# HYDROGNOMON: A HYDROLOGICAL DATA MANAGEMENT AND PROCESSING SOFTWARE TOOL

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**Session HS29: *Hydrological modelling software demonstration***

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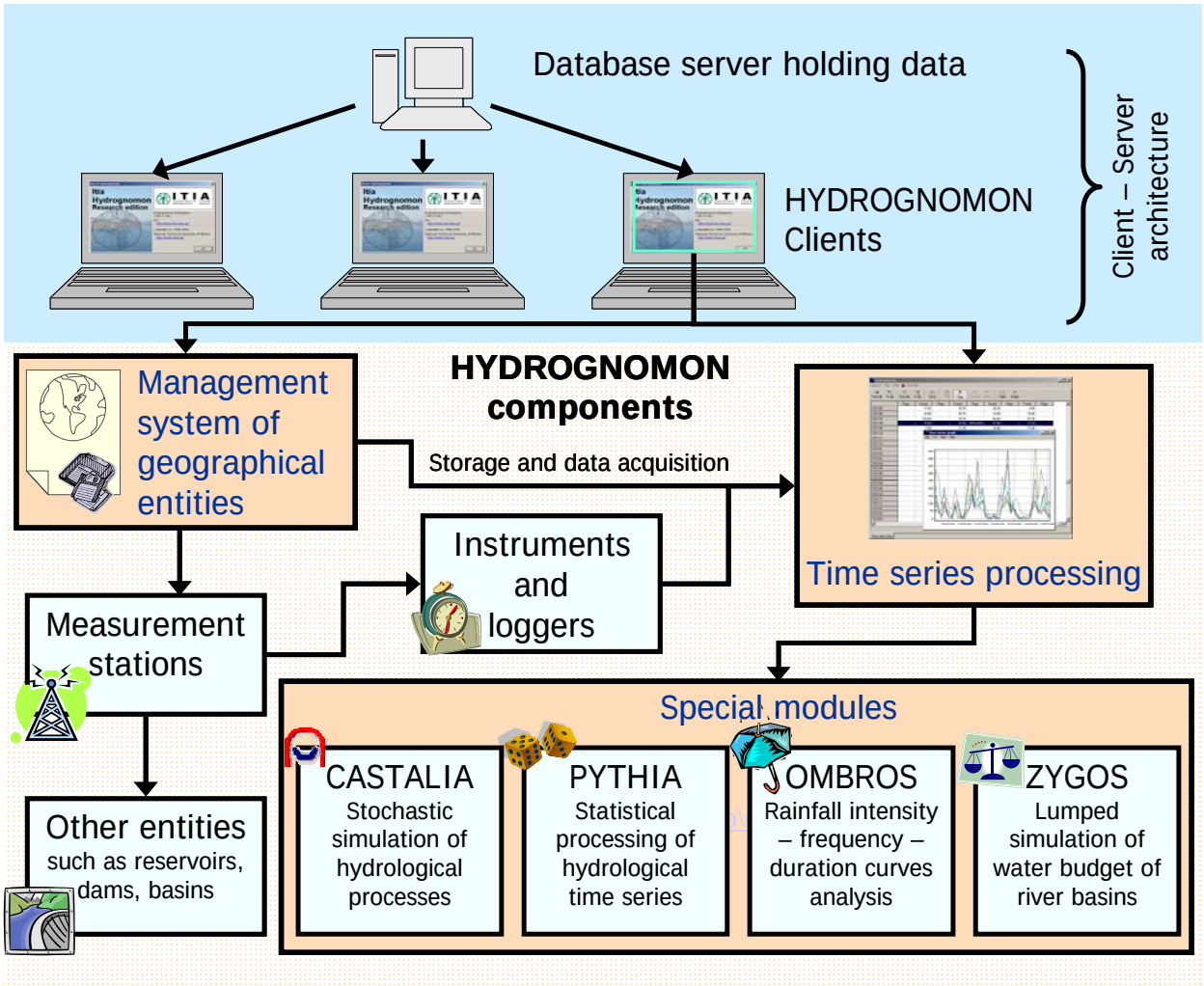
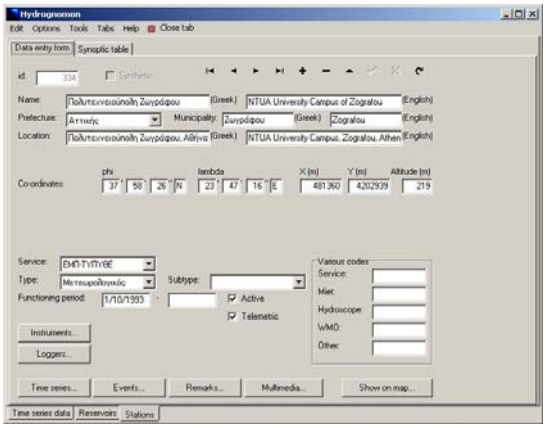
## 1. Introduction

