Master USTH
TP
Manage data with ArcGIS

T. Libourel   M.-A. Laporte   S. Andrés

2012-2013

Introduction

In this TP, you will deepen your practice of ArcGIS *approaching closer to the data and processes. To do this, you will work on a case study simplified risk assessment of flooding in the town of Saint Loup Cammas (Haute-Garonne - France).*

$$R = A \times E$$

Risk R is the multiplication of a hazard A by an issue E .

The hazard (or event, or process) is defined by its intensity (how ?), Its spatial extent (where) and time (when ?, How long ?).

The challenge or issue (or vulnerability) is linked to human presence : people, property, economic activity and infrastructure. The definition of vulnerability depends on the considered hazard.

A given hazard, regardless of its intensity, produces a zero risk in the absence of challenge. Conversely, constant hazard, the greater the challenge, the greater the risk.

Corine Land Cover *is a classification of land. The data layer available from the Department of French Ecology (`http: // www. statistiques. developpement-durable. gouv. fr/ donnees-ligne/ t/ telechargement-donees. html`).*

1 Data preparation

1.1 Reprojection in Lambert RGF 93

Open *ArcCatalog*. Create a link to repertory *TP_ARCGIS*.

You will work on the data contained in the `SaintLoupCammas`. You can open with *ArcMap* shapefiles located in different directories. Six shapefiles are associated with geographic coordinate system RGF 1993 and projected in map

coordinates RGF 93 Lambert 93. Other two depend on geographic coordinate system NTF and projected in NTF Lambert III map coordinates. You can view this information by right-clicking on the layer, then `Properties > XYcoord. system`.

To combine geographic data, they must be expressed in the same coordinate system. Normally, *ArcMap* warned you of this inconsistency in the opening shapefiles. Watch her displaying only layer the parcels of Commons, then close *ArcMap* without saving.

Before starting any operation, it is necessary to reproject the data expressed in NTF. In *ArcCatalog*, you use *ArcToolbox* to carry out this treatment. In the toolbar `Standard`, enable the *ArcToolbox* by clicking on the representation of a toolbox.

In the tree pane that appears, follow :
`Tool data management > Projections and Transformations`

Then use treatment :
`Features > Project`.

A window opens in which you must complete four fields :

1. The path of the file containing the input data. Start with `SaintLoupCammas/parcelle/parcelle.shp`.

2. The file path to save the output data. Choose a file name (or use the default name).

3. The projection system output. Click the button to the right of the field. You can provide this information in two ways :
   – Or using the definition file *RGF 1993* : click the menu `Selection`, then choose `Projected coordinate System > National grid > RGF 1993 Lambert-93.prj` (ex : use this way for parcelle),
   – either by specifying a shapefile already projected *RGF 93* (for instance `SaintLoupCammas/corineLandCover/CLC06_D31_RGF_Clip.shp`) (ex : use this way for bati).

4. the geographic transformation. Choose `NTF_To_RGF_1993_1`.

Confirm by clicking `OK`. You can observe a smooth projection. Reproject the same file `SaintLoupCammas/bati/bati.shp`.

Observe the effect of reprojection `preview`. Close *ArcCatalog*.

1.2 Extraction of waterway (Cours d'eau) by spatial query

Open *ArcMap*.

Load the data necessary for the extraction : Menu `Fichier > Add data` Select repertory *SaintLoupCammas* and add files `coursEau/TRONCON_HYDROGRAPHIQUE.shp`

et `commune/commune.shp`.

You will now select coursEau through the town Saint Loup Cammas. To do this :

1. Select the town Saint Loup Cammas by toolbar Tools `Select features`. Right click on the selected feature gives you access to information, so you can determine the name of each town. . .

2. Click on menu `Selection` > `Selection by locations`. In the window that opens :
   – Choose operation selection : `Selectionner features from` .
   – Define the layer `TRONCON_HYDROGRAPHIQUE`.
   – Select the spatial operation : `intersect`.
   – Give name of the layer : `Commune`. Take care to specify that the operation is limited to entities selected by checking the appropriate box.
   Apply this query, in order to verify that it meets the desired objective, then click `OK`.

