

Integration of multi-source data for the realization Of a hydrogeological map

Case of study : plain of Mleta of the big watershed of the Oran sebkha

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1. Abstract

The traditional approach used in the hydrogeological studies is generally long, very expensive and time consuming. With the advent of the geographical information systems (GIS), satellital imagery and the digital terrain model (DTM), it became possible to integrate purely digital techniques able to release hydrogeologist of many tasks met in their studies.

The wells data of the study zone presents gaps in the altitude (Z) parameter. To overcome this problem we used a method which consists to extrapolate the value of altitude (Z) from the digital terrain models. The satellite images as for them, will intervene in the correction of various discontinuities affecting the thalweg which will serve in the update of the hydrographic channel and for use of satellital image like melts cartographic and in the realization of the spatio-chart. These data will be processed, corrected to be finally integrated into a GIS for establishment of the hydrogeological map of the M'leta plain of the big watershed of Oran Sebkha.

2. Introduction

These last years, the hydrogeologic studies knew a big scientific progress thanks to the use of different technics of automatic cartography. The latter permits the integration of the

multi sources data through a computer tool as the MapInfo software serving to acquire, manipulate, stock and process the georeferencing informations.

It is in this optics that we started a hydrogeologic study of the big watershed of the sebkha of Oran using a numerical approach, while using a set of information data (cartographic, altitude, satellite, hydrogeologic, etc..).

3. Presentation of the zone of study

The region of survey 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 endoréique 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, etc.) and to the south a very big extended plain (plain Mleta).

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

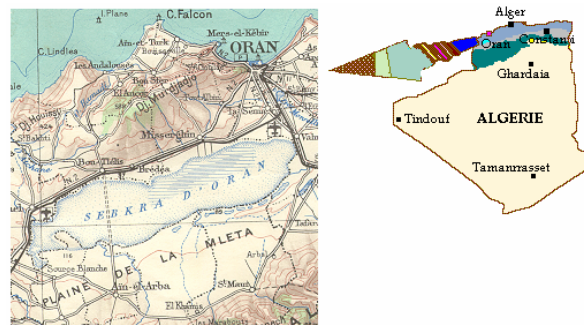


Figure n° 1 : geographical Situation

3. Methodology of work

The objective of this work is to introduce many of the information provided from different sources (hydrogeological, geographical and satellite data) in order to produce hydrogeological map by a numeric approach. The different steps of awer work can be structured ace shown: (Fig n°2)