HYDROGNOMON is a software tool for the management and analysis of hydrological data. It is built on a standard Windows platform based on client-server architecture; a database server is holding hydrological data whereas several workstations are executing HYDROGNOMON, sharing common data. Data retrieval, processing and visualisation are supported by a multilingual Graphical User Interface.

## 2. Program structure

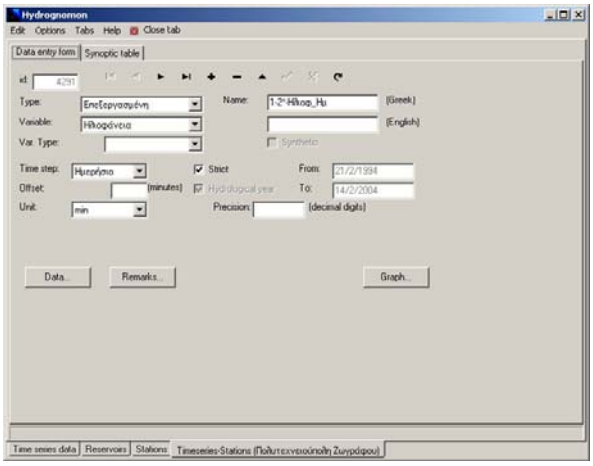


## 3. Geographical entities



User interface based on single window application. Several entities (e.g., basins, reservoirs, aqueducts, monitoring stations) are organised in Tabs.

Special properties are stored and displayed for each entity, such as station type for measurement stations.

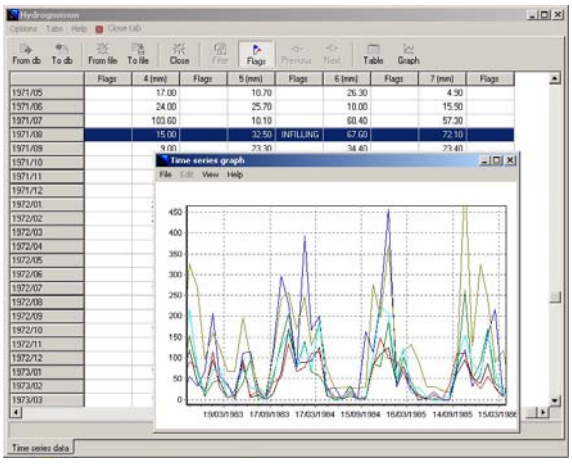


Entities system helps the organisation of time series.

Several attributes are assigned to time series such as time-step, variable type, measurement unit, etc.

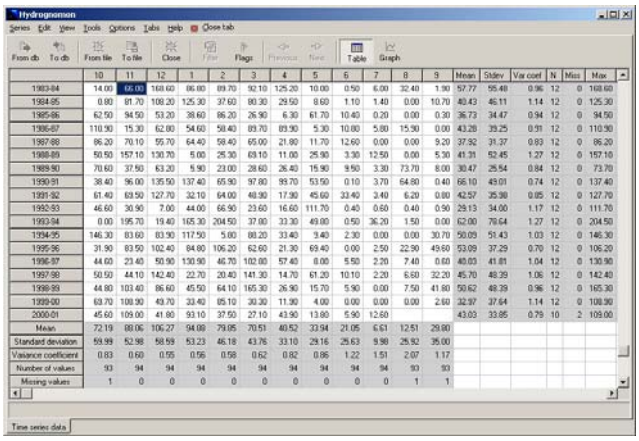
Synoptic tables are included to browse into entities or time series records.

## 4. Time series data



Time series records are displayed on data grids as sets of timestamps, values and flags, or on graphical views.

