ESTABLISHING THE SPATIAL OPTIMAL MODEL TO IMPACT THE CLIMATE CHANGES BY DESIGN OF EXPERIMENT

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ABSTRACT

Changing in climate is the global problem and, locally, it will destroy or damage some factors of enviroment in province-wide. By using design of experiment (DOE) method, the affected geographical-relation factors in a province will be discovered. Initially, this paper will establish the spatial optimizing model to minimize the impacts of climate changes. The result will be used in decision making process in preventing the damaging in Tra Vinh Province.

1. INTRODUCTION

Climate change causes more impact on people living. The impact on various aspects such as [1]: resources, environment, health, agriculture, urban development, water supply, infrastructure, energy... Limitation the effects of climate changes through two methods: reduce the causes of climate changes and try to choosing the developing way to minimize the damage due to climate changes. The first method requires time and the cooperation of all countries, all organizations and parties in the world. Organizations around the world will connect together through these programs such as emission reduction,... In a province, reforestation is the effort of this method. And the latter method is the way to planning and adjust the economic, cultural, and social development in local. In this solution, the adaptation measures (prevention, protection, resistance, ready) [1, p57] is one of the solutions to reduce the damage group. The development of each locality is always associated with the manufacturing, services and key trading to determine. As a results, optimal model is built on the basis of factors influencing and impacting provincial industries by means of experimental designs. This article mainly describes the proposed and methodology research.

TraVinh is the province in southern of VietNam. Its area is 2,215km^2 and have over 1 millions peoples (2009). Geographycally, TraVinh is the low plain with average height from 0.5 to 0.8 meters.

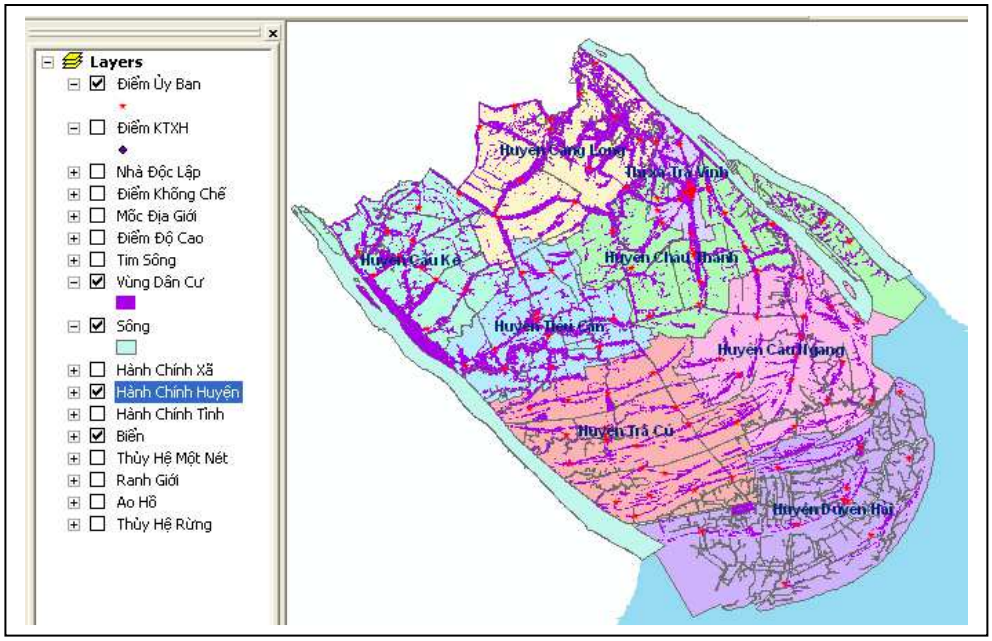

Figure 1. Map of Tra Vinh province in the study.

2. THEORIES AND METHODS

2.1 Climate changes and its affects

According to [2], climate change is a significant and lasting change of prolonged climate patterns in period of a few decades to a few million years. Climate change alters the average weather conditions, that is to appear more or less the weather phenomenon. Climate change causes many changes such as temperature, rainfall, mineral resources, and changes in agricultural production as well as human settlements and other plant and animal species.

For this research, the GIS data layers are collected as follows:

- The economic, cultural and social (with mainly agriculture and fishery).
- Elevation.
- Roads, the main traffic routes.
- Hydraulic system, drainage works.
- Residential areas, independent houses.
- The cultivation.
- Current status and land use planning.
- Industrial, commercial, manufacturing plant.
- The landfill, the focus wastewater treatment, solid waste.
- Slot administrative provinces, districts and towns.