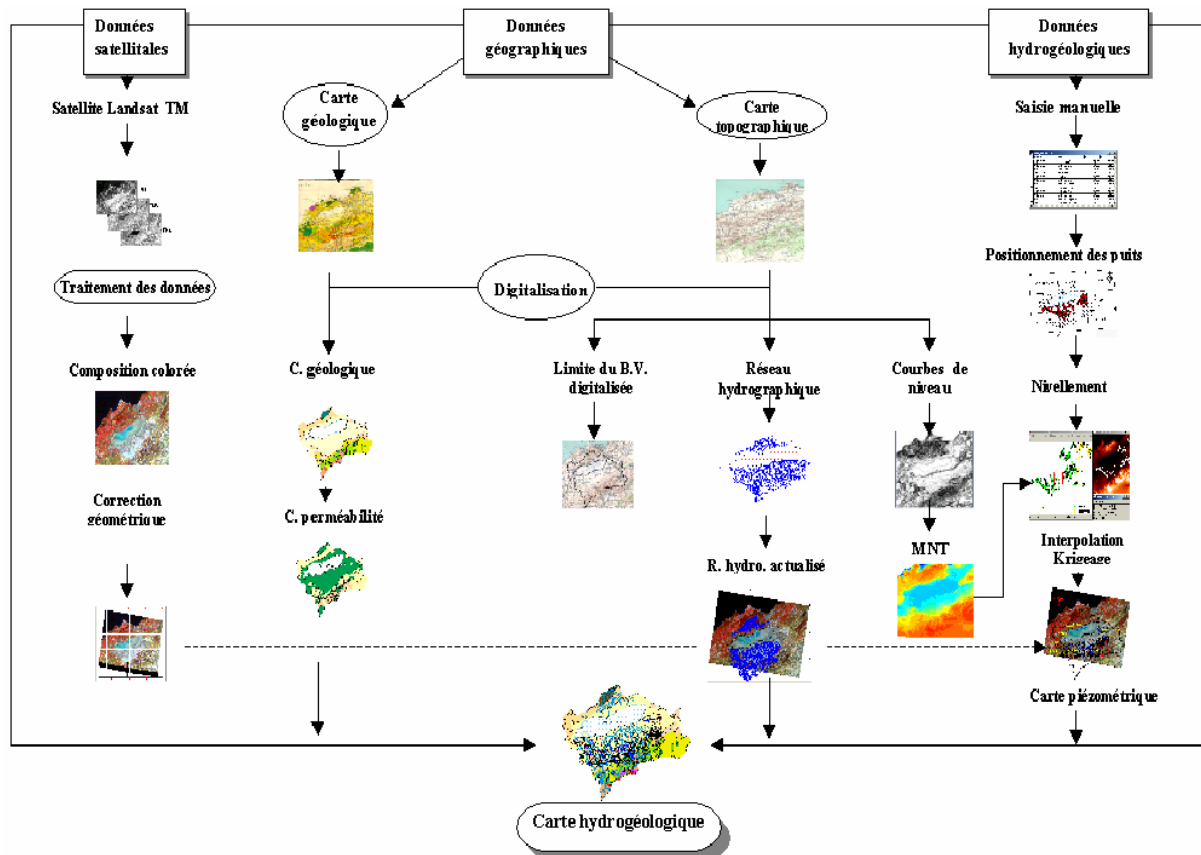


Figure n°2: the flow chart adopted for the development of the hydrogeologic map

4. Development of the piezometric map

To establish the piezometric map of the zone of study only the well data are used. These information present the hiatuses and anomalies in the altitudes parameters, what won't facilitate the task as for the development of the hydrogeologic map. To overcome this problem we used a method which consists to extrapolate the value of altitude parameter (Z) from the digital terrain models.

5 . Extraction of the altitude parameter

The altitude of a water point (well, boring, etc..) is considered like a necessary data in all hydrogeologic study. The absence of the altitude parameter (Z), recorded on the set of the information provided by hydraulic agency, pushed us to use a new based technique essentially on the use of the DTM to leveling the wells data. (Fig n°3)

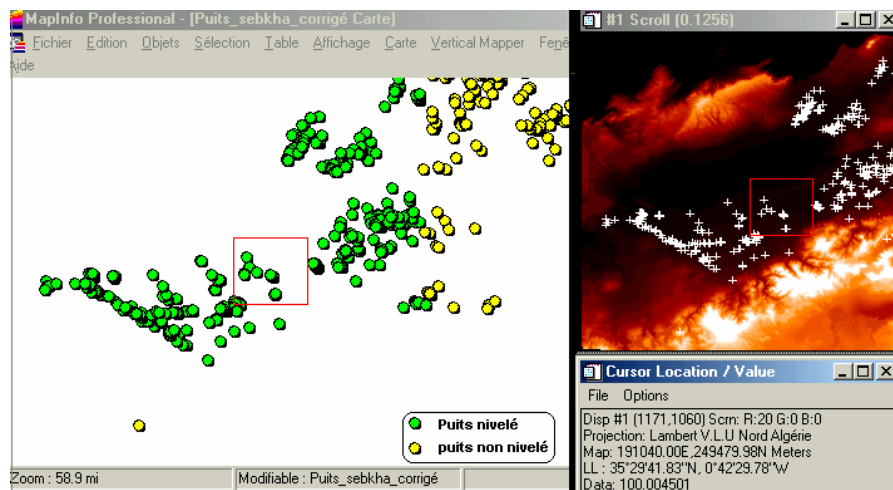


Figure 3: Technique de nivellement utilisée

6. The piezometric map of the Mlèta

The piezometric map of the plain of the Melèta, elaborated by data well of the years 1986, has been gotten by the krigage interpolation method. This method of interpolation estimates the values of the points sampled by a combination of the information. The weights of the samples are weighed by a function of structure that is descended of the information. (Fig n°4)

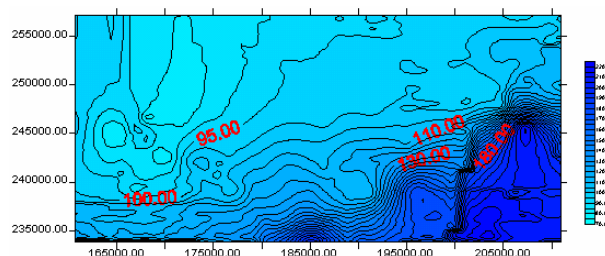


figure 4: Representation of the piezometric surface of the Me lèta.