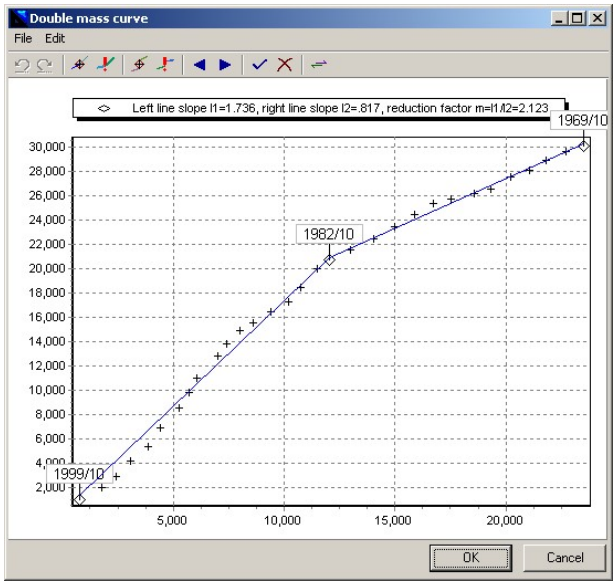
Time series grids help operation with multiple time series and data exchange between HYDROGNOMON and other applications, such as spreadsheets.



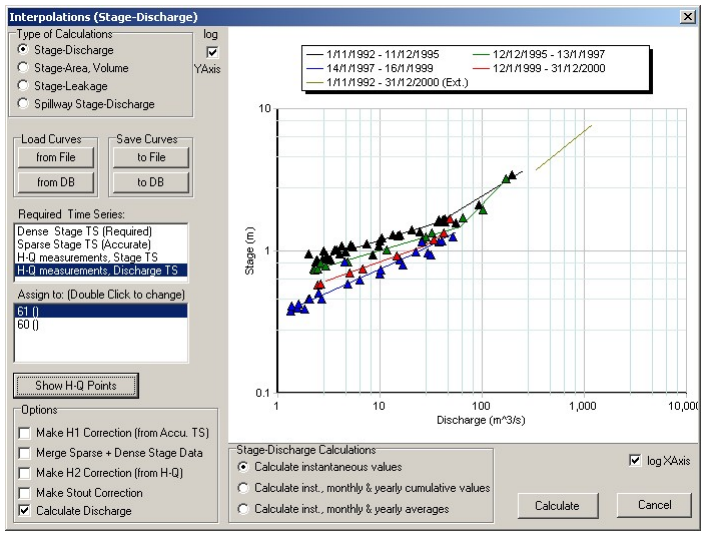
Data representation is extended with tabularisation, data filtering and highlighting capabilities.

Time series processing system may work independently of the database system by using ASCII files for storage.

