# DIAGNOSTIC AND MONITORING TOOLS

As a complement to the visualization and analysis tools, some of Sahara's tools provide the possibility to generate charts and reports previously designed, allowing a specific diagnosis on certain subjects more quickly.

Diagnostic tools contribute to a fast and efficient decision making, and help observe the characteristics that identify each of the wells and their condition within a group.

In addition, the Meeting tool helps to review the actions associated with each well, enabling the user to see its status, responsible person, comments and specific characteristics for each well.
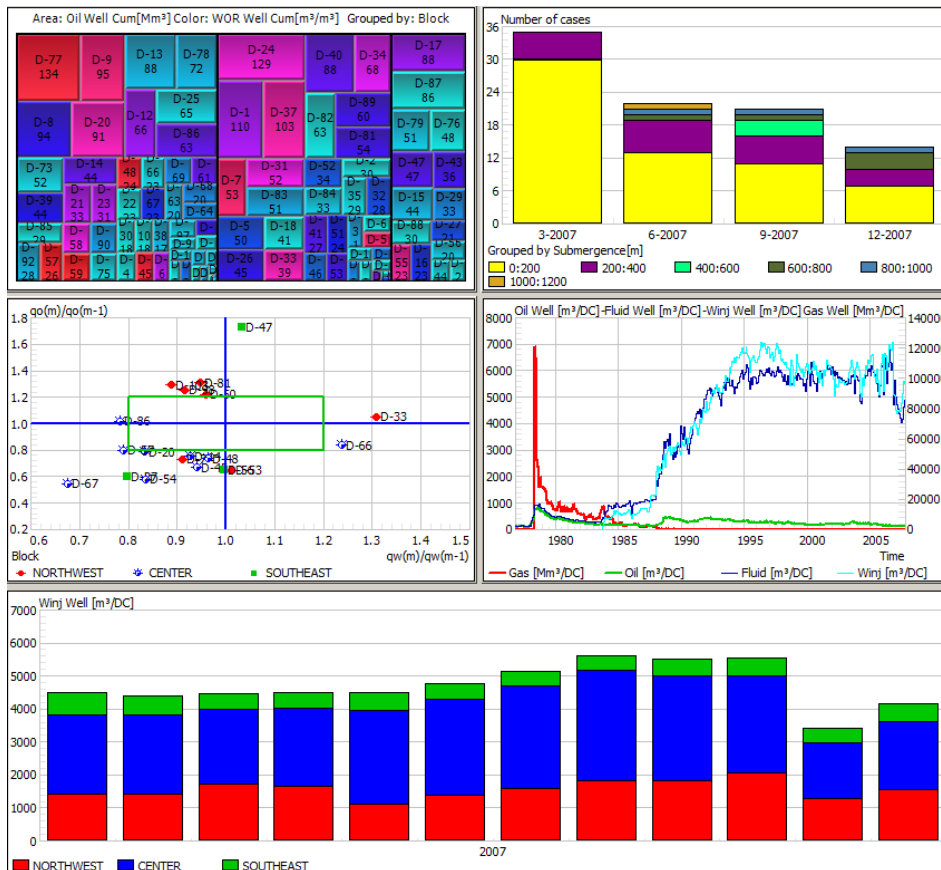

Using all the tools offered by Sahara, a daily workflow can be designed, with the purpose of finding frequent problems and improvement areas to optimize the operation and production of each project.