The representation in block diagram in three dimension (3D) of the map offers a very net view of the piezometric surface where clearly appears the domes and the depressions above, (Fig n°5)

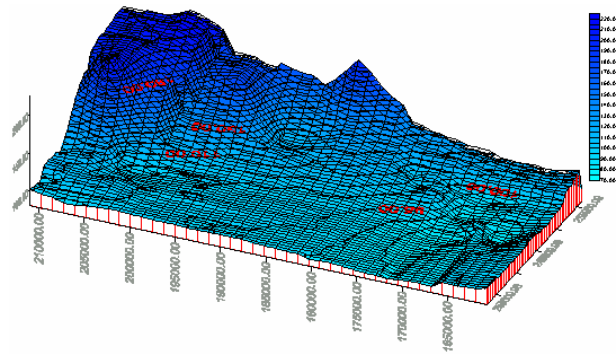


figure 5 : Representation of the surface piezometric of the Me lèta in block diagram

7. The interpretation of the piezometric map of the Melèta

The tracing of the axes of drainage and the divides on the map of the piezometric surface show the different senses of out-flow of the underground waters in the plain of the Me lèta. (Fig n°6)

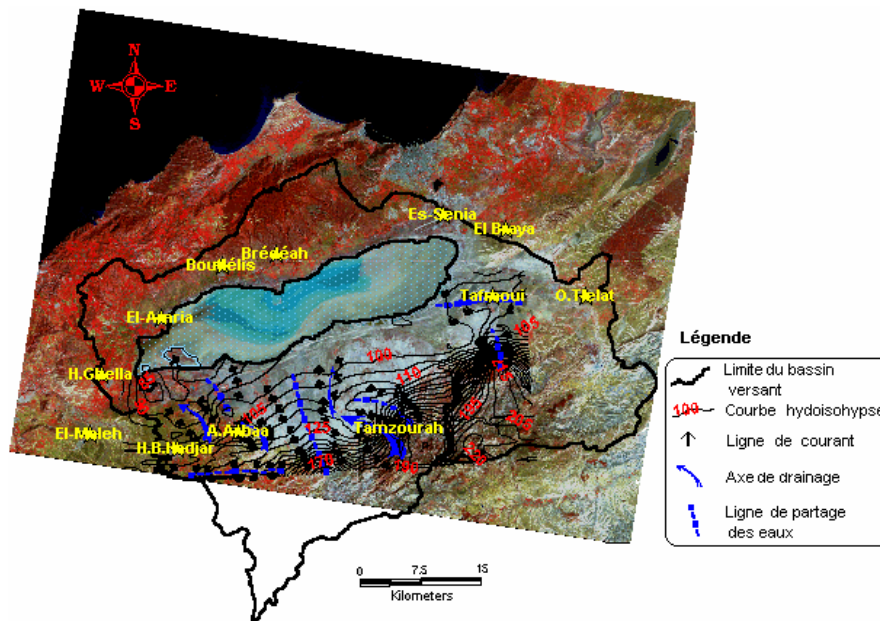


Figure 6 : piezometric chart of the M'lèta

The elaborate piezometric chart has a big axis of drainage situated in the center of the plain taken out again (zone of Tamzourah) of direction SE-NW in the uphill and downstream S-N, the two other axes of drainage that are in the zone of A.Arbâa and H.Bouhadjar have the SE-NW direction.

The underground out-flow sense makes itself in a general manner toward the salt lac (sebkha).

The piezometric surface is marked by some protuberance, characterizing the zones of important provision that is located in **SE** part, what it can be to explain by the provision zone of limestones or by the meteoric waters.

The curves hydroisohypses is tightened upstream, and the module of spacing is decreasing of the uphill toward the downstream what translates the reduction of the permeability toward the border of the sebkha due to the heterogeneity of the land.

8. Presentation of the hydrogeologic map

The hydrogeologic map is the result of the superpositions of the different layers (geological, hydrographic and piezometric). (Fig n°7)

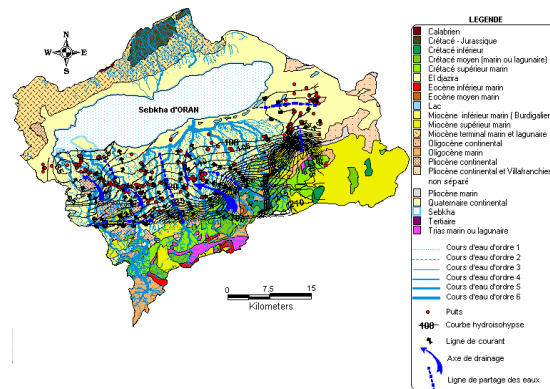


figure 7: Chart Hydrogeologic of the plain of Me lèta

Conclusion

The new techniques used in the setting of our work such as : The digital terrain model (DTM), the satellite imagery and the geographical data permitted us to describe, in a numeric manner, the set of the parameters intervening in the working of the underground waters.

The operation of leveling, of the different wells covering the zone of survey, by the DTM permitted us to restore the indispensable altitude parameter automatically in the development of the piezometric map. This technique can be considered like an useful basis in the leveling of the wells that stays in most cases deprived the paramètre altitude (Z), case of the majority of the wells in Algeria.

The satellitale imagery can be considered like excellence cartographic basis in the updating of the hydrographic channel, road and urban, etc.. And lake a ideal cartographic support for the production of the spatio charte.

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