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Input-Output Balance Calculation of Energy and Material from Geomorphic Basins in Planning & Management of Basin, Case Study: Kor River Basin

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Abstract

This paper tries to systematically survey, with taking theoretical view on geomorphic basin and its changes into account. The purpose of this research is to determine the balance and stability of geomorphic basins from the past to present and then to future. Consequently, it tries to determine the balance between energy and input-output materials for example (rainfall , solar radiation, tectonics and neotectonics …) to the basin based cybernetics (including geomorphic, topographic and geological state) and also to calculate energy and material balance considering positive and negative entropy at basin level. Based on the findings, which is the outcome of cybernetic resultant between form and process in basin, we can determine stability and type of balance in the basin. In this paper, emphasis has been put only on rainfall (express of the energy exponent). However, it first discusses Kor Basin Geomorphic locations and Energy-Material Entropy on its surface and then Quantity form of energy (Isolated & Potential Energy). Considering geomorphic state of the basin, we

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can determine the best planning method from all systems (planning, risk management and crisis management) for basin that neither requires a great cost nor causes disturbance in stability and geomorphic balance while being the optimal process. In Kor geo planning, we are encountering and determining two dimentions: (Y dimension, for geomorphic change for example throughput topogeraphy geradient formations on Kor Basin and X dimension, for rainfall discharge range on Kor Basin rivers out let only and only on fiat paper surface), but in Kor geo management, we represent at least three – dimensional ordered, for example topogeraphy gradient for Y coordinate and rivers discharge quantity for X coordinate and absolution geography location (for space point Z coordinate). Consequently, Kor River Basin can be studied based on two scientific metod : I . Planning & II , Management .

Keywords: Geomorphic, balance, input, output , Management , Planning .

1. Introduction

Changes of earth's crust, especially in quaternary, is much important for geomorphologists, since it can be effective in human structure. On the other hand, man can be affected by this structure and the resultant of these actions and reactions can show a point to managers and planners that under the title of determining various stabilities and region balance, they can take a process of development and utilizing it together with scientific or even fuzzy logic (Siler . 2005). So in this way, the human and nature will have the most comfort and the least instability. Therefore, the present paper is an attempt to study geomorphic basins from systematic theoretical view to achieve the following goals:

First: Studying mobilization and stability threshold of basin to determine the effect of future climatic changes and fluctuation and its geomorphologic effects.

Second: Calculating the extent of input material and energy to the basin and studying its output to identify the reasons for occurrence of land-form and that how these forms can affect the environmental engineering and basin structures (Barthes, 2002). As it was mentioned, the applied scientific method in the recent research is the systematic geomorphologic approach of basin process in the form of structural changes which occurr during basin evolution and that help researcher provide a model based on reasonable foundations because:

Firstly: The evolution of landscape in geomorphic basins has been made in a time interval so longer than human life.

Secondly: In diverse nature of basins, the erosion has destructed the evolution of landscape.

Thirdly: Very different theoretical methodologies can be used in the study of geomorphologic changes of basin. For example, we can mention methodologies from Davis theory (Davis, 1899: 490) to earth crust motions in regard to landforms of "Kor" basin from Walter Pank theory (Penck, 1924) or the study of geomorphologic process of basin in time from Laster King (King, 1953: 240) or applying methodologies of models related to Hack time (Hack, 1975: 90) on basin.

In geomorphic research, basins can be studied taking three approaches: 1) Historical approach "Morris Davis and his followers". 2) Catastrophism "extent of events based on their frequencies". 3) Systematic approach "balance between energy and input-output materials from geomorphic basins [One of the well-known frameworks and approaches in geomorphology is systematic approach. This approach which is sometimes named "Functional Geomorphology" has been brought forth from Gilbert's time (Gilbert, 1877). However, systematic approach which was proposed by Bertalanffy, Ludwig von. (1973) and permitted to be published a year after his death, made a great change in evaluation framework of phenomenon]] Smally and Vita-Finzi (1969) suggested that the concept of system in contemporary geomorphologic literature has been proposed in the concept of thermodynamics of the moderns (Strahler, 1952, 1950). Systematic modeling has also been a reality which was proposed in 1960s with the effort for developing quantitative geomorphology Chorley (1962) provided preliminaries for applying systematic models in geomorphology. The easiness in expressing the concepts of this model in the framework of quantitative values caused these models to be applicable in geomorphology. Strahler used the term "system" in geomorphology as a method in thermodynamic analysis, however, at that time, he said nothing about Bertalanffy issues. Hack discussed on Strahler disquisition and expanded his explanations in systematic approach in a new concept which was later known as "Dynamic Balance Hypothesis" (Hack 1960: 88). Till that time, none of these two deal with philosophical basis of systematic cognition which had been composed and explained by Bertalanffy, but in 1962, Chorley suggested some valuable points in the concept of system in geomorphology by publishing a disquisition in United States Geological Survey (USGS). Chorley explained Strahler and Hack's ideas and in fact he proposed fundamentals of the concept of system in geomorphology.