3. Save the selection in a file (Right click on layer `TRONCON_HYDROGRAPHIQUE` > `Data` > `Export data`...). *Be carefull* : it is important to organize your data so you will find it later. Logically you should save this new layer in the `SaintLoupCammas/coursEau /` and give it a descriptive name such as `coursEauSaintLoupCammas.shp`.

Save your project in the repertory `SaintLoupCammas`.
Name the file `TP_SaintLoupCammas_Name_surname.mxd`. Close *ArcMap*.

2   Data Structuration

You have manipulated data so far through shapefiles. You will now explore other types of data recording.

2.1   Creation of the Geographic Database (*geodatabase*)

Open *ArcCatalog* for create « *file* ».

1. Browse *TP_ARCGIS* and right click on repertory `SaintLoupCammas`.

2. in the context menu follow `New` > `File Geodatabase` .

3. Name `risqueInondation` the that appears in the right column.

CoursDeau

numCarthage : text(24) not null (pk)

nomCoursEau : text(50)
regime : text(50)
shape : line not null

fk_nomCoursEau

EstTraverseePar

numCarthage : text(24) not null (pk, fk)
numINSEE : long integer not null (pk, fk)

fk_nomINSEE

Commune

numINSEE : long integer not null (pk)

nomCom : text(100) not null
population : long integer
canton : text(50)
shape : polygon not null

fk_numINSEE

fk_numRisque

OccupationDuSol

numOccSol : text(18) not null (pk)

classOccSol : text(3) not null
vulneraOcc : float
classVulnera : text(50) not null
shape : polygon not null

fk_numOccSol

Parcelle

numCadast : text(24) not null (pk)

surfParcelle : double
COSReel : double
shape : polygon not null
numOccSol : text(18) not null (fk)
numRisque : text(50) (fk)
numProprio : text(10) not null (fk)
numINSEE : long integer not null (fk)

fk_numProprio

ZoneRisqueInondation

numRisque : integer not null (pk)

valRisque : float
classRisque : text(50)
shape : polygon not null
numAlea : integer not null (fk)
numVul : integer not null (fk)

fk_numAlea

fk_numVul

fk_numCadast

Proprietaire

numProprio : text(10) not null (pk)

nomProprio : text(50) not null
adresse : text(200)

ZoneAlea

numAlea : integer not null (pk)

shape : polygon not null
valAlea : float
classAlea : text(50)

Batiment

numBati : long integer not null (pk)

typeBati : text(10) not null
surfBati : double
nbHab : short integer not null
numCadast : text(16) not null (fk)
shape : polygon not null

ZoneVulnerabilite

numVul : integer not null (pk)

