

GID APPLICATIONS TO FIELD DATA ANALYSIS

Silvina G. Serra^{1,2}

¹*Aula CIMNE-FICH. – Facultad de Ingeniería y Ciencias Hídricas. Universidad Nacional del Litoral, cc 217, Ruta Nacional 168, km472.4, 3000 Santa Fe, Argentina*

²*Water and Environmental Studies Group
Engineering and Water Resources Department (FICH)
Universidad Nacional del Litoral, cc 217, Ruta Nacional 168, km472.4, 3000 Santa Fe, Argentina*

SUMMARY: Several agronomical, hydrological, sedimentology, and other engineering problems require, previously to the numeric simulation, a field data explanation such as, for example, topography features, physical parameters, spatial and time distributions, in order to determine ranges of values of calibration parameters. This data establishes dominions with irregular geometries and require spatial interpolation methods to shape a mesh homogeneous and easy to interpret. This work presents a GID application with the purpose of showing morphological changes experienced at experimental trenches dig on the Paraná River bed, Argentina. The NURBS “line” and “surface” commands transform points data in topological surfaces. The use of “layers” allows to define the different trench’s steps within each period and by creating ‘.flavia.res’ files with altitude information, it is possible to visualize with “Countour Fills” and “Countour Lines” commands, details of the topography. The different time step visualization exported to image file format allows to make animation files.

KEYWORDS: field data, topography, irregular geometries, experimental trenches, visualization.

INTRODUCTION

Numerical simulation of hydrological processes like overland and overflow flux in rural and urban catchments, open channels or pipeline networks propagation rate discharges, sediment transport mechanics, underground flows, between others, needs a hard work of transformation of the land’s lift data and satellital images into mathematical parameters of the model to be solved. These parameters can vary according to the spatial distribution, and, at the time to assign values at the finite elements or finite differences mesh for the real system geometry division, it should have a different magnitude at each node.

Actually, the work of transforming the field data to dimensional or non dimensional parameters with or without physical meaning, within a range of values characteristic of each system stat, mostly takes much time and dedication than the required by numerical simulation process. On other hand, the plots and simulation of visualization of variables from physical parameters

distributed at the system to be simulated, make it possible to obtain previous conclusions of the simulations that can even change the initial hypothesis, as far as disqualify the problem formulation.

Through this work we intended to facilitate utilization of the GID software to prepare the field data to the definition of physical parameters to feed a mathematical model, making the magnitude estimation on each node of the mesh utilized for the simulation.

The first implementation chosen, as the first trial of this methodology, was the evolution analysis of an experimental trench dig on the Paraná River bed, in Argentina. The bed elevation assignment at each mesh nodes establish the initial condition of the bed evolution simulation, made with an hydrodynamic model altogether with the sediment transport and conservation equations.

DATA SOURCE

The Paraná river, born in the south of Brazil, and going on through Argentina with an average water discharge of $16.000 \text{ m}^3/\text{s}$ per year, until the boundary between Argentina and Uruguay, builds a natural laboratory within which occur most of the hydrosedimentologic phenomenon which analysis concern to the majority of the mechanic fluvial scientists, who do not have yet solve the fundamental questions of this science (ASCE, Task Committee, 2002).

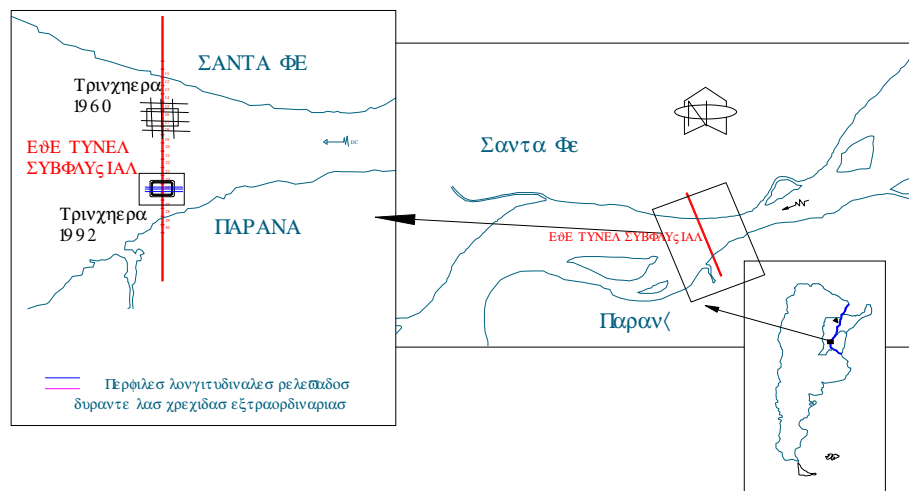


Fig. 1: Field data location.