2. Geographical Position of 'Kor' Basin and Energy-Material Entropy in Geomorphic System & its Role on Balance and Basin Stability

"Kor" river basin with an area of 21400 km^2 has been located between latitude of 29.289° to 31.271° and longitude of 51.625° to 53.844°. In other words, the extension of this basin in latitude and longitude is 1.982° and 2.739°, respectively. The extension of basin is in general direction of Zagros Mountains (Northwest- Southeast).

Entropy means the rate of decrease of input material and energy to geomorphic system. In geomorphic basin, entropy can be divided into two parts; positive and negative entropy. In fact, entropy should be known as a logarithmic probability from thermodynamics of a system. A system shows the least entropy when it has a good order.

Here, the term "Positive Entropy" is used, when the system trends to the least entropy and increase of order and this concept is parallel to negative feedback in the basin. The released energy in system can produce work and may result in distortion in geomorphic systems. In contrast, "Negative Entropy" is used for a state of system in which disorder is increasing (positive feedback). In this state, material and energy gradient has a great intensity (Ramesht, 2001). Also relieves are seen in some geomorphic basins. The morphology of these relieves is shown as flat plains with a collection of dispersing point channel network that in fact indicates networks which really proceed distribution of water strength in basin level, raise water dispersion and spread level and as the result, cause the increase of evaporation level in one side and decrease of flow power in the other. These energy levels approach the basin potential to positive entropy and this principle promote the basin to balance (Morris, 1988: 138). However, collective effect of these consuming subsystems in positive entropy of energy besides having an influence with input solar radiation which plays the role of a rail quantity, takes upward movement. The residence basin of these subsystems is mostly alluvial deposits and fine grains of plains. In other words, decreasing of main river power by these subsystems is mostly attributed to the increase of evaporation than penetration level (Allen, 1974).

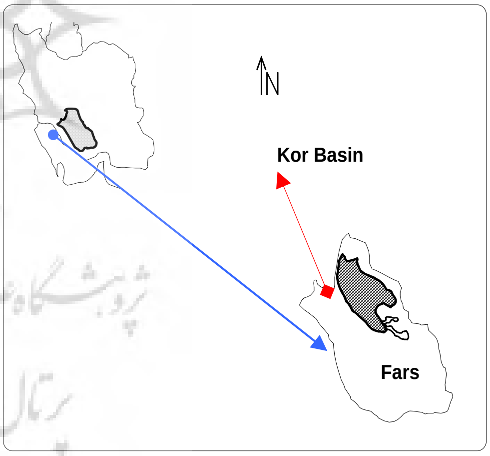


Figure 1 GIS Location of Kor Basin in Iran and Fars Province.

3. Methodology

The systematic thought in the study of geomorphic basins is based on this principle that geomorphologist looks at the basin as an algebraic function that is defined by geologic condition and specially internal force of earth and tectonics. For example, if we consider the following hypothetical functions as indices of morphic systems of hypothetical basins:

F (x) = X+100 **(1)**

F (x) =1/(X-100) **(2)**

F (x) = 0.5X **(3)**

though operation of each function is determined by F(x), each function does particular reaction on its input concerning the method of its throughput that is x variable. This principle expresses the response of geomorphic basins to its inputs. In other words, if each of the above functions is algebraic expression of morphic landscapes of three basins, supposing that X variable is rainfall and in the case that annual rainfall in each three basins is considered 100mm, the first basin would reach dynamic balance, since by injection of these 100mm of rainfall to the first basin, throughput structure of the basin such as geology composition, permeation and evaporation … is in such a way that this input variable makes 200-unit changes on the proposed basin. But if such an input is injected to the second hypothetical basin, will lead to imbalance of the basin, because we will face a situation in which the basin throughput will lead function to infinite (ambiguity). Geomorphic environment in the third function will decrease the effect of 100 mm of rainfall to the half, or will lead the basin to thermodynamic balance. So, one of the features of models in systematic device is the use of special symbols and factors for expressing type of concepts and existing relations and some dominant processes in systems. Many researchers have tried to create special symbols to express such concepts. Using these factors and symbols in these models, is in fact, the use of mathematical symbols or instructions related to sets and such symbols. Based on these models, in study of basin we can use factors such as input, output, information saving and arrangement and material and energy in geomorphic basin as factors of the selected model to study basin by simulation of basin drainage of pyramid structures in applying systematic thought. We can put these factors in four groups that are: A) basin inputs (precipitation on the basin, received radiant energy from sun, and finally internal forces of earth which cause tectonic movements on the basin). B) basin outputs (evaporation from basin due to solar radiation that in fact is a kind of outflow of material and energy from basin level, output of basin rivers to general base level of basin and finally the most important output of basin that are present landforms in basins level) (Ramesht, 2007: 31 – 48). In fact, by comparing inputs and outputs of a geomorphic basin, the results will be apparently proved. C) throughput or system regulators (basin slope, permeability of basin, evaporation rate, vegetation cover, human efforts in utilization of basin environment such as dam construction, industrial and agricultural utilization) that are information or processing system of basin and saving material and energy in basin and finally channel structures control material and energy flow in basin. D) Subsystems of a geomorphic basin and their throughput cybernetic function, usually geomorphic basins of rivers greater than 2000 km^2 include several sub-basins(Joyce, 2004) . Finally, all these sub-basins enter the general base level of basin together after discharging their debit in the main river. These sub-basins can be divided into consuming, stiffer, isolated and topographic sub-systems that each group represents a clear feature in cybernetic of material and energy transfer in the basin.