shape : polygon not null
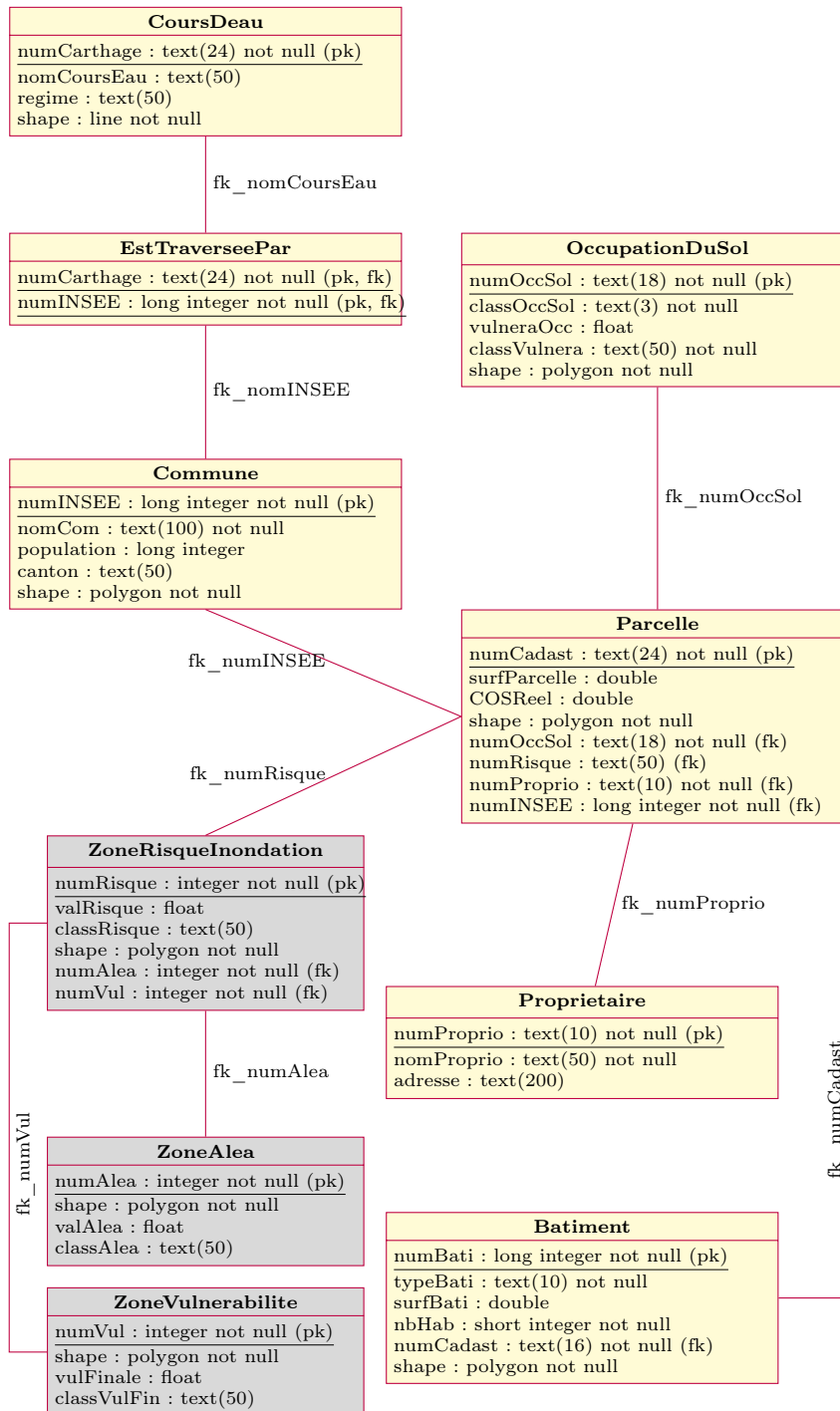vulFinale : float
classVulFin : text(50)

FIGURE 1 – Model of the Geographic Database.

2.2 Creation of the structure

You will now create structures to organize data according to the model presented (Figure 1).

First create *set of feature Dataset*. Right clic on `risqueInondation`, and in menu `New > Feature Data Set`. Give name for each : `alea`, `risque` et `vulnerabilite`. The **projection systeme** for the three lot of feature class **is RGF 1993 Lambert-93** (`projected coordinate systeme`…).

then create different *Feature class* in each Feature Data Set :

alea : `CoursDeau` et `ZoneAlea` ;

risque : `ZoneRisqueInondation` ;

vulnerabilite : `Batiment`, `Commune`, `OccupationDuSol`, `Parcelle` et `ZoneVulnerabilite`.

To create a feature class, right click on the lot of feature class concerned and `New > feature class`. Enter the name and type of geometry (you view the data to determine the type of geometry adapted).

Take good care of the different characteristics of information fields of each feature class :

- For `ZoneAlea`, `ZoneVulnerabilite` and `ZoneRisqueInondation`, you import the file structure provided in the respective file on repertory `zonage` : `zone_alea.shp`, `ZoneVulnerabilite.shp` et `ZoneRisque.shp`.
- For others, be careful of the chain length, data types, the prohibition of nullity **respect name of field** .

Finally create the *tables* (`EstTraverseePar` et `Proprietaire`) : right click on file `risqueInondation`, then `Nouveau > Table`. As for feature classes, complete the different fields carefully.

2.3 Insertion into the structure

You have created the structures… is to fill them with data. These are in files. It is possible to import directly into the database, provided to match the attributes of both sides

To load data into a structure, right-click on the feature class or table in question and then in the menu :

`Load > Load data`

A window opens. For each structure, follow these four steps :

1. Choose the file corresponding (input data)
2. Establish the correspondence between the structures and attributes of shapefiles (Table 1).
3. Load data.
4. Run the filling structures.

Do not forget the data areas of aléa, vulnérabilité and risque d'inondation.