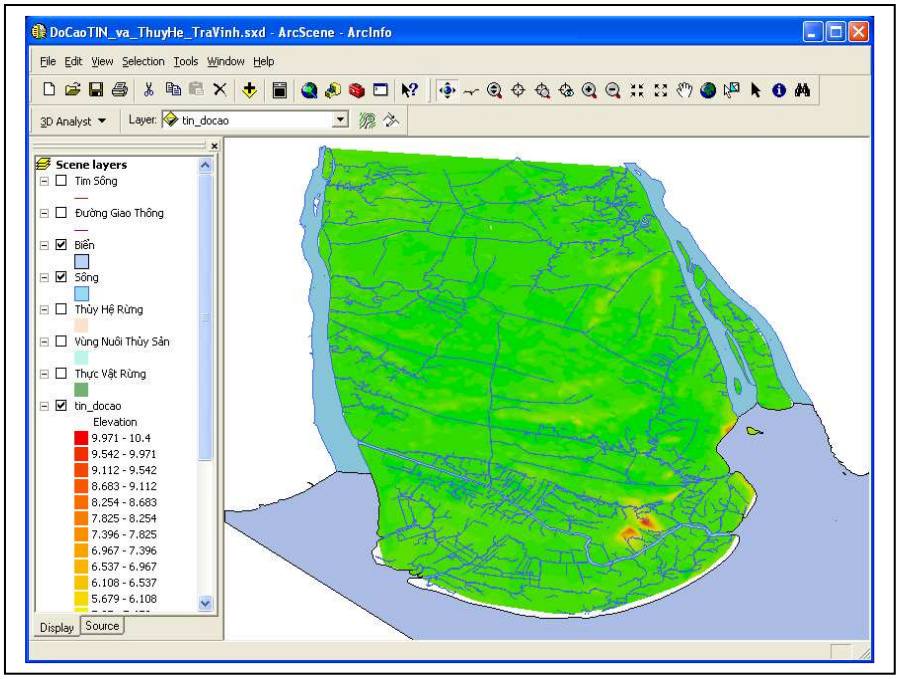

Figure 2. Elevation (TIN) and main hydrology system of TraVinh Province.

2.2 Brief on Design of Experiment and applies

According to [4], proposed by Ronald Aylmer Fisher (1935), the experimental design method is a technique used to explore the new rule, gain more knowledge of the existing process and these optimize processes. Experimental design is applied in many fields of industries with the Taguchi method, Genichi Taguchi proposed in the 50s of the previous century. Designed laboratory experiments using the filter floor (screening experiment) to evaluate and find the important factors that affect the process, and find out the factors that are not really important, have less image significant effects or processes without analysis of the entire number of significant factors. In the experimental design, the factor (factors) is the input (input). These factors can be categorized into factors that can be controlled (controllable) or control (uncontrollable). Each factor levels (levels) are the properties of interest of factors that can affect the results (response). For example: the rainfall factor with two levels: less and more can affect the results of the yield of rice.

Normally [5], an experimental design is done through eight steps as follow:

- Step 1: Identify the problem (define problems).
- Step 2: Define objectives.
- Step 3: Calculate (Brainstorm).
- Step 4: The experimental design (design of experiment).
- Step 5: Perform the experiment and data collection (conduct experiment and collect data).
- Step 6: Data analysis (analyze data).
- Step 7: Translation results (interpret results).
- Step 8: Test results (verify predicted results).

3. PROPOSED OPTIMAL MODEL FOR DECISION SUPPORT TO REDUCE IMPACTS OF CLIMATE CHANGES

In fact, for coastal and seperated province as TraVinh, climate changes mainly cause, at least and clearly, in 4 damage factors: sanilization, drought, flooding and lack of freshwater. They all affects to agricultures, fisheries, and social plan for development.

Table 1. Surveying factors and their 2-mapping levels.

Factors	Levels
Salinization	short or long term in year.
Drought	month or fixed quadter.
Flooding	low or high height.
Lack of fresh water	low or high percents of people effect directly.

And, in practical, TraVinh province has being done a lot of programs to against climate changes such as reforestation, selecting suitable rice seeds, studying and choosing appropriate plantings. But four factors will not be disabled absolutely in the future. Therefore, development plannings for industries of the province will be needed to drive the provincial economy and social. The idea minimizes the industries affected by climate changes and maximizes the others having less climate changes effects gradually.

