

*Archive of SID****The Combination of Mathematical and Statistical Modeling of Barchan Dunes (Case-study: Chan Jam Erg)*****Mousavi S.H.\***

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**Extended Abstract****Introduction**

The base of analysis of applicative geomorphology is according to systemic stand point. Systemic geomorphology is based on recognition of geomorphic forms and processes and relationships between them. Efficiency of this stand point, when there are linear and non linear reciprocal relationships between parts and elements of system, is very important. The studied feature in this research is Barchan dunes in the south of playa Chah Jam. In studied field, hundreds of barchans can be found; generally all of them have same size and shape. These landscapes are mobile dunes which constitute a considerable threat to infrastructure in study field with their mobile sands. They move over communication ways of region, phone lines and even in to Damghan city, and also disturb agricultural fields and intensify desertification problems in study area. Barchan dunes are open and natural systems and are capable of being modelled in different levels. These dunes are observed where sand availability is low and prevailing wind direction is quite constant.

In this paper we have tried to describe morphologic characterizes of the Barchan dune using mathematical and statistical modelling process via morphometric parameters and parabola characterizes. The obtained results from this study can be helpful in the systemic management of desert regions and also can be benefit in the plans of stables of trombone sands and recognition of critical regions from view point of windy erosion.

**Materials and Methods**

The studied area (Chah Jam erg) is located in the south of playa Haj Aligholi, in central part of Semnan province, Iran. Studied field is bounded between latitudes  $35^{\circ},45'$  to  $35^{\circ},50'$  N and between longitudes  $54^{\circ},40'$  to  $55^{\circ},10'$  E.

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For measurement of morphological parameters, at first, we have been defended a model, and Barchan morphometric characterize are measured along 10 transects in nature that these transects were covering entire extent of Chah Jam erg. Mathematical modelling of the Barchan shape is performed via its simulation in the coordinate system and using non linear equations of the parabola that it has been gotten two equations for windward side parabola and slip face parabola. Then for recognition of type and intensity of relationships between them, we have studied and reexamined these relationships, using SPSS software and regression analysis techniques. For this achievement, at start, we have reexamined linear and nonlinear, simple and multiple variable regressive analysis technique such as linear, power, exponential, cubic, logarithmic, multiplier and etc, and then we have been selected the most important and the most suitable of relationships. Totally, in this study, the most important and the most suitable of relationships are following from power relationships.

## **Results and Discussion**

Using Statistical modelling, relationships between mathematical and morphological parameters of Barchan dunes has been determined, that these relationships show a significant power relation with maximum of determination index and minimum of estimation error. One of the most important results of this study is the statistical and mathematical modelling of Barchan dunes and converting of mathematical method to statistical method and vice versa.

One of the main characteristics of morphology of Barchan dune is its parabolic shape, that this characteristic is influenced by morphology of crescent and aircraft of Barchan. Therefore for mathematical modelling of Barchan shape can be used parabola equations. On the other words, two-dimensional modelling of Barchan surfaces (regardless from its spatial characteristics) is possible through parabola equations.

The recognition of morphologic characteristics of Barchan can act as an index in order to determine the condition of Barchan system and also shed light on its trends. Furthermore, the investigation and exact estimation of these parameters is a consequence from rate of threat, destruction and annual movement that their assessment determines different region from the view point of environmental management and prioritize them. Therefore, obtained results from these methods can be very important for investigation of shape and recognition of behavior of Barchan dunes in nature.

## **Conclusion**

In this paper we have used statistical and mathematical modeling methods and have represented models that using them, can easily account morphological parameters of Barchan dunes. Therefore the results of this study provide possible of exact and rapid estimation of Barchan morphometric and morphologic parameters. The combination of two methods of statistical and mathematical modelling is a fundamental infrastructure for simulation of Barchan dunes geomorphologic characteristics in the laboratory and imaginary circumferences. Focal distance is one of the important parameters of the parabolas of Barchan dunes that shows its different situations with each other. Results show that if the focal distance of the Barchan dune decreases, its spout becomes closer and the divergent state of Barchan horns decreases, too. Barchan dunes that have farther focal distance are wider and have extensive dimensions and more volume.

**Keywords:** *Barchan, Chan Jam Erg, Parabola equations, Regression analysis technique.*