4. Quantity of Input Potential Energy in Ground Level of Geomorphic Basins:

For example, precipitation is one of the most important input of energy and material to a geomorphic basin. The average of rainfall in river basins is the rate of annual precipitation that this amount is a mass of material which is injected to basins. This mass put a potential energy to the basin which is completely accountable for the entire basin based on joule-scale. It is clear that this amount of energy is a remarkable amount. While this calculation is usually considered with average rainfall of the basin and other factors such as threshold rainfalls with long-term return periods are ignored. Also there is no sign of mean height of basin that has a very important role in the type of material movement in basin level. So to calculate potential energy of basin, we should consider the resultant of factors as rainfall depth, mean height of basin, the rate of rainfall and also time distribution of rainfall (Halliday, 1987). Then we can calculate input potential energy to the basin based on the following equation:

$$EP = mgh \quad (4)$$

In the Equation 4, (EP) is potential energy, (m) is mass of input material (here basin rainfall during year) in kg., (g) is gravitational constant that is 9.8 m/s^2, (h) is mean height of rainfall on the basin (average distance of rainy clouds from basin level). In addition of this equation , there is a sun radiation function of energy that can be positive or negative effect on EP . On the other hand, in the rainy area this effect is negative because sun radiation energy is used for evaporation so this factor reduce the total quantity of energy. In the dry are, this effect is positive because sun radiation energy is increase the total temprarture . The sun radiation function of energy is calculated from :

$$E(s) = I.*60*12*365.25*(\cos\Theta)*a \quad (5)$$

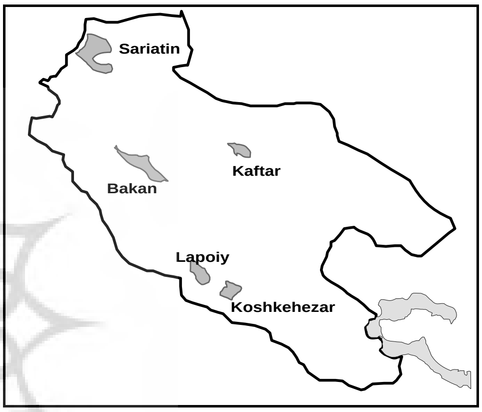
In the Equation 5, (I) is net solar radiation , (Θ) is area latitude and E(s) is total energy of solar radiation in calory dimention for total surface basin and (a) is basin area in (m^2) .

NTE (b) = EP + Es – eE – p (6)

In the Equation, (5) NTE (b) is net total basin energy (EP) is basin potential rain energy , Es is The sun radiation function of energy , eE is evaporation energy and (p) is infilteration facior .

5. Isolated Potential Energy on Basins:

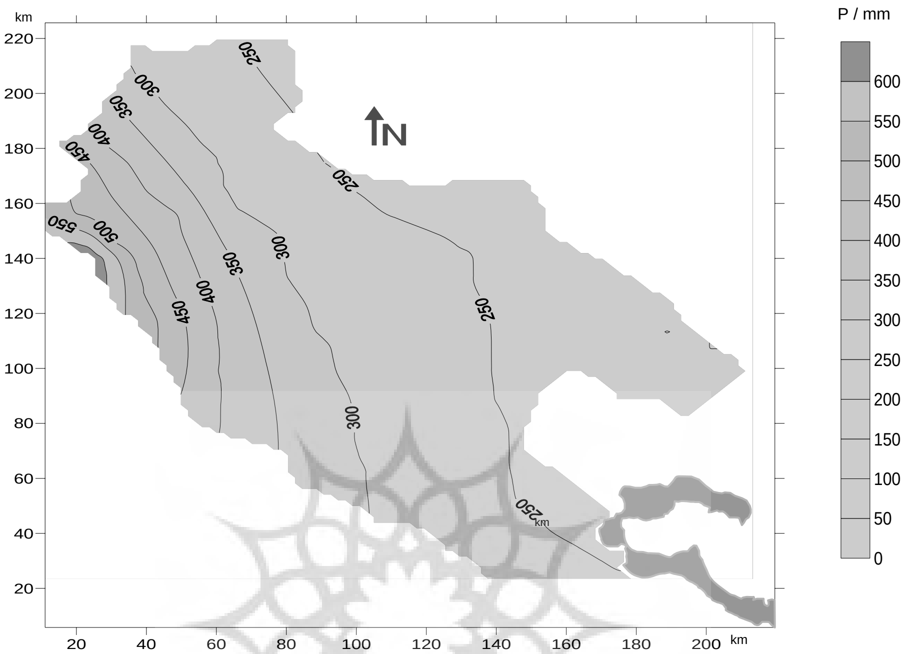
It includes a percent **Isolated Potential Energy** of total basin area that input material and energy precipitate on its level as rainfall and also water that enter it through rivers inlet. This part of basin is in fact holes that have made independent sub-basins in geomorphic systems and in practice cause that special parts of runoffs of the main basin are gathered in them and prevent them to join the main basic level of basin. In fact, in the first phase, these holes keep rainfall on them from basin and prevent its movement to the lower parts and in the second phase keep water flows injected to them through upper inlets instead of transferring them to the lower sub-basins or main inlet of the basin. In other words, after receiving input material and energy, these holes keep it in themselves and if the conditions are provided, seek threshold limit for overflow and transfer material and energy. This transfer is completely normal, but the main point is time delay that is occurred in this cycle. In other words, if in the first phase, input amount of these holes entered the cycle of geomorphic system, perhaps it would cause change of balance system in the whole basin.