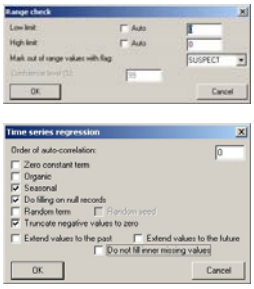
# 5. Hydrological data analysis

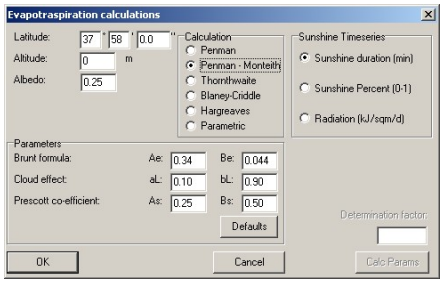


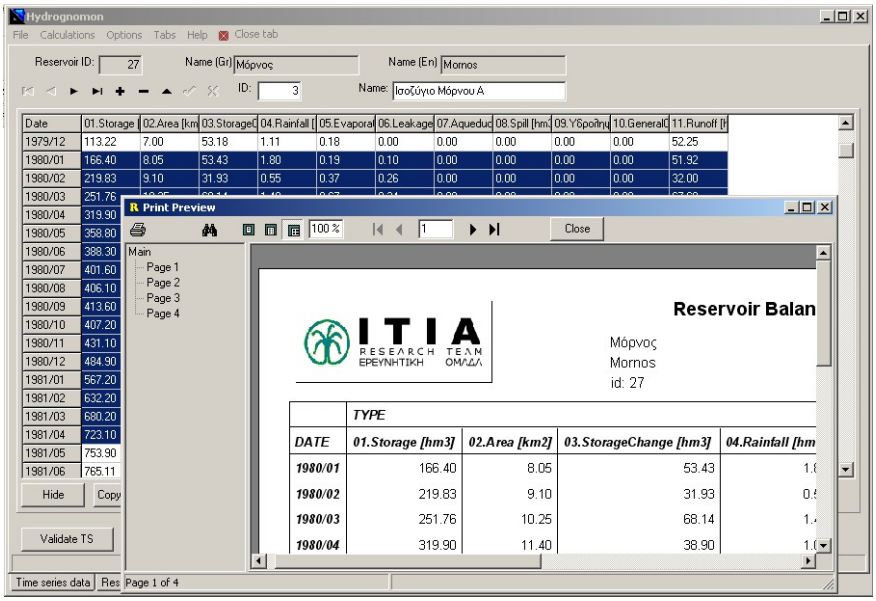

*Homogeneity analysis by the double mass curve method*




*Stage-discharge curves*



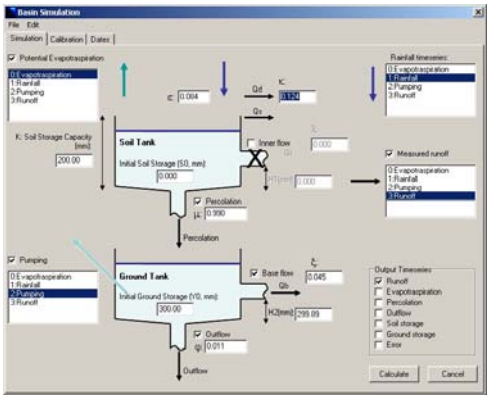




*Hydrological balance of reservoirs, with reporting capabilities*

Hydrological data analysis includes the majority of typical hydrological manipulations, such as:

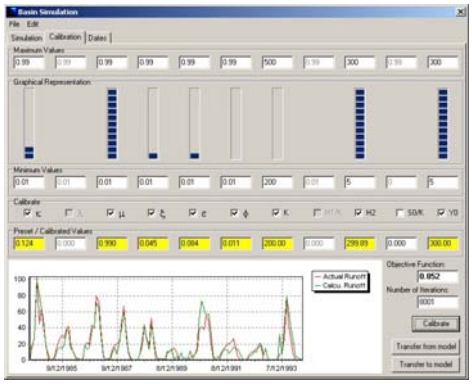
- Range and time consistency tests
- Homogeneity test
- Time step regularisation
- Time series integration and aggregation
- Stage-discharge calculations and other interpolations
- Evapotranspiration modelling
- Time series regression and infilling of missing values
- Time series combinations
- Hydrological balance

## 6. ZYGOS: Lumped water balance model



ZYGOS models the main hydrological processes of a watershed, using a lumped approach. It implements a conceptual soil moisture accounting scheme, based on a generalisation of the standard Thornthwaite model, extended with a groundwater tank.

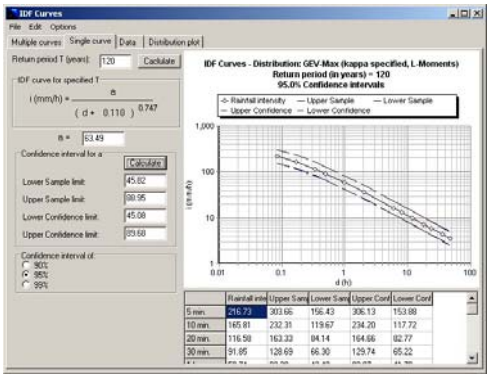
A visual representation of modelling components helps the implementation of different configurations.

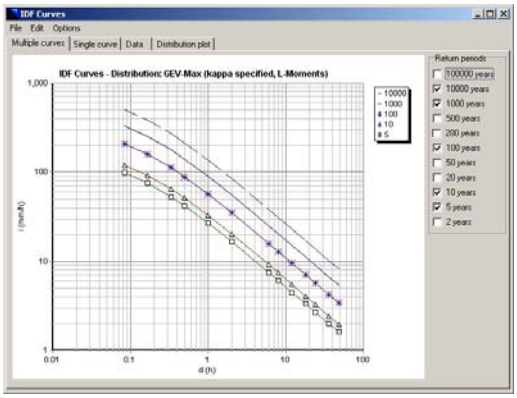


A global optimisation procedure, implementing the evolutionary annealing-simplex algorithm, is included for the automatic estimation of model parameters.