By means of the Production Loss tool, the user can quickly make comparisons of production variables using different analysis frequencies. The comparison can be made with variables of monthly productions or daily productions. A particular function within this tool is that it is allowed to select one or more groups of wells to make the comparison and then, when selecting each of them the user can visualize the values for the wells in the selected group. In the case of using monthly productions, the analysis can be done by comparing one or more variables on two different dates or comparing each of them in two different production scenarios.
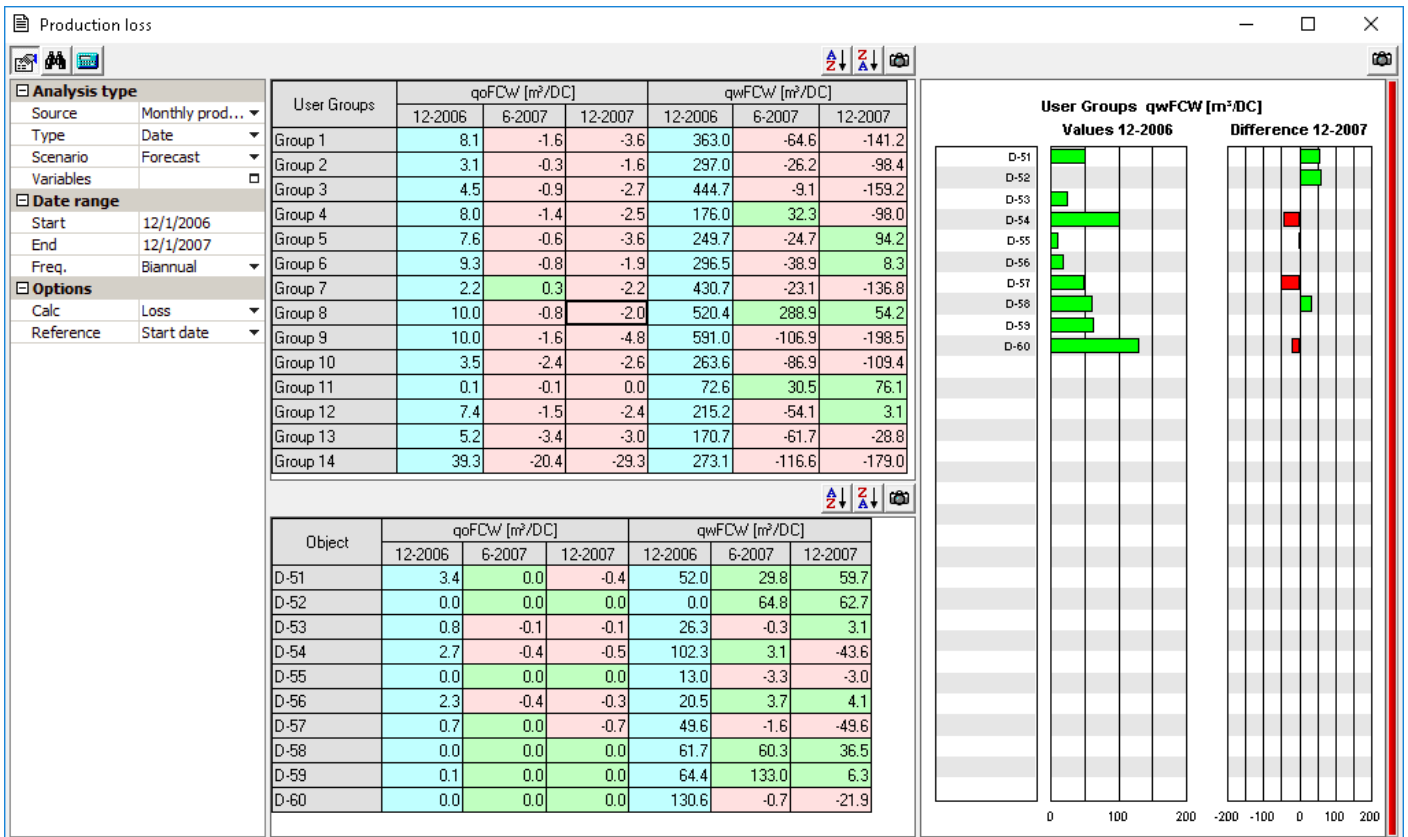
Production Loss. The image shows a production and injection loss analysis with monthly production data for groups of wells generated according to the block they belong to and its drilling campaign.
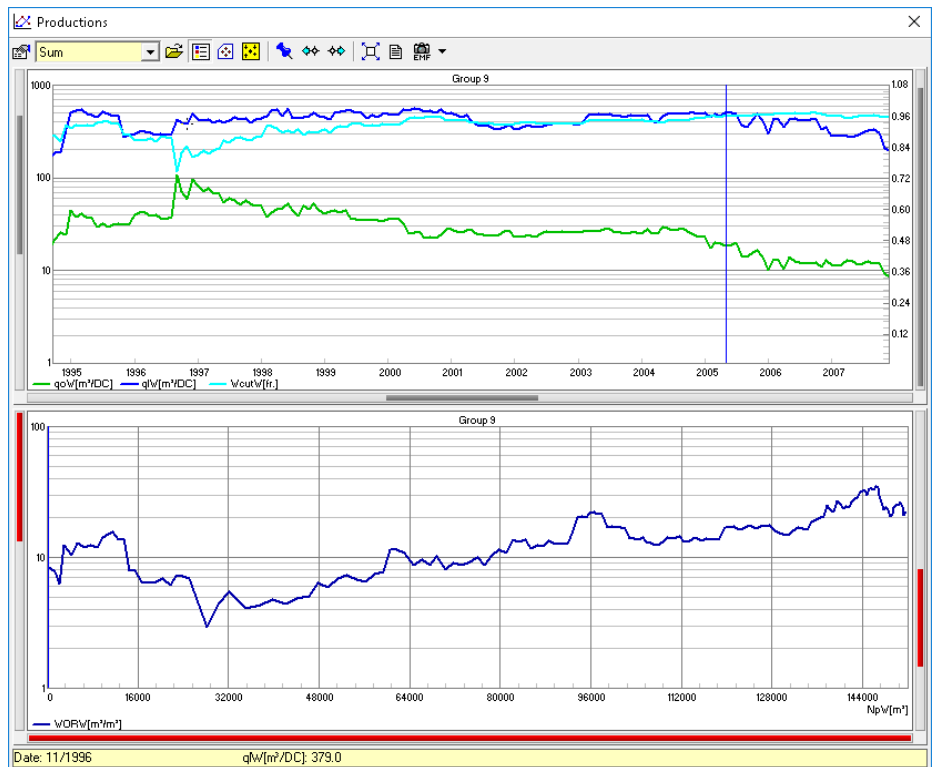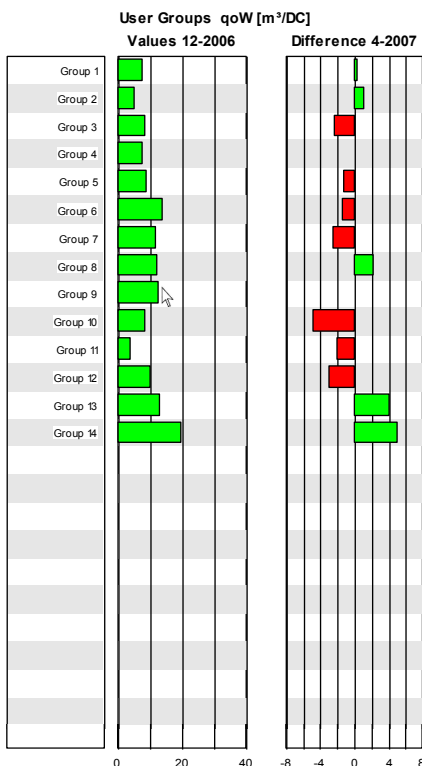
Connecting Production Loss and Productions Window. When a group or well is selected in the Production Loss tool, in the tables or the charts, the Production window will display the associated configured curves.
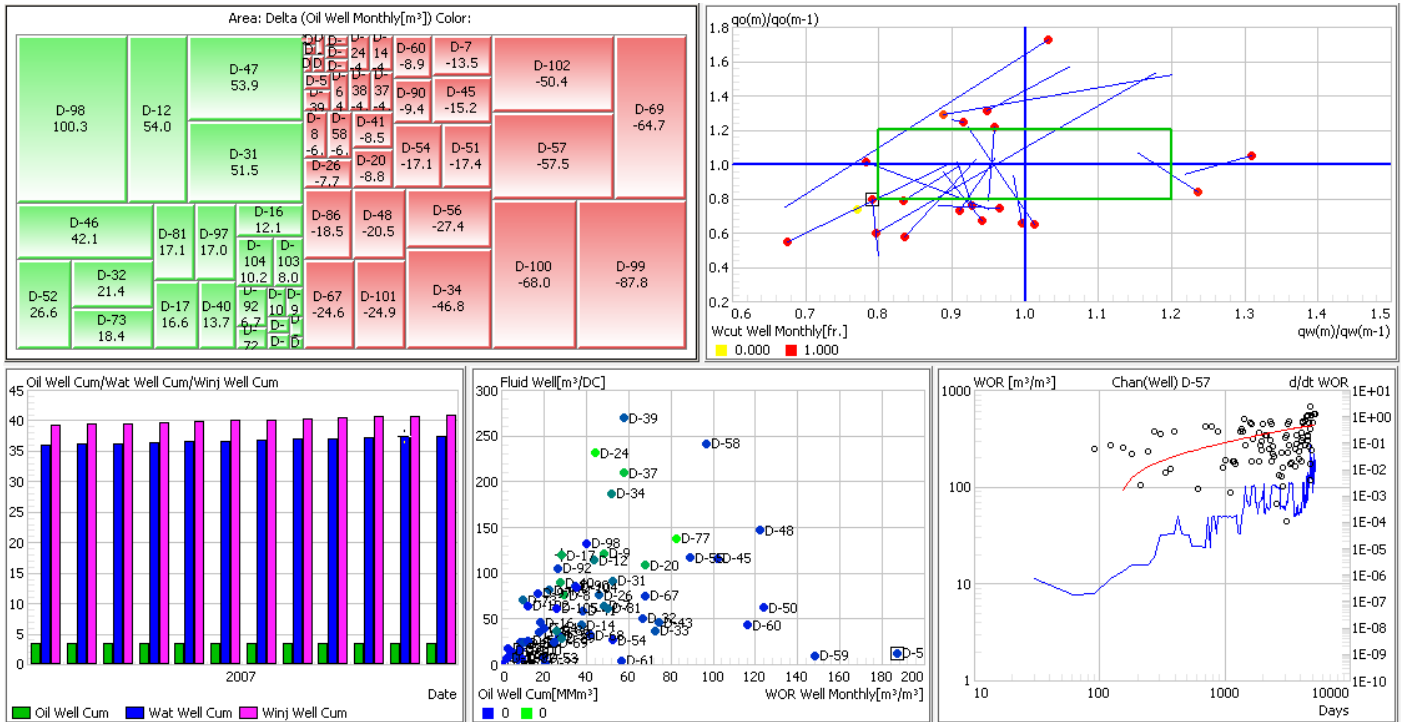
Control Panel. The window displays a template in which charts of different types have been configured.

