# Modelling and conception of hydrological data base of the watershed. Case of Sebkha of Oran (West of Algeria).

Amar DIF<sup>1</sup>, Zine eddine Zebbar<sup>1</sup> Samia ZAITRA<sup>2</sup> and Moulay IDRISS HASSANI<sup>2</sup>

<sup>1</sup> Centre National des Techniques Spatiales (CNTS),BP 13 Arzew, 31200 Oran, ALGERIE <sup>2</sup> Université d'Oran Es-Senia (IST)

Mail : adif@usa.com

Tél: +213 (0) 41 47 22 17 Fax: +213 (0) 41 47 36 65

KEY WORDS: Modelling, watershed, Sebkha, hydrological data base and GIS

#### Abstract:

The objective assigned to this work, is the modelling of the water resources of the watershed of the Sebkha of Oran (Algeria) by the implementation of a hydrological data base able to write in an adequate way constituting elements of the physical environment.

The elaboration of a computerized data bank directed to the study of the functional unity which is watershed constitutes the quintessence of this work. In the concern to study the various factors acting on the functioning of the environment, it was possible to integrate a set of data resulting from various sources, such as the satellite images and the digital terrain models (DTM), within a geographic information system (GIS).

## 1. INTRODUCTION

Today, the geographical information systems (GIS) appear like real tools, contributory to the understanding of the real world for a better mastery of the scheduling of his development. They permit to integrate the various data relating at the environment, some either their structure or their nature. They manipulate thus, the geographical data, destined to be drawn and the descriptive data bearers of the information relative to the first.

Depending on whether one is located of the side of the users or decision-makers, the SIG for the first is a system of database managements, for the seizure, the storage, the extraction, the questioning, the analysis and the display of the localized data (PORNON H., 1992). For the side of the second, its seen lake a set of data marked in the space, structured in order to be able to extract of it conveniently of the useful to the decision syntheses (DIDIER Mr., 1990). Concerning our work, the idea was how to simplify and to put between the hands of the decisionmakers a tool that will facilitate the stain and the access to the different information. This, consist therefore in elaborating a geographical data bank, capable to describe a more advanced manner the set of the parameters, that act directly or indirectly on the working of the physical model (watershed). For that to make, a set of the geographical data, satellite images and semantics have been introduced and manipulated in a geographical information system.

#### 2. Presentation of the study zone

The study region is situated in the external zone of the Tellien domain. It is situated between two sets of mountains, the mounts of Tessala to the south, culminating at 1061 meters (pick of Tessala) and the mounts of the Murdjadjo to the north, culminating at 584

meters to Mesabih. These two sets form between them, the big endoréïque basin named the watershed of the big Sebkha of Oran. The Sebkha is constituted of a big extended salt lake, surrounded by a set of plains juxtaposed to the north (plain of Misserghin, Amria, Bou-Tlelis, ...) and to the south a very big extended plain (plain of Mleta).

Geographically, the zone of experimentation is localized between the meridians  $0^{\circ}$  45 and  $0^{\circ}$  55 (W) and the parallels 35° 20 and 35° 30 (N). Fig n°1.



Fig n° 1: Geographical situation

## 3. METHODOLOGY

The methodology of our work consists to modelling the set of the elements constituting the physical environment of the big watershed of the Oran Sebkha by using a GIS. The acquirement of these data has been introduced by the different fashions (manual, recuperation of the data in vector and raster format). The general diagram of the geographical data bank elaborate can be summarized of the departure phase (seizure of data) until the construction of the data base in the following organization chart. Fig.2



Fig. 2: flow chart of the data bank achieved.

### 4. Modelling of the geographic data

The data modelling designates a general description of the entire geographical objects and their relations. It tries to represent the reality more or less according to the big degree of finality. It is about a conceptualization of the reality under the shape of separated information layers, relative to different themes. According to CLARAMUNT C., 1991, the data and the processes to modelling must correspond as closely as possible to the objective reality.

#### 4.1 Conceptual Model

The conceptual model is the fundamental part in the architecture of a data base system. The passage from the real model to the conceptual model (M.C.D) correspond to a process of modelling where the objects of the real model are classified in categories and nominees by names. It consists in three elements of basis called entities, attributes and relations between entities. Fig3



Fig. 3: Conceptual model.

#### 4.2 Dictionary of data

When the conceptual model is defined, its necessary to structure the data and the processes identified, this step permits the physical implantation of the conceptual model in the informatics corpse of the SIG (CLARAMUNT C., 1991). Thus, will be defined the files that contain the information, the attributes connected to these information, to get this one, in brief, everything that will contribute to make the system a real tool of management and analysis.

The dictionary of the data contains all information on the entities of the data base (names, definition, spatial reference, ...).