GIS Isolated area of Potential Energy on Basins

6. Potential Energy(for example) Produced from Rainfall on Kor Basin:

The average annual rainfall on Kor Basin is 318 mm. The maximum annual precipitation is seen in the northwest of Kor Basin. By moving eastward, the amount of rainfall will be reduced. A rainy cell has occupied more than 600 mm of northwest of the basin, while, the great part of eastern area of the basin is between isohyetal 240-280 mm. Based on the metric plan, the weighted average of annual rainfall on the basin has been accounted for 318 mm. It is understood that about 11000 km out of 21000 km of the total area of Kor basin, has annual rainfall less than 300 mm and this area is mostly in the east side of Kor basin. If we multiply



GIS Yearly Rainfall area land on Kor Basin

this average rainfall to the total area of the basin, we can calculate the total input mass to the basin. Then we can reach to input potential energy to the basin:

EP= mgh

318:1000=0.318 rainfall to the basin in meter **(7)**

21400*1000000= 21400000000 area basin in square meter **(8)**

21400000000*0.318=6805200000rainfall to the basin in m^3 **(9)**

6805200000*1000=6805200000000weight mass of rainfall in kilogeram **(10)**

In order to calculate input potential energy to the basin, mean height of rainfall on the basin should be also calculated while considering type of rainfall on the basin (Kaviyani and Alijani, 1998: 200). So, by having the required variables, the amount of input energy on the level of Kor basin during year will be as follows:

6805200000000*9.8*2300=1.53(exp)17 Potential energy on the whole part of Kor basin (joule) **(11)**

1.53(exp)17:21400000000 =7167700 Potential energy for each m^2 of Kor basin during year (joule) **(12)**

when each energy joule unit is equal to10 000 000 ergs, so potential energy on Kor Basin due to mean annual rainfall is equal to 1.53(exp) 24 ergs that this amount of energy is equal to the energy released by explosion of 153 000 megatons of TNT, in other words, this amount of potential energy is equal to the energy of 153 atomic bombs with the power of 1 megaton TNT (Halliday, 1978: 133). Of course it should be noted that this amount of energy can not directly act on geomorphic forms of Kor Basin, but it is distributed in the form of a very delicate cybernetic function on basin level. In other words, however energy of solar radiation is one of the main energy input in the level of Kor Basin, it plays vector role in input energy balance to the basin, because increase of evaporation will cause quantitative decrease in the function of this amount of input energy produced by rainfall during year , the vector role of solar radiation on Kor Basin surface is reduced by evaporation .

7. Isolated Potential Energy on Kor Basin:

From the total 21 400 km^2 of Kor Basin, 2900 km^2 or 13.5% of the basin keeps in isolation input material and energy to the basin that falls as rainfall and also water flow that enters them through running water network. In fact, this topographic model is applied to holes that have made independent basins in Kor basin and practically cause that special parts of runoffs of Kor main basin are gathered in them and prevent them to join Kor main base level (Bakhtegan Lake). A clear sample of this model can be seen in Kafter Lake, Bekan, Lapooei and Kushk-e Hezare plains and their drainage basins (Table 1). In their first phase, the level of these topographic holes keeps rainfall from basin falls on them and prevents their movements to the lower parts. In other words, from 1.53(exp)24 ergs of potential energy on the basin, 13.4% of which, equal to 2.05(exp)23 ergs, 20 500 megatons of TNT or 20 atomic bombs of 1 megaton is kept in the cycle of Kor water system in isolation. Besides this amount we should add the amount of water that is entered to these holes through runoff network.