The Paraná River generates the interest of several sciences, from economic sciences since it is the most important Mercosur route, to the engineering sciences due to its important expanse buildings. The Aguas Corrientes section, that separates the provinces of Santa Fe and Entre Ríos (Fig. 1), has been deeply analyzed from the inter-provincial sub fluvial tunnel building since 1960. This section has suffered very important extraordinary floods that endangered its stability. Over this section, and specifically over the tunnel axis have been made measurements and experiments to know the bed load transport (Amsler and Schreider, 1992). Classical methodology to measure bed load discharge turns less reliable and of very difficult application because of the depth of this section of between 15 and 20 meters and a velocity of over one meter per second. Instead of it, there are two other methodologies feasible to apply. One is the indirect method of tracing dunes and the other is the direct method of tracing evolution of experimental trenches.

This work presents an analysis of the bed topography evolution, of two experimental trenches dug over the river bed at the height of the sub fluvial tunnel axis. The obtained field data lets estimates the bed load sediment transport, which is a very important parameter of the hydrosedimentology model to be implemented, and the bed initial state of the simulation.

It has been found information from two trenches dug over de tunnel axis, one made in 1960, from which it have been obtained longitudinal and cross profiles, and the other dug in 1992 , from which, longitudinal profiles were obtained through the utilization of acoustic sound. All the information was scanned, scaled, digitalized and transformed to text format files, that make it easier to process.

METHODOLOGY

The obtained data consist in x, y, and z coordinates points acquired on different times (4 for the 1960's trench and 9 for the 1992's trench) was transformed in two GID format files. To the geometry definition, points of the digitalized profiles have been entered with CAD files. The profiles were drawn with the NURBS line GID pre process command. The bed surfaces were created with the NURBS surface GID command (Figs. 2 y 3).

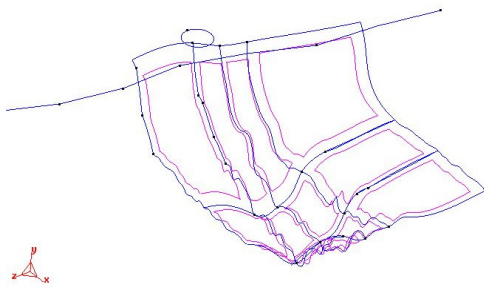


Fig. 2: Geometry definition.

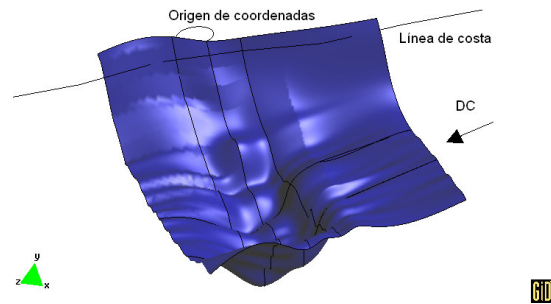


Fig. 3: Renderized geometry.

For each time measurement surface, it was defined one LAYER named with the date of the topographical lift. See all the surfaces for each LAYER in Fig. 4. In order to separate the surfaces in the posprocess, it was necessary to assign a different material to each surface.

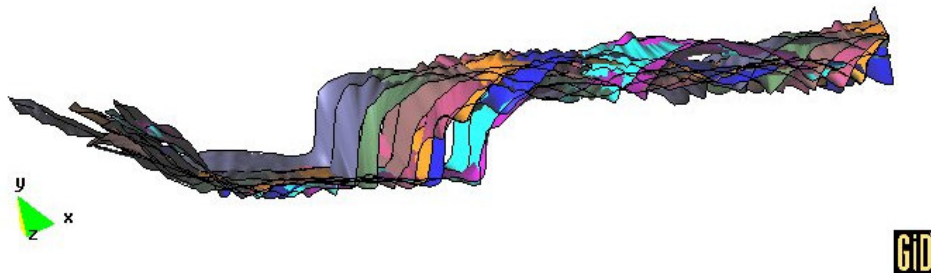


Fig. 4: 1992 year trench: Surfaces made with the field data lift, each one related to a LAYER date name.