The Control Panel allows the user to display a large amount of information in different tables and charts in an organized and functional way. Each of the charts admits a customized configuration and, in addition, they interact with each other and with other windows within Sahara. When a well or group of wells is selected in any of the charts, they are highlighted in the other configured charts, and their location in the map and their production curves are shown in the corresponding windows. There is an extensive group of various available charts grouped into different categories. The General category includes the following:
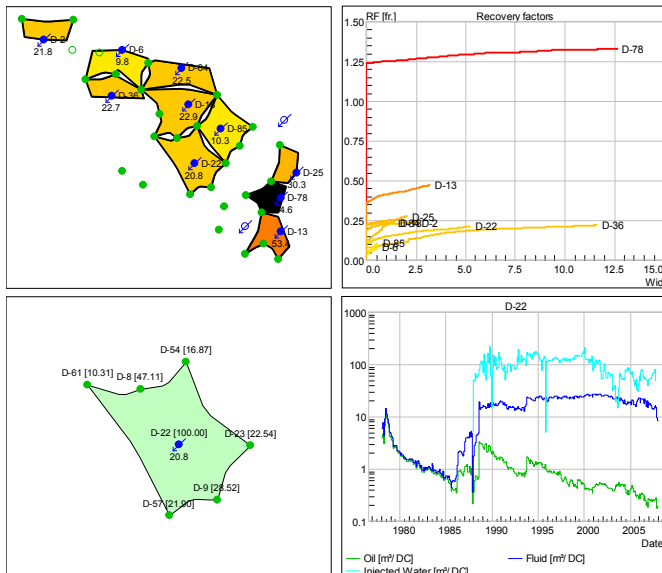
• **X-Y Charts**: Any monthly production variable can be plotted according to another variable. In addition, the color of each point can be represented with a different color depending on the value of a third variable.

