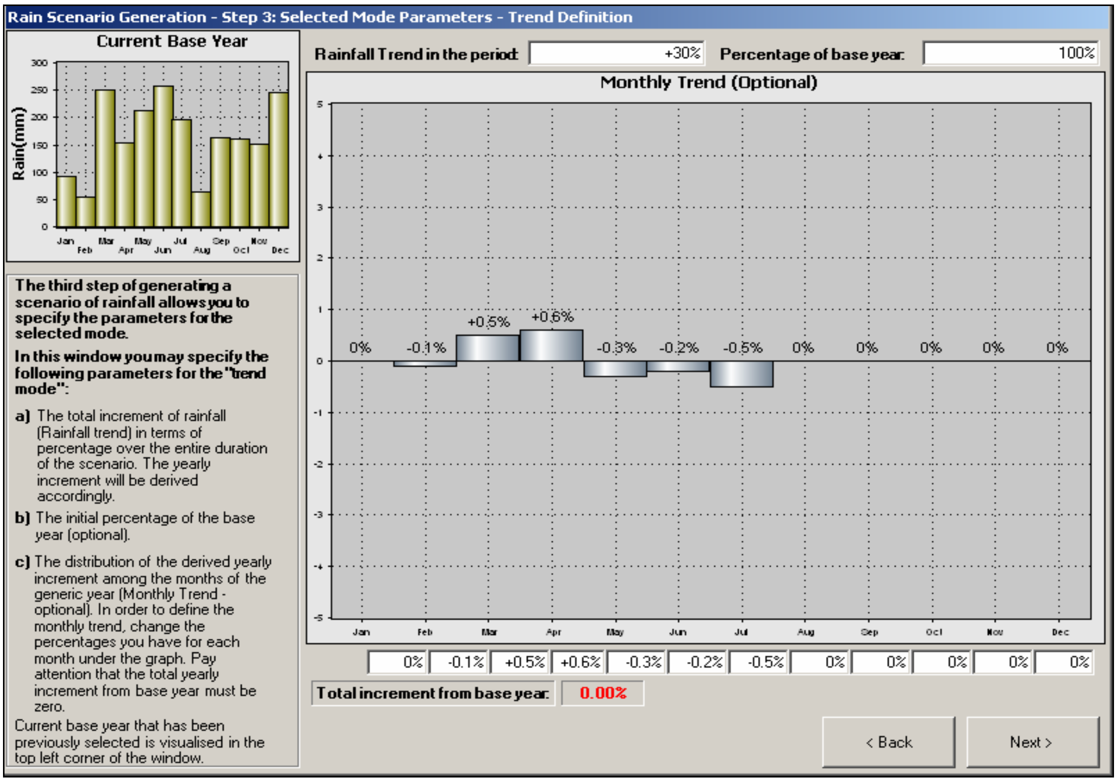

Figure 6. The Trend Definition window of the wizard for rain scenario generation

After the rainfall and ET_o scenarios have been generated, they are read by the water balance routine and time series of discharge are computed for each cross section in the river water body. Time series of natural recharge for the aquifers are produced as well.

The window that presents the resulting water availability scenarios that will be used by the allocation module of the DSS comprises of:

1) a drop-down menu where the type of network element can be chosen, either a lake, a river reach or an aquifer;
2) a list of available elements of the type selected by the user;
3) the chart where the corresponding discharge or recharge time series are plotted.

The interface menus of the availability module are the *View* and the *Tools*. The *Tools* menu includes the sub-menus for creating the weather scenarios and for running the water balance, whereas the *View* loads the maps and the base years or scenarios that have already been produced and are available for the water balance.

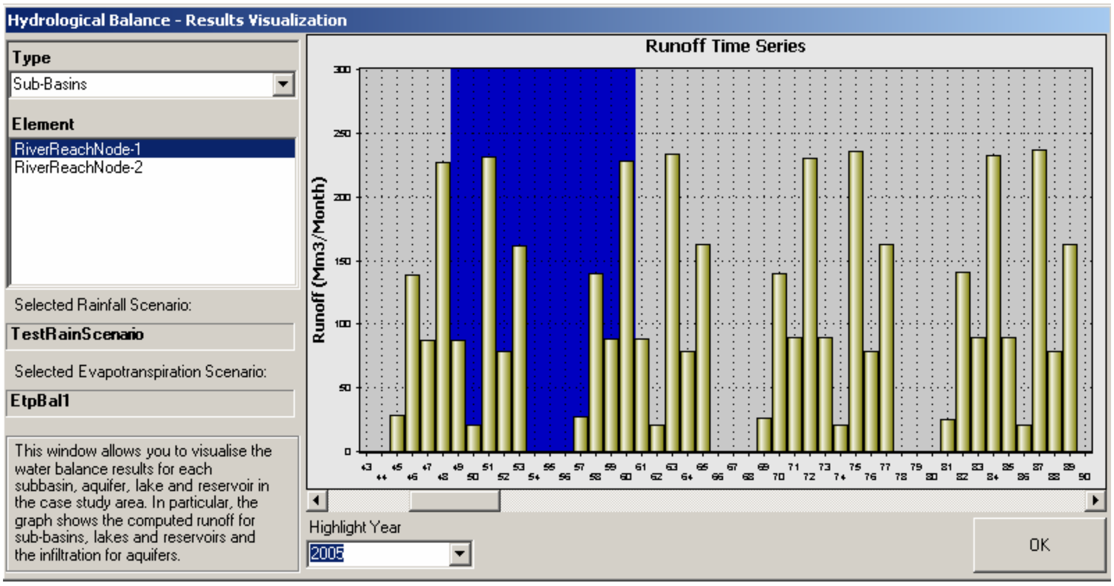

Figure 7. Displaying Results for river reaches