A finite element mesh was generated with the GID meshed. From the mesh was taken the z coordinates values, that was "copy" inside an ". flavia.res" GID posprocess file, showing the z coordinate like a result variable. It was named "bed elevation".

RESULTS

With the data ready, the GID posprocess software makes it possible to visualize details of the bed topography with the “contour fill” command, being this procedure very useful for the user, who can separate the surfaces in each measurement time step to the bed evolution animations makeup (Fig. 5).

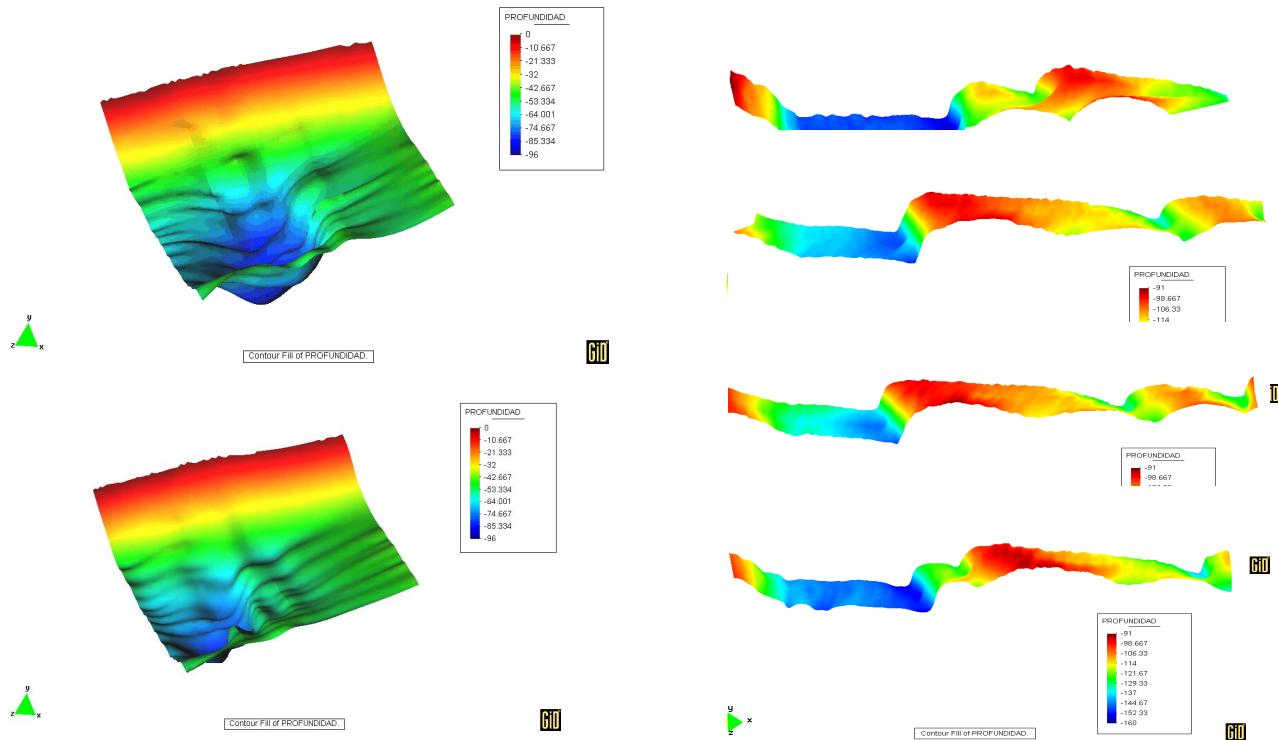


Fig. 5: Different time steps of the result process

CONCLUTIONS

The presented methodology let conclude that at the time to make natural phenomenology simulations in which geometries are irregular and parameters have very important variations in the extension of this geometry, GID have the tools to make physics analysis and assign the value of the parameters at each node mesh.

REFERENCES

1. Amsler M., Schreider M., Prendes H., Huespe J. and Zanardi L., “Diseño del sobreancho del área de dragado para la obra de protección del Túnel Subfluvial”. *Comisión Administradora Ente Túnel Subfluvial Hernandarias. Informe Final*. F.I.C.H., U.N.L. Argentina, 1992.
2. ASCE Task Committee on Flow and Transport over Dunes, “Forum: Flow and Transport over Dunes”, *Journal of Hydraulic Engineering*, 128, 2002, pp. 726-728.