Example:

## WATERSHED: WATERSHED

Definition: set of the slopes toward a same river. These basins separated by lines of shared waters. Attributs: BV\_ID: unique Identification Nom\_BV: Name of the basin Cod\_BV : Number of the basin Superficie: surface of the basin in km<sup>2</sup> Relations: To contain -2: Geological Data To belong 1: infrastructural Data To belong 2: Climatic Data To belong 3: Hydrological Data To belong 4: Hydrogeological Data

#### 4.3 Logical model

The logical model is a representation of the (M.C.D) according to the possibilities of the status of the technological material. (DELOBEL C. and al., 1992).

The entities and the relations described in the conceptual model of data are transformed under tables form. Identifying of the relations is gotten by concatenation of the identifying of the entities that participate in the relation.

Example: relations types

Relation one to one:

Case of a relation between the lithostratigraphy\_Drilling\_ table and the drilling table: the two tables are joined by the key Drilling ID. Fig. 4.

us spektha Dunndes 📰							torage Donnies							
Forage1_10	Forage 10	Epsison	if acits	Protondeue	圖		Forage_ID	Non carie	Non	Code AND	Coard X	Protondeur	j	
n¢t		н	Argèn bruner sableuser					and	Ound Tield		723 167 17	er.;	ľ	
402	1	1,20	Liple Journ schlouter 3:	198	11			ahai	Ban Latigue 1	196373	773 397 88	50		
n(0	1	67	Grite & packages mameur	242	11			Abd	Ban Latigue 2	25873	7(37)84			
- 64	1	112	Alberrancies de gen titanca	2/1	18	0		Adual	Dund Tatal 2	012	720 455 27	E.4		
NOS.	1	4)	Calcares stayman harres o	417	111			ahai	7 allerated	363973	724 271.17	12		
801	1	15	Terre végélak, manen brig	13	11		6	abai		\$3.4	720 064 36	200		
102	2	7	Manes pixes & manore 14	207	11			454	-	52A	710 576.53	34		
800	1	1,25	Agin naneum einane	200	11			Abal		52 Th	710 332 58	34		
864	2	71	Calcaire blancs partie sat	400	11			Abd		5-64	212.527.51	28		
105	2	20	Maries pries area deutor	501	11	0		Adual	-	5/5e	717732.10	271		
001	1	64	Toples (possion), applied	64	111		11	Abul		164	717 297 63	29		
082	1	177	Apples brighter partois dated	204	11			abd		\$54	714 256.71	196		
000	)	110	Apples manager binar a	347	11			An. #3mt	Drove Solde	362373	702 646.00	24		
C04	1	67	Gres adorea torros.	400	11	0	- 14	Tempathere	Air El Adres	800474	601 626,75	110		
bór			Apples brunes of gravees to		11		15	Tenoucheri	HBou Hadar	4005 F4	687 452,14	154		
			A		4-14	1.4								

Fig. 4: Example of relation type one by one.

#### Relation one to several :

Case of a relation between the Hydrochimical table and the well table. Fig. 5.

	an information		1000	1			See by	100			
10	10,00	inte	Ka	m 1				10.0	dua	Diam.	Street, Surger
	1 Hannah Mele Car	214.45		- 10				CD4	The Labor	(Colores)	11
	20. milliona	214.40				Annual City Million				N-Arise	11
	- Street	214.45		- 10	1 1	Spherica D Fat. 0 18			Box Reported B	1 Area	0
	(PaulK senat	214.45	1.0			1.0.1		C14-	And in faces with a	A risk and	14
	12 Annuale	214.40		- 26	1 2			CDX-	Add Cloud BTT 1	N-Aristo	1
	10 April March	214.45		- 10		- 6 - 1		014	Frank Palette	1 Area	111
	20x010xm	214.40	10	321	28.5		1-1			A reaction	141
	NOT A DURING AND ADDRESS OF ADDRESS OF ADDRESS ADDRESS ADDRESS ADDRESS	214.40						0.0	Report 1	S. Aristo	100
	10 Loss Laters N	214.45		- 261	1 12			02-	Barran I.	1 Acres	164
	Highly he we have been been	214.40	10		1 2			0.24	Tax Patrix Little?	N Avenue	1.4
	F. Proget Sci., education	21.4.45		- 42	1 12				False	Transfer I	4.8
	C (NLAMA)	214.45		- 61		2 000			Redeff to the	Terra land	1.0
	Coloran Carla	2.1.1		- 18	1 12				Budobuda A	True las	1.8
	topinus Iniana	2.1.1	1.10	- 19	1 0				Andread and Date And	Transfer !	10
	Hilling Information	21.8.45	50						Budenburght #	Terrisolani	14.1

Fig. 5 : Example of relation type one to several.

Relation several to several :

Case of a relation between geology table and the watershed table. Fig. 6.