The user interface allows to determine the parameter bounds. Also, it provides graphical tools for monitoring the progress made during optimisation and assessing the model fitting.

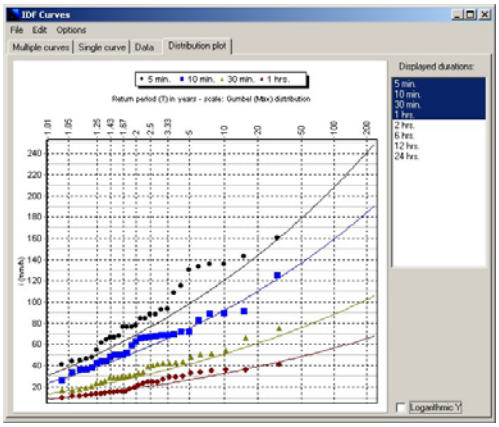
## 7. OMBROS: Intensity – duration – frequency analysis





The construction of rainfall intensity – duration – frequency curves is achieved through an original methodology, which allows a unified expression of rainfall intensity using a single equation, in terms of time scale (duration) and return period.

A set of probability distribution functions is offered to describe the intensity values including Exponential, Gamma, Log-Pearson III, Gumbel-Max, GEV-Max and Pareto distributions. A Monte-Carlo simulation procedure allows the estimation of confidence intervals for the curves.



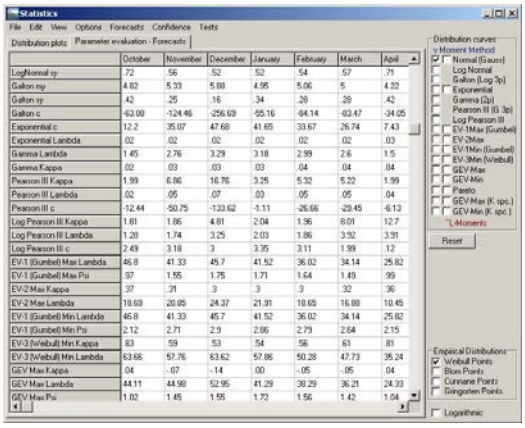
The results are displayed in graphical format (IDF curves, distribution functions), as well as in tabular format, with data exchange capabilities with other software.

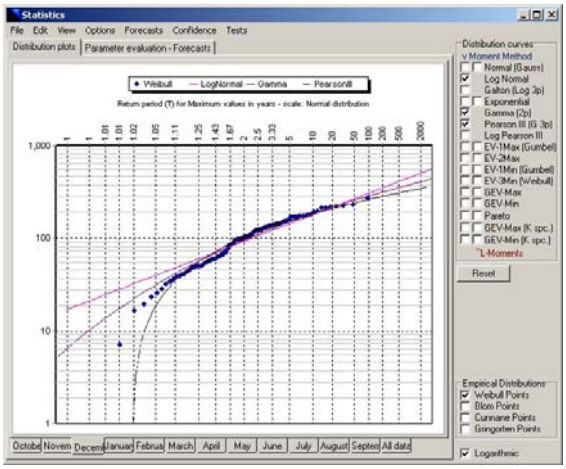
The input to the models, i.e. annual time series of extreme rainfalls, either may imported into HYDROGNOMON manually or calculated directly from time series of fine time-step.

## 8. PYTHIA: Statistical analysis of hydrological time series

PYTHIA is an advanced statistical analysis tool for time series. Some characteristic features are:

- Calculation of sample statistics
- Parameter estimation of 16 distribution functions, including Normal, Gamma and EV families, using the moment or the L-moment methods
- Visualisation of results and export to spreadsheets and word processors
- Statistical prediction
- Estimation of confidence intervals though Monte Carlo simulation
- Hypothesis testing




## 9. CASTALIA: Stochastic simulation of hydrological processes

CASTALIA provides advanced stochastic analysis tools, for the generation of synthetic hydrological time series. Some specific features are:

- Multivariate analysis, for many processes and locations
- Multiple time scales, in a disaggregation framework
- Generalised generating scheme for any covariance structure
- Preservation of essential marginal statistics up to third order (skewness) and joint second order statistics (auto- and cross-correlations)
- Reproduction of long-tem persistence (Hurst phenomenon) and periodicity
- Operation in either steady-state simulation or forecast mode