The interaction for geographical information is information extraction from heights, population, the productivity of rice or vegetables, the current state of land use in the area affected by the climate in some decades. Since the population and the terrain, such as hydrology system, of province is not regular distribution, we must apply the geostatistics functions to order the set of factors at district or ward level. In addition, because of long-years plannings and annually adaption for the social-economics of province, the model will not have all linear functions, instead containing timeseries or Markov chains. And mathematically, the system will contain set of non-linear polynomials. As a results, optimizating this system may lead us employing some algebraic algorithms.

In the model, optimization factors that can be found by many methods, such as: PTAS (polynomial-time approximation scheme, the method of meta-heuristics based simulator development patterns, the optimal method for time series). In the model, KPCA (kernel principle component analysis) is proposed to select the main factors. Design of experiment technique is based on the geostatictis function to choosing the main factors for ward level as well as industry zones level.

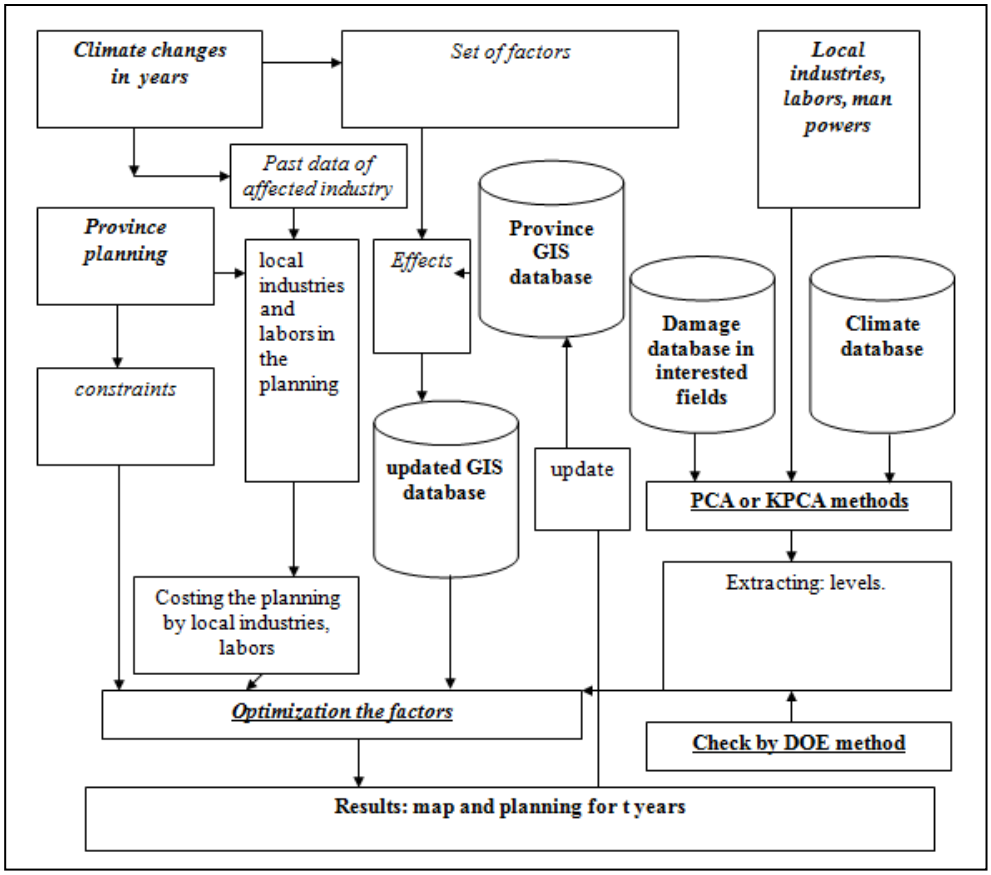

Figure 3. Proposed model.

4. CONCLUSIONS

Implementating the optimal model in order to limit damage and finding the factors that the impact of climate changes is essential. The method used to select factors is statistics. And design of experiments as well as others methods such as PCA, KPCA will take the role of identify the effects factors. Experimental design method allows testing has found factors. Detailed expansion will meet the seasonal climate change. Model will apply statistical methods as ARIMA to calculate the time series of time and damage caused by climate change.

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