

IRENE: A Software to Test Model Performance



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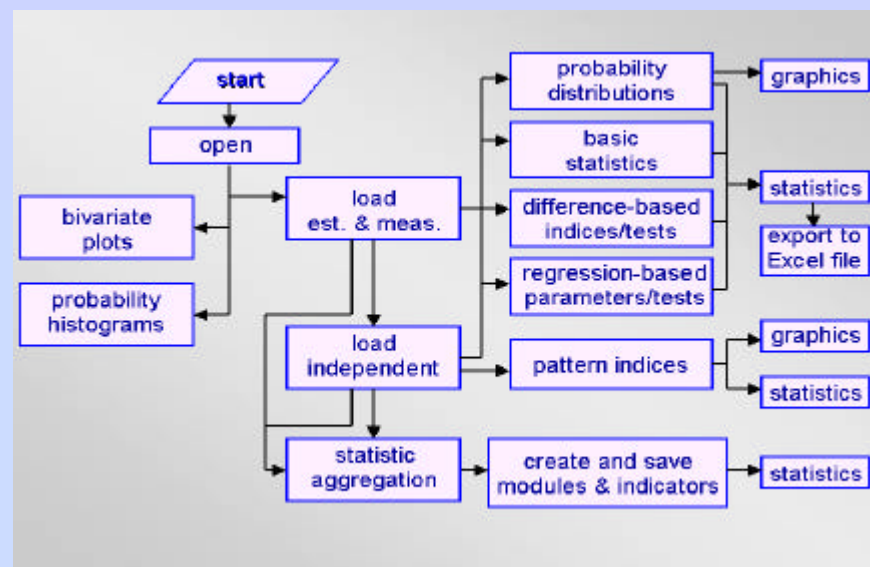
Introduction

Comparison between the model outputs and the measurements is a basic activity to test the model accuracy in simulating systems by process-based models, and may guide through further model improvements. A model that does not fit the measured data in a proper way does not provide good answers to the scientific issues under investigation. Several statistical indices were developed for variously quantifying how well the model outputs fit the measurements. Evaluation indices and test statistics are usually classified in two main categories, i.e. difference-based and correlation-based statistics. More recently, indices were proposed to quantify systematic behaviours of residuals against independent variables (PI: pattern indices). Attempts to aggregate more statistics in one synthetic indicator were also made.

IRENE (Integrated Resources for Evaluating Numerical Estimates) is a user-friendly program that allows comparing estimates (E_i) against measurements (M_i) by a variety of statistics and graphical utilities.

Work Environment

IRENE includes a rich set of tools all housed in a single, integrated environment. After starting the program, the basic working components appear. Additional components are activated according to data loaded.



Software Description

The program allows computing both statistics based on model residuals and on the correlation-regression analysis. Residual-based statistics are grouped in simple, absolute and squared indices. Regression parameters are calculated according to two methods: least squares (LS), reduced major axis (RMA).

The software allows analysing four types of comparison between model outputs and measurements:

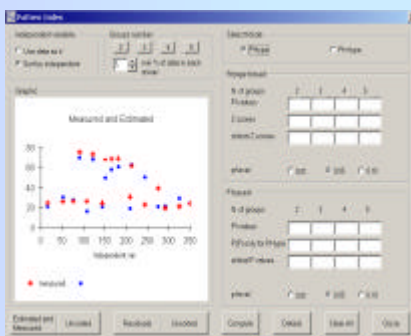
- One-to-One: unique model outputs against unique measurements;
- One-to-Many (Many-to-One): unique model outputs against replicated measurements;
- Many-to-Many: replicated model outputs against replicated measurements.

Significance limits are computed and statistical tests are performed when replicates are available.

Utilities provide the computation of pattern indices, and the aggregation of indices of different type according to fuzzy rules.

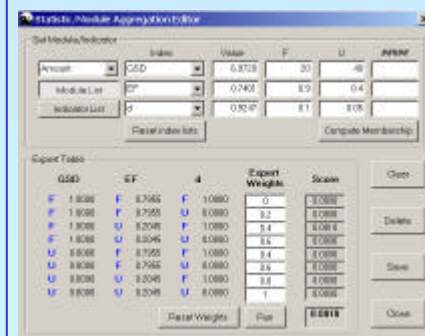
IRENE reads MS Excel files. The outputs are displayed into spreadsheets and may be saved and exported in MS Excel workbooks.

Pattern Analysis

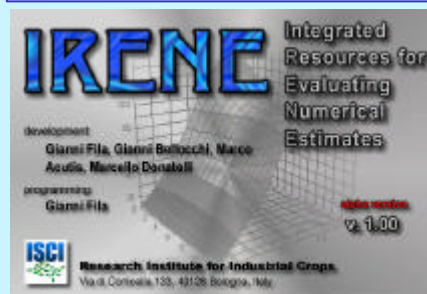


Pattern indices are computed by dividing the range of the X-variable in 2, 3, 4, and 5 sub-ranges. Two types of PI may be used: 1) range-based: the absolute value of the maximum difference between pairwise comparisons among average residuals of each group; 2) F-based: the F-ratio of the variance between groups over the within groups variance. Both types may be computed either given fixed sub-ranges (PI-type: PI, PI-F), or varying sub-ranges according to an optimisation exhaustive algorithm (PI-type: PI_i, PI-F_i) with the constraint of a minimum number of data (5%, 10%, 15%, 20%) in each sub-range.

Statistic Aggregation



Statistic aggregation is based on fuzzy logic. A hierarchical structure is used to aggregate statistics into first-level indicators (modules) and, next, into a second-level indicator.



IRENE is freely downloadable from: <http://www.isci.it/tools>
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