Data Article

Data on morphotectonic indices of Dashtekhak district, Iran

Ali Fadaie Kermani, Reza Derakhshani *, Shahram Shafiei Bafti

Department of Geology, Shahid Bahonar University of Kerman Iran

**A R T I C L E   I N F O**

**Article history:**
Received 9 July 2017
Received in revised form 18 August 2017
Accepted 31 August 2017
Available online 5 September 2017

**Keywords:**
Tectonics
Geomorphology
Morphometrics
Geology
Kerman

**A B S T R A C T**

Morphotectonic indices by representing the longer period of time than recorded earthquake data, are useful in evaluating the tectonic activity of a region. Dashtkhak area is located in Kerman province of Iran, where one of the most active faults, Kouhbanan strike slip fault, passes through. This data article provides a precise level data on mountain fronts and valleys of Dashtkhak region that is fundamental for morphotectonic investigations of the relationship among geomorphology and tectonic activity. This data is valuable in the field of geology and geography. Mountain fronts and valleys data is more relevant in the field of tectonics and geomorphology. It helps to evaluate a region from the viewpoint of tectonic activity. The data which are presented for 31 mountain fronts and 61 valleys, is taken by processing of remotely sensed Landsat satellite data, photogeology of areal photographs, measuring on topographic maps and controlled by field checking. This data is useful for calculating of some morphotectonic indices such as sinuosity of mountain fronts \( s_{mf} \), mountain front faceting percentage \( \text{Facet}\% \), the ratio of valley floor width to valley height \( V_f \) and the valley ratio \( V \).

© 2017 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).
**Specifications Table**

| Subject area          | Geology |
|-----------------------|---------|
| More specific subject area | Tectonics, Morphotectonics, Tectonic geomorphology |
| Type of data          | Table   |
| How data was acquired | Survey, Topographic maps, Photogeology, Field checking |
| Data format           | Raw, analyzed |
| Experimental factors  | Geometry of Mountain fronts and valleys |
| Experimental features | Mountain fronts and valleys |
| Data source location  | Dashtekhak, Zarand, Iran. Latitude: 56°19’ to 56°48’ N & Longitude: 30°46’ to 31°14’ E |
| Data accessibility    | Data is available with this article. |

**Value of the data**

- The data provides a vivid vision about activity stage of Dashtekhak area.
- It helps to explain the impact of Kouhbanan fault segments on the activity of the area.
- Data can be utilized for quantitative analysis in the field of tectonic geomorphology and morphotectonics.
- Other researchers may utilize the data for their research work and further investigation.

1. **Data**

The data presented here describes the morphometric characteristic of 31 mountain fronts and 61 valleys of Dashtekhak district. Data is given in table form. The data is prepared on the basis of field work and laboratory analysis.

2. **Experimental design, materials and methods**

Morphotectonic investigation is an effective tool to enable us to detect and distinguish the procedures that occur on the landforms. Erosion and tectonic movements leave their imprints as a morphological components which their measurement is the best approach to relate the landforms with the neotectonic evolution of the area [1,2].

In order to achieve the most accurate data, the analysis was undertaken on topographic maps in 1:10,000 scale. Landsat Satellite images and 1:50,000 scale aerial photographs beside advantages of google earth software are used to locate and measure precisely the mountain fronts and valleys geomorphic specifications. The analysis comprised the calculation of morphotectonic indices ($S_{mf}$, Facet%, $V_f$, $V$) for 31 mountain fronts and 61 valleys, according to the mathematical relationships which are presented on Tables 1–5.

The sinuosity and faceting of mountain fronts are useful morphotectonic indices that reflect the balance between erosional and tectonic forces. So that, if the tectonic activity decreases, erosion process begins to form the sinusoidal mountain fronts which turns more irregular over time. For $S_{mf}$ the closer the data to 1.0 is thought to be a tectonically highly active mountain front while the higher values belong to less active regions. For Facet% index, large percentages reflect high level of tectonic activity in the mountain fronts. Therefore, the mountain fronts influenced by active uplifting are almost straight and their $S_{mf}$ indices roughly equal 1 and Facet% around 100%. $V_f$ and $V$ are valuable...
morphometric indices to quantitatively differentiate the shape of a valley along its cross section. High values of these indices indicate U-shaped valleys that associated with low tectonic activity, while low values show deep V-shaped ones indicating active uplift [3–9].