Tronçons hydrographiques (extraits)	
numCarthage	ID
nomCoursEau	NOM
regime	REGIME
Occupation du sol	
numOccSol	ID
classOccSol	CODE_06
Parcelles (reprojetées)	
numCadast	NULPAR
numOccSol	FIRST_ID
numProprio	FIRST_CODE
numINSEE	MIN_NUMCOM
Bâtiments (reprojetés)	
numBati	FID_BATI
typeBati	TYPE
nbHab	NOMBREHAB
numCadast	NUMPAR
Communes	
numINSEE	CODE_INSEE
nomCom	NOM
population	POPUL
canton	CANTON
Table Proprietaires	
numProprio	CODE_ADHER
nomProprio	NOMB
adresse	ADRESE
Table EstTraverseePar	
numCarthage	ID
numINSEE	CODE_INSEE

Table 1 – Correspondance des attributs.

3 Data query

Open*ArcMap*, then add the data in the geodatabase that you created, structured and filled.

3.1 Selection

Menu `Selection` > `Selection by attributes`

Create the query to select. . .

1. Communes of the 15e township of Toulouse.
2. Communes of the 15th canton of Toulouse with a population greater than 3,000.
3. Communes of the 15th canton of Toulouse with name beginning by « P ».
4. Communes of the 15th canton of Toulouse with name contains a « p » or a « P ».

3.2 Selection by geometry

Menu `Selection` > `Selection by location`

Create the query to select. . .

1. Cours d'eau crossing Communes of the 15th canton of Toulouse
2. Cours d'eau contained in Communes of the 15th canton of Toulouse
3. Cours d'eau that are at a distance 200 m of Communes of the 15th canton of Toulouse
4. Buildings in an area of high or very high risk of flooding.

Note. To restrict communes or zones, you must apply the selection for geometry to entities previously selected by attributes . . .

3.3 Computation of the geometries

You will now calculate and save the length of each tronçon hydrographique. Open the attribute table of class `CoursDeau`, puis suivez `Option` > `Add Field`. Create the field (or attribute) `longueur` de type `double`.
The new field appears in the attribute table. To calculate the length, right-click on the field and `Calculate geometry`. Select operation length . . .. What is the length of ruisseau de beausoleil ?

3.4 Basic processing with *ArcToolbox*

3.4.1 Computing and representation of population

Fisrt formatting communes.To do this, check the properties of the layer and use a suitable symbology to view the population of each municipality in the canton (colors, number of classes . . .). Lay out soberly (Title, north arrow, scale and legend exclusively to the representation of the population) and export the map *.pdf* (`TP_SaintLoupCammas_population_Name_Surname.pdf`).

You will now group the communes of one canton to perform a calculation on the population of this communes. In `ArcToolbox`, find :
`Data management tools > generalisation > Dissolve`

Dissolve (Merge) Communes with the same canton of belonging. Specify the statistical operation to be performed : the sum of the population of all communes in the canton.
View the layer result et give the sum of population.

3.4.2 Detection of bâtiments near cours d'eau

Build a buffer 500 m around all the tronçons hydrographiques : `Analysis Tools > Proximity > Buffer`

How many bâtiments in this buffer 500 m ?

Now use the definition of concentric buffer zones to define three buffers of 50m, 75m and 100m around the rivers (cours d'eau) that cross the Saint Loup Cammas.

Select each of these three buffers using the attribute `distance`. For each, save selected by right-clicking on the corresponding data layer, followed by `Data > Export Data`. Beware the location (inside the tree `SaintLoupCammas` preferably) and format (feature rather shapefile) of your data : the logical organization of a project is critical to navigate at the long term.

3.4.3 Dimensioning the hardware and embankments

Now we use operation intersection find in *ArcToolbox*.
`Analysis tools > Overlay > Intersect`

Make intersection between Saint Loup Cammas and the rivers (cours d'eau) that cross.

Open the layer result. Compare column `length` and column `SHAPE_length` ? Do you need to update the column `length` and make them consistent with the data.

Compute the total length of hydrographic network in Saint Loup Cammas (dissolve).

4   Layout

Make a attractive layout featuring a theme you want to develop from the data used and produced during the TP.

Export the map in *.pdf* (`TP_SaintLoupCammas_Name_Surname.pdf`).