In the next section, in a general analysis, this important factor will be generally discussed. These sub-basins keep inputs after receiving them and if the conditions are provided, seek threshold limit for overflow and transfer material and energy (water). This transfer is completely normal, but the main point is time delay that is occurred in this cycle.

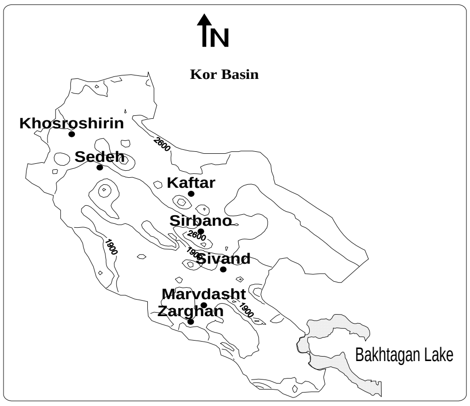


Figure 2.GIS Topographic situation of Kor River Basin**.**

8. Consuming Topographic holes and their Roles in Positive Entropy of Potential Energy of Kor Basin:

In the south and southeast of Kor Basin, while relieves are stretched to plains, we face a collection of dispersing point channel network. These networks that proceed distribution of water strength, raise water dispersion and spread level and as the result, cause the increase of evaporation level in one side and decrease of flow power in the other side. It should be noted that the area of these cells alone is 2829 km^2 or (13.2%) of the total area of basin that this area directly approaches Kor Basin to positive entry with [20.02(exp)23] erg (potential energy). The number of these topographic cells is more than other topographic cells and they compose less than half of topographic holes of Kor basin (10 cells). However, the cumulative effect of these consuming topographic holes in positive entropy of energy will have a vector state in influence quantity with internal and external vector total besides having an influence with input solar radiation that plays the role of a bar quantity, (multiplying solar radiation quantity either in the role of scalar physical function or in the role of vector quantity). However, since the residence basin of these cells is mostly alluvial deposits and fine grain of plains, languishing of main river power by these cells is mostly attributed to the increase of evaporation level than penetration.

Table 1 Isolated topographic cells in Kor Basin

Isolated topographic cells	Area km^2
Sarteen	975
Kaftar	558
Bakan	210
Lapooei	890
Kushk-e Hezar	228
Total	2871

9. Kor Geomorphic Planning attribute

In Kor geo planning form , for example we are encountering & determining of two dimentions: (Y = Q dimension , for discharge range on Kor Basin and X = P dimension, for rainfall quantity on Kor Basin rivers if and only if for this two coordinate. Because Kor Basin River comprising rainfall, river discharge, evaporation, topography gradeat , relative humidtiy, human population & so on, consequently we ought use of different variable function for example (X, T , E …) in (lin, quad , E.exp , ABexp . power , inv) form for Kor or other geomorphic planning attri bute . In this basin planning formations if there is and only there is one output for each input we have a planning basin function and if input & output is equal , we have a copula connector . However. Geomorphic environment of Kor basin has 23 geomorphic trough can base of Kor geomorphic planning attribute which divided into the following groups: humid, dry, heating, cooling, main, subsidiary, isolated, consuming, karstic and intensifier titled as topographic and climatic holes that their cybernetic can have a (point, vector, internal and external scalar collective) resultant. Certainly, each of these cells receives input from neighboring trough and gives their output to the neighboring geomorphic holes as their input, by accepting a special type of 8 geomorphic balances that follow completely and absolutely the throughput of these cells. In other words, throughput of these topographic and geomorphologic cells of Kor Basin has provided conditions through which cause each cell of Kor Basin acts as an open system in a way that the considered geomorphic system in Kor Basin has this capability to exchange energy and material with neighboring geomorphic holes through its boundaries. As the result of this completely cybernetic exchange, the possibility has been made that balance is established in geomorphic system of Kor Basin in the process of exchanging elements and their relations between input and output. This state is made by self-regulating cybernetic in system and the result of such state is systematic consistency in Kor basin. On the other hand, since there is a special relation between form [or throughput of morphic cells that their function (group of consuming, topographic,… trough) is on input materials and energy] and process or input material and energy to these cells (whether indirectly through neighboring cells or directly through rainfalls), geomorphic system of Kor Basin is in a thermodynamic balance state, consequently, in order to define such concept, there is a need to codify an extensive literature of concepts, in a way that before we reach to the depth of concepts of thermodynamic balance in the whole Kor Basin level, we should first study state, balance, imbalance and kias in basin to firstly understand the concept of balance in general and secondly to the spectrum of the concept of balance and steady in different states. But it should be noted that mathematical definition of thermodynamic balance in Kor basin is not possible without resorting to non-linear functions. In other word, this model represents extreme tendency of geometric system of Kor Basin to reach balance equal to the second law of thermodynamics. As we know the first law of thermodynamics states that the difference of final energy and initial input to Kor basin is equal to the sum of work done on the basin by this energy in addition to that amount of energy which is radiated from Kor Basin as heat based on the law of material conservation. Based on material conservation law, the second law also states that energy flow from the level with maximum potential to the level with minimum. In other words, energy resulted from mean annual rainfall of Kor Basin or even rainfall in glacial period in quaternary climatic fluctuation or maximum rainfall of the basin in the process of climatic fluctuations and changes established potentially on basin cause its flow to basin level, that is Bakhtegan Lake. Classically, this energy flow should cause doing work on basin level, or in other word, cause making and changing geomorphic levels of basin to make again balance between input and output energy to the basin. To state this model, we can use the following three functions:

(Y= 1:X) **(13)**

(Y=e^X) **(14)**

(Y= sinX:X) **(15)**

In each function, in this systematic model, after putting energy and material to geomorphic system of Kor Basin, the basin trends to thermodynamic balance and makes itself balanced as soon as possible. However, it should be noted that in practice just 10% of the total rainfall to Kor Basin changes to kinetic energy (negative entropy) and the remaining input material and energy to the basin is distributed in a way that practically enters positive entropy cycle in geomorphology of Kor Basin due to cybernetic between geomorphic cells (sub-basins). In fact, the considerable point in applying thermodynamic balance in Kor Basin is that after the entry of energy and material to geomorphic levels of Kor Basin, cybernetic system of basin tries to approaches basin to a balance level in a minimum possible time, due to this fact, the input energy is distributed among phormic levels. This state is due to input structure of Kor Basin. In other words, to establish thermodynamic balance on a geomorphic basin, the occurrence of two balance states is possible. First: after the energy entered geomorphic basin considering the throughput defined by the considered basin (rate of permeability, evaporation, transpiration, slope, topographic state, rate of vegetation and geologic structure of basin…), the great part of input energy and material to the considered basin is not distributed among neighboring sub-basins, but cause alteration and erosion in geomorphic cells of the basin. Downward movement of input and output energy and material in this state has thermodynamic form. In this case we have a basin which moves to thermodynamic balance, but at the same time, the considered basin is a basin with negative entropy. That is in this state, disorder in the basin is maximum. Second: after the energy and material entered geomorphic level of basin, due to throughput cybernetic defined by the basin, input energy and material are distributed among geomorphic levels, in other words, we face a negative feedback (positive entropy) in the output which has been caused due to distribution of material and energy between geomorphic levels, not because of negative entropy in the basin. Certainly, based on the findings of the present research, Kor River Basin is the second aforementioned state. In other words, receiving the present rainfall or encountering regional changes and fluctuation even by receiving maximum threshold quantities, Kor Basin distributes input energy between geomorphic levels of Kor Basin in a way that we face maximum positive entropy due to throughput defined by geomorphic levels of basin for systemic cybernetic of geomorphologic model of the basin that this important fact shows order in the basin of Kor river. In fact, Diagram (1) classically represents change and fluctuation in the input of Kor Basin. In other word, diagram of homographic function **(Y=1:x)** classically expresses quaternary climatic fluctuations and diagram of Trigonal function**(Y=sinX:X)** expresses climatic fluctuations in Kor Basin. The aforementioned diagram, which has been classically drawn based on input and output of Kor Basin in normal and maximum threshold of the basin (in Kharameh hydrology station, the most end of Kor river entrance to base level that is Bakhtegan lake), shows that incase of any alteration or fluctuation is made in input energy and material to Kor Basin (tectonic, neotectonic and rainfall changes or fluctuations), the basin tries to approach homographic asymptote with vector cybernetic to its geomorphic levels as soon as possible, that this important fact indicates establishment and dominance of the most subtle thermodynamic balance on Kor basin. As Diagram (1) shows classical expression of functions in thermodynamic balance of geomorphic cybernetics such as balance dominating all geomorphic system of Kor basin is **(Y= x^-1)**. In quantitative calculation of thermodynamic balance, first the table of basin output in the most end of hydrology station of Kor Basin in Kharameh was drawn for 15 years from 1969 to 1983 in average and maximum state and then output average discharge amount was drawn from both series. 15th-year average discharge of Kor River (19.7 m^3/s) enters material mass of :

19.7 * 3600 *24 * 365 = 621 259 200 **(16)**

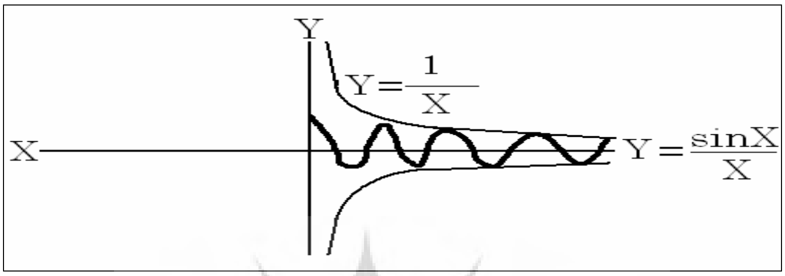


Diagram 1 Thermodynamic equilibrium form of Kor Basin**.**

(621 259 200) m^2 out of the total input material resulted from rainfall to Kor basin that is (6 805 200 000) as an output to the base level of Bakhtegan lake that is the base level of basin.