| Table 1 |
| --- |
| Formulas for calculating the morphotectonic indices. $s_{mf}$: sinuosity of mountain fronts, $L_{mf}$: mountain front length along the foot of the mountain, $L_s$: the length of the straight line of the mountain front, Facet%: the percentage of the mountain front faceting, $L_f$: total length of facets in a mountain front, $V_f$: the valley floor width to height ratio, $V_{mf}$: the width of the valley floor, $E_{ld}$: the elevation of the left valley divides, $E_{rd}$: the elevation of the right valley divides, $E_{sc}$: the elevation of the valley floor, $V$: Valley ratio, $A_c$: the area of the valley, $A_t$: the area of the semi-circle with an equivalent radius of valley depth. |
| **Morphotectonic index** | **Formula** |
| $s_{mf}$ | $s_{mf} = L_{mf}/L_s$ |
| Facet% | Facet% = $(L_f/L_s)$ |
| $V_f$ | $V_f = 2V_{mf}/([E_{ld} - E_{sc}] + (E_{rd} - E_{sc}))$ |
| $V$ | $V = A_c/A_t$ |

| Table 2 |
| --- |
| Data which is used for determination of mountain front sinuosity index. |
| **Front no.** | **$L_{mf}$ (m)** | **$L_s$ (m)** | **$s_{mf}$** |
| F1 | 482 | 381 | 1.27 |
| F2 | 164 | 148 | 1.11 |
| F3 | 845 | 589 | 1.43 |
| F4 | 912 | 673 | 1.36 |
| F5 | 441 | 323 | 1.37 |
| F6 | 1092 | 914 | 1.19 |
| F7 | 837 | 684 | 1.22 |
| F8 | 2078 | 1628 | 1.28 |
| F9 | 1084 | 906 | 1.20 |
| F10 | 1100 | 941 | 1.17 |
| F11 | 2029 | 1818 | 1.12 |
| F12 | 1693 | 1315 | 1.29 |
| F13 | 1696 | 1514 | 1.12 |
| F14 | 1742 | 1439 | 1.21 |
| F15 | 3789 | 2919 | 1.30 |
| F16 | 601 | 517 | 1.16 |
| F17 | 1580 | 1377 | 1.15 |
| F18 | 1627 | 1181 | 1.38 |
| F19 | 1471 | 1310 | 1.12 |
| F20 | 885 | 692 | 1.28 |
| F21 | 2265 | 1772 | 1.28 |
| F22 | 778 | 597 | 1.30 |
| F23 | 2663 | 2002 | 1.33 |
| F24 | 1872 | 1668 | 1.12 |
| F25 | 2616 | 2258 | 1.16 |
| F26 | 7308 | 6332 | 1.15 |
| F27 | 2389 | 1980 | 1.21 |
| F28 | 2894 | 2343 | 1.24 |
| F29 | 807 | 712 | 1.13 |
| F30 | 936 | 870 | 1.08 |
| F31 | 726 | 832 | 0.87 |
### Table 3
Data which is used for determination of mountain front faceting index.

| Front no. | L_s (m) | L_f (m) | Facet% |
|-----------|---------|---------|--------|
| F1        | 381     | 325.4   | 85.4%  |
| F2        | 148     | 137     | 92.6%  |
| F3        | 589     | 504.4   | 85.6%  |
| F4        | 673     | 637.5   | 94.7%  |
| F5        | 323     | 263.9   | 81.7%  |
| F6        | 914     | 832     | 91.0%  |
| F7        | 684     | 568     | 83.0%  |
| F8        | 1628    | 1452    | 89.2%  |
| F9        | 906     | 837     | 92.4%  |
| F10       | 941     | 936     | 99.5%  |
| F11       | 1818    | 1678    | 92.3%  |
| F12       | 1315    | 1278    | 97.2%  |
| F13       | 1514    | 1305    | 86.2%  |
| F14       | 1439    | 1367    | 95.0%  |
| F15       | 2919    | 2696    | 92.4%  |
| F16       | 517     | 516     | 99.8%  |
| F17       | 1377    | 1332    | 96.7%  |
| F18       | 1181    | 1016    | 86.0%  |
| F19       | 1310    | 1297    | 99.0%  |
| F20       | 692     | 631     | 91.2%  |
| F21       | 1772    | 1656.8  | 93.5%  |
| F22       | 597     | 551     | 92.3%  |
| F23       | 2002    | 1968.2  | 98.3%  |
| F24       | 1668    | 1524    | 91.4%  |
| F25       | 2258    | 2068    | 91.6%  |
| F26       | 6332    | 5939    | 93.8%  |
| F27       | 1980    | 1930    | 97.5%  |
| F28       | 2343    | 2089    | 89.2%  |
| F29       | 712     | 646     | 90.7%  |
| F30       | 870     | 542     | 62.3%  |
| F31       | 832     | 511     | 61.4%  |