• **Time-Variable**: Any monthly production variable can be plotted on a time basis.

• **Well-Variable**: Any variable of monthly productions, production controls, interventions or test results can be plotted as a bar graph.

• **ABC**: It is an X-Y special chart that is used to compare temporal variations of two different production variables. There are two particular cases in which oil flow is compared with water flow for monthly productions or production controls.

• **Histogram**: It shows the number of wells within each interval taking into account the selected scale and variable. An additional option groups together the wells using some attribute or variable.

• **Hall**: This chart shows the injection pressure multiplied by the cumulative production during the effective time in terms of the injected volume. The value of the chart curve is an indicator of the well injectivity.

• **Historic**: It allows the user to create charts similar to those available in the Production window.

• **TreeMap**: Using boxes of different sizes, it is possible to visualize a hierarchy of wells depending on the selected variable. There is the possibility of using a second variable to color the boxes.

• **Chan:** Water-oil ratio or gas-oil ratio and its derivative over time are compared, both in logarithmic scale alongside with a three-degree polynomial fit for the derivative. By observing the behavior of the derivative, it is possible to evaluate the sweeping efficiency and identify possible channelization.

• **Bars**: Any variable of monthly productions can be plotted showing its evolution over time.

The additional chart categories available are: Fractures, Stimulations, Tests, Production Downtime and Normalized Wells. Within each of these categories there are charts similar to those within the general category, configured specifically to perform analysis on the particular topics that give name to each category.

The Pattern Analysis tool was designed for studying recovery factors, with the additional purpose of performing validations of the production per layer distribution and of the pore volume and original oil in situ maps. Specifically for the secondary recovery, there are charts according to the cumulative injection in pore volume, as well as several production and injection charts, in relation to time or cumulative productions. The analysis is made using patterns within which the calculations are performed. The patterns can be created manually or based on the flow elements designed for the calculation of the secondary recovery simulator. Each of the patterns will have an associated pore volume and a volume of original oil in situ. Also, the production and injection of the wells involved will be distributed using factors per pattern. These factors can be assigned manually or calculated using one of the three available methods: geometric (takes into account angles), weighted by original oil in situ or weighted by pore volume.

The Well Monitoring module allows the entry and monitoring of the actions that are defined for each of the wells in the production meetings. During a monitoring meeting, actions taken on the wells can be followed up, using filtering tools and locating the wells on the map with different flags or according to the status of the actions associated to them. The selection of a well in the Monitoring window will activate the zoom in the Map window, to locate its position, and the selection of the well in all the display windows that are open, whether Productions, Wellworks and/or Logs.
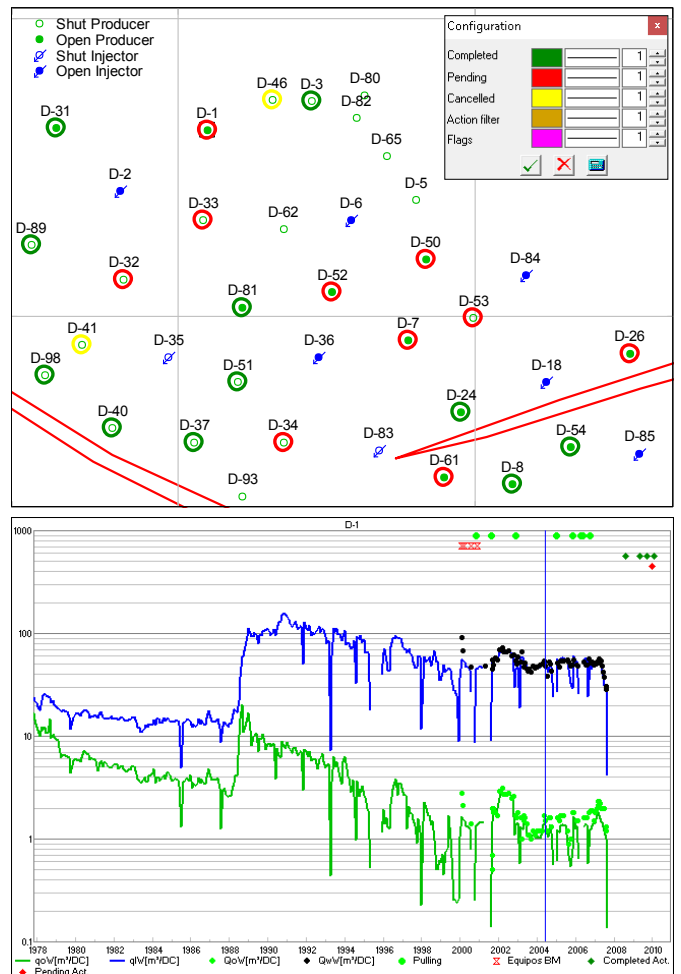

Pattern Analysis. Main charts of the Pattern Analysis window, showing the patterns involved in the analysis, in color according to the recovery factors, a chart of the factors based on the cumulative injected water, the production distribution factors in the pattern selected and the production associated with it.
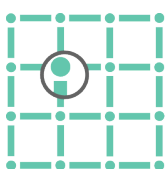

Pattern Report. Within the window there are multiple reports to assess the results of the analysis. In this case, a summary of the patterns in a particular layer is displayed where the values of the parameters associated to each of them are reported.

Map, Productions and Meeting. The Meeting window, with the actions associated with a particular well, is shown next to the Map window that displays the attributes of each well, and the Productions window that informs about its historical production curves.