(318:1000) * (21 400 * 10 000 000)= 6 805 200 000 m **(17)**

In other words, Bakhtegan Lake receives just 9.1% of the total present input material to Kor basin (interglacial period) as the output of Kor Basin and input to itself. The average rainfall of maximum kiasic of basin is calculated through equation equal to 1320 mm that in average this amount causes the occurrence of maximum thresholds. This amount of rainfall enters 2/8x (10^10) m^3 to the basin from which, 2 576 678 040 m^3 enters Bakhtegan lake as an output from Kor basin considering mean of maximum debits. By finding kiasic relation that is a classic symbol of thermodynamic relationship between input and output of energy and material to a system (Conrad,1986: 9) in rainfall to Kor basin in normal and maximum states, expression of dominant thermodynamic balance to Kor basin is defined based on the following equation:

Table 2 Average and maximum discharge of Kor in most end of Basin Station . Kharameh in

Year	Average	Maximum
1969	8.9	34.6
1970	1.8	33.3
1971	10.9	73.6
1972	14.55	60.5
1973	11.7	44.52
1974	20.0	109.0
1975	36.2	95.4
1976	19.0	79.32
1977	48.2	147.9
1978	29.5	150.2
1979	35.7	111.1
1980	25.3	81.5
1981	16.8	87.0
1982	13.6	69.0
1983	2.8	47.8
	Mean: 19.7	Mean: 81.7

Q= (e^15.9) * (P ^ (0.997)) **(18)**

In the above equation, P is the input rainfall to the basin and the amount of water in m^3 for the basin and Q is the amount of basin discharge in the last station of Kor River and in the entrance of river to the base level of Kor Basin that is Bakhtegan Lake. The above-mentioned thermodynamic function states balancing establishment on Kor Basin that after receiving any fluctuation in the basin entrance, immediately throughput of basin causes negative feedback (positive entropy) in the basin output in base level of basin that is Bakhtegan lake by distributing input energy to the basin with a vector cybernetic based on the second rule of thermodynamic. In fact, the main factor in thermodynamic balance state of Kor basin which caused stability of Kor Basin in spite of its tendency for joining base level of Persian Gulf or central basin of Iran, is the throughput cybernetic role of basin including state of tectonics, slope, topography, wrapping up and down, operation, permeability and karst fundamental of the entire basin. In other words, the occurrence of fluctuation and climatic changes whether in glacial period or at present time (interglacial period) has existed in Kor Basin like other neighboring basins, but volume control of runoffs which have affected the basin due to these fluctuations and climatic changes, has been distributed in a way that it has not caused spatial change in collapsing its stability by direct affect of input cybernetic of Kor Basin. In other words, input of Kor Basin encompasses geomorphic forms of basin and its complications. These geomorphic forms and views have been initially formed by internal forces of earth, but they have formed their special geological structures from residual sediments produced in basin during the past geological era. In other words, geological structures of basin caused geomorphic formation of Kor Basin by tectonic, neotectonic, fluctuations and quaternary climatic changes and completely maintained the stability of geomorphic cybernetic operation of basin against these changes (considered as input to basin) during the time based on thermodynamic balance rule even when maximum threshold level amount are entered during glacial period.

10- Results

The earth is appeared in different forms in nature and the forms always incurred changes slowly or even sometimes very fast. Therefore, the role of geomorphologic studies in land development is certain. The majority of changes are naturally made in the surface forms of land as the result of the change in rainfall time, deposit amount of water flows or changes of basic levels. Therefore, the significance of present research can be summarized in this principle that stability and type of geomorphologic balance in Kor Basin or any other basin of river can be determined by calculating balance of input and output energy and material to basin and give quantitatively a vector resultant from past, present and future geomorphic state of to the managers to make plan for basin by determining the most logical management system to get the highest rate of productivity with the least fluctuation or change in geomorphic balance and stability in Kor Basin (Renwick, 1992: 270).In other word , the first function that view of the data base on Kor Basin, in deed, expression the basin planning, for example, discharge and precipitation relation. If, we derivated in definite points, we calculated Kor Basin equilibrium, and if, we integrated Kor functions we calculated Kor Basin stability. For example in Q= [(e^20) (P * 0.0122)] function we have a plan between Kor Basin discharge and precipitation. If we derivative this plan to definite points we calculate the Basin Equilibrium for each Q or P to each other, and if we integrated this fuction in definite Q or P we calculate the Kor Basin Stability:

Q= (e^15.9) * (P ^ (0.997))------------bace planning calculated structure number 16 function

d/dp = (e^15.9) * (P ^ (0.997))= (e^15.9)[P^ (8.58^{-8})]------------ derivative plan to definite points for calculate the Kor Basin Equilibrium for each P quantity **(19)**

and :