<b>D</b> .	معادر إسار	atio Prater			with a	1 5	Conneck, 7 Brancher (1978)	i ni				
17		a subs	José phá	Famalian, Miss	Puntahini 3	8 C	Shall PL B	18				
	443	Tel.et	-	Collete, same choice	Jupereith 1	1 C	447	711		And Address of the Ad	Stands.	with a
	10.0	10.00		Longin, same obside	Tegendate	I C	-4400	111		100 m	Inc. or	and my
	444	14,40		( ) offerer, annu offerer	(approval)		Lasia .	1			press, pre-	1100.01
	443	and and		Talais same alais	Teperatula	I C	481	1	- 5		(Ouel-teat)	
	ani 1	100.00		Longing, same photo-	Depreshén	L C		201	- 5	3	COVER 2004	
	41.5	14.40	-	1 where each other	TRANSPORT	I C	Curries .	78.0	- 5		100xad-same	41
	44	10.00	-	Takin, new shine	Teperatula	1 - e C	447	710	1-45		* Over Descent	411
	411	and sold	-	I where same other	(marrolds)		4400	111	_	ā	COARD DALE SARE	
	4.0		-	Collector and children	and the second second		4400	711	5	· · · · · ·	1]Dad/Badi	1
	41.0	1000	-	Lodgin, specializing	Transition 1	1 2	4474	11	1	· · · · · · · · · · · · · · · · · · ·	Control West	618
	-		-		(marging a	I 6	41.0	-111	- C	1	Elihaded fost-streams	416
		135		Table ton all			410	-111	- C		10 David Selat	1
	-	124	-			1 2	100	-11	10		COMPLEX.	- A1
		100	+	Contract of Benefician		. 8	2210	201	- C	1	T Coake Sally	410
	A 44 1 1 1	197		- produces and a second		. 2	1.00	211	- 24			
		-		A Design of the state of the st			100	-11				
	ALC: N.	100		Construction and the Advancement	200		200	님비				
123	410.00	1.00		1 page pr	No. of Lot of Lo	6 10	-410-1	-121				

Fig. 6: Example of relation type several to several.

## 4.4 Physical model of data

The physical model corresponds to the structure of storage of the data. It permits therefore, to describe the data as they are stocked in the machine

Name of the table : watershed By the attribut: BV\_ID

CHAMPS	ТҮРЕ	LARG EUR	NOMBRE DECIMAL
BV_ID	Entier		
Nom_BV	Caractè re	35	
Cod_BV	Entier		

Fig. 7: Example of the physical model.

#### 5. CONCLUSION

The modelling of the hydrological data we permitted to have a global vision of the set of the data constituting the physical environment.

The fast access to the data and the possibility to produce different types of scripts give the advantage to the specialists of the domain to predict the different critical situation types in the working of the physical environment.

This modelling has the advantage to give some fast answers and useful to our decision-makers in order to answer the different better requests.

This work constitutes a link of a long chain that will treat the development of the management model of the watershed.

## 6. REFERENCES

BEDARD, Y, 1987., Les Différents Types de Systèmes d'Information à Référence Spatiale. <u>Actes du congrès</u> conjoint Carto- Québec / Association Canadienne de la Cartographie, Université Laval, Sainte-Foy, Québec, pp. 73-88.

BURROUGH, P.A, 1986. Principles of Geographical Information Systems for Land Resources Assessment. <u>Publications</u>, Monograph on Soils Survey, n° 12, Oxford Sciences. 194 P.

CLARAMUNT, C, 1991. Du Monde Réel aux Systèmes d'Information Géographique. <u>GERMINEWS</u>, n° 2, département de Génie Rural, Ecole polytechnique fédérale de Lausanne, pp. 5-7.

CLARAMUNT, C., DE SEDE, M.H., PRELAZ-DROUX, R. & VIDALE, L, 1993. Integration of Heterogeneous GIS for Environmental Management Planing and Management, Proceedings, for East Workshop on Geographic Information Systems FEGIS. <u>Word Scientific Publications</u>, Singapore, pp. 404-415.

DELOBEL, C. & ADIBA, M, 1992. Base de Données Relationnelles. <u>cours</u> CNTS.

DE SEDE, M-H., CALOZ, R., PRELAZ- DROUX., CLARAMUNT, C. & VIDALE, L, 1996. Système d'information Géographique, Télédétection et Gestion des Ressources en Eau : des Outils Pertinents. <u>Publ. Actu.</u> Scie.- Télédétection des Ressources en Eau, pp.121-133.

DIDIER, M, 1990, Utilisé et Valeur de l'information Géographique, Service Technique de l'Urbanisme, Conseil National de l'Information Géographique. <u>Ed.</u> <u>Economica</u>. 255 P.

PORNON, H, 1992. Les SIG, Mise en Œuvre et Applications. Ed. Hermès.

DIDON, E, 1990. Systèmes d'Information Géographique; Concepts, Fonctions, Applications. Laboratoire commun de Télédétection <u>CEMAGREF/</u> <u>ENGREF</u>, Montpellier, 44 P.

LAURINI, R, MILLERET, F.R, 1993. Les Bases de Données en Géomatique. <u>éd. HERMES</u>. 340 P.

PORNON, H, 1992. Les SIG, Mise en Œuvre et Applications. Ed. Hermès.