P = **e[(** $^{\ln(Q\,:\,e^{15.9})}$ **): (-0.9878)] ---------------------------------** for each quantity of Q **(20)**

These function is planning Kor Basin formatting in Thermodynamic equilibrium fundamental , that is concept of Kor Basin planning formation which based on at least two dimention in form of liner function to maximum 3 dimention in trigonometrical (e ^ x) hyperbolic form . In each previous form we can integrate the (P&Q) in vertical or horizontal expanding , in this case we can act on Kor Basin Management agent .

$$\int_{a}^{b}$$ **(e^15.9) * (P ^ (0.997))** for Kor Basin Spatial management on volum of rain quantity **(21)**

for example if (a & b) are being 275 &390 (mm) for two different year in Kor Basin , the precipitation volum on surface Basin will be :

$$\int_{275mm}^{390mm} (e^{15.9}) * (P ^{\wedge} (0.997)) = 3.02*10^{11}\ m/3$$

However we have had 3.02*10^11 m/3 body water in Kor Basin Surface . If in this case we calculate the Potential Energy . evaporate range and …. In vector matrix shape we will have spatial management that on it each humen and natural formation have logical concept . In Kor Basin Management we have : I : input energy for example sun radiation (1 dimention), precipitation (2 dimention), infiltration (3 dimention) in Kor Basin ,II : through out , for example Kor Basin Geomorphic land form structure , III : out put : vectoric variations resultant of these factors in definite points , in horizontal integrated (at the most 3 dimention) in Kor Basin with concept of risk management Kor Basin formations , and vertical integrated (at least 3 dimention) , that these formation are spatial surface of Kor Basin management in form of :

$\int_{a}^{b}$ 23000 **p (**net Kor atmosphere precipitation quantity) first dimention of Kor Basin at least planning form **--(22)**

$\int_{\alpha}^{\beta}$ 23000 **e ^[(**$^{\ln(Q\ :\ e^{15.9}\ )}$**): (-0.9878)]** second dimention of Kor Basin discharge at the most planning form or at least risk management --- **(23)**

$\int_{\alpha}^{\beta}$ 23000 **e ^[(**$^{\ln(Q\ 15e9\ )}$**): (-0.9878)]) : (**$\int_{\omega}^{\lambda}$ **(e^49.6 *cosΘ))** second dimention of Kor Basin vectoric variations resultant of these factors in definite points , in horizontal integrated (at the most 3 dimention) for crisis Management --- **(24)**

In these functions , a and b are minimum and maximum of Kor Basin yearly precipitation, β and **α are** minimum and maximum of Kor Basin discharge in definite time points, λ and ω are minimum and maximum Kor Basin latitude . vectoric variations resultant of these factors in definite points , in horizontal integrated (at the most 3 dimention) is variation natant Kor Basin surface shape that in bace of it , managers can contoroled the Kor Basin humen and natural responding .

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محاسبه و نقش بیلان انرژی و ماده ورودی و خروجی از حوضه‌های ژئومورفولوژیک در برنامه‌ریزی و مدیریت حوضه (مطالعه موردی: حوضه رودخانه کر)

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دیدگاه سیستمی که بعضاً ژئومورفولوژی کارکردی نیز خوانده شده است، از زمان گیلبرت در سال ۱۸۸۷ طرح شده است. نگرش سیستمی که در سال ۱۹۶۰ توسط فون برتالنفی مطرح و یک سال پس از مرگش اجازه انتشار یافت، تحول گسترده‌ای را در چاچوب ارزیابی پدیده‌ها به وجود آورد. مدل‌سازی سیستمی نیز واقعیتی بوده که در دهه ۱۹۶۰ با تلاش در توسعه ژئومورفولوژی کمی طرح گردید. چورلی در سال ۱۹۶۲ با انتشار مقاله‌ای در سازمان زمین‌شناسی آمریکا به نکات ارزشمندی از مفهوم سیستم در ژئومورفولوژی پرداخت. در هر حال پژوهش‌های ژئومورفولوژی حوضه‌ها را می‌توان از سه دیدگاه مورد مطالعه قرار داد که عبارتند از: دیدگاه تاریخی (موریس دیویس و طرفداران نظریه او)، کاتاستروفیسم (بزرگی وقوع رویدادها با توجه به بسامد این رویدادها) و دیدگاه سیستمی (تراز بیلان انرژی و ماده ورودی و خروجی از حوضه‌های ژئوموفیک). در مقاله حاضر حوضه ژئومورفیک و تحولات آنها از دریچه تئوری سیستمی مورد پژوهش قرار گرفته است. هدف از انجام این پژوهش تعیین وضعیت تعادلی و پایداری حوضه‌های ژئوموفیک (با تأکید بر اجرای این‌گونه مدیریت بر حوضه رودخانه کر به‌عنوان نمونه) از گذشته تا حال و در آینده است.

واژگان کلیدی: سیستم، انرژی، نوسانات اقلیمی، تغییرات اقلیمی، حوضه رودخانه کر

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