### Table 4
Data which is used for determination of $V_f$ index.

| Valley no. | $E_{sd}$ | $E_{sf}$ | $E_{sc}$ | $V_{fm}$ | $V_f$ |
|------------|----------|----------|----------|----------|-------|
| 1          | 2094     | 2112     | 2031     | 61       | 0.85  |
| 2          | 2210     | 2269     | 2122     | 101      | 0.86  |
| 3          | 2438     | 2338     | 2243     | 74       | 0.51  |
| 4          | 2092     | 2044     | 2021     | 41       | 0.87  |
| 5          | 2228     | 2225     | 2134     | 76       | 0.82  |
| 6          | 2335     | 2395     | 2250     | 158      | 1.37  |
| 7          | 2459     | 2524     | 2373     | 131      | 1.11  |
| 8          | 2155     | 2138     | 2089     | 39       | 0.68  |
| 9          | 2283     | 2226     | 2178     | 50       | 0.65  |
| 10         | 2460     | 2417     | 2320     | 123      | 1.04  |
| 11         | 2261     | 2241     | 2221     | 26       | 0.87  |
| 12         | 2273     | 2275     | 2167     | 11       | 1.04  |
| 13         | 2439     | 2439     | 2334     | 67       | 0.64  |
| 14         | 2400     | 2404     | 2348     | 48       | 0.89  |
| 15         | 2365     | 2382     | 2245     | 73       | 0.57  |
| 16         | 2343     | 2367     | 2224     | 114      | 0.87  |
| 17         | 2270     | 2283     | 2212     | 75       | 1.16  |
| 18         | 2284     | 2294     | 2181     | 95       | 0.88  |
| 19         | 2452     | 2418     | 2346     | 82       | 0.92  |
| 20         | 2485     | 2541     | 2418     | 133      | 1.40  |
| 21         | 2475     | 2472     | 2291     | 104      | 0.57  |
| Valley no. | $E_{h}$ | $E_{c}$ | $E_{sc}$ | $V_{min}$ | $V_{r}$ |
|-----------|--------|--------|--------|---------|-----|
| 22        | 2093   | 2116   | 2029   | 80      | 1.06 |
| 23        | 2150   | 2223   | 2050   | 98      | 0.72 |
| 24        | 2300   | 2286   | 2248   | 162     | 3.60 |
| 25        | 2225   | 2229   | 2168   | 67      | 1.14 |
| 26        | 2241   | 2199   | 2160   | 83      | 1.38 |
| 27        | 2318   | 2301   | 2261   | 71      | 1.46 |
| 28        | 2173   | 2166   | 2119   | 55      | 1.09 |
| 29        | 2124   | 2142   | 2070   | 76      | 1.21 |
| 30        | 2161   | 2184   | 2103   | 137     | 1.97 |
| 31        | 2131   | 2140   | 2097   | 71      | 1.84 |
| 32        | 2118   | 2076   | 2039   | 65      | 1.12 |
| 33        | 2076   | 2115   | 2048   | 101     | 2.13 |
| 34        | 2266   | 2239   | 2091   | 170     | 1.05 |
| 35        | 2061   | 2070   | 2002   | 88      | 1.39 |
| 36        | 2102   | 2095   | 2047   | 89      | 1.73 |
| 37        | 2211   | 2244   | 2153   | 113     | 1.52 |
| 38        | 2070   | 2074   | 2051   | 54      | 2.57 |
| 39        | 2170   | 2139   | 2119   | 106     | 2.99 |
| 40        | 2286   | 2283   | 2254   | 67      | 2.20 |
| 41        | 2104   | 2088   | 2053   | 113     | 2.63 |
| 42        | 2152   | 2177   | 2110   | 148     | 2.72 |
| 43        | 2196   | 2201   | 2131   | 122     | 1.81 |
| 44        | 2182   | 2188   | 2150   | 96      | 2.74 |
| 45        | 2164   | 2186   | 2137   | 56      | 1.47 |
| 46        | 2095   | 2096   | 2070   | 93      | 3.65 |
| 47        | 2245   | 2224   | 2164   | 138     | 1.96 |
| 48        | 2186   | 2114   | 1985   | 186     | 1.13 |
| 49        | 2240   | 2218   | 2151   | 65      | 0.83 |
| 50        | 2346   | 2321   | 2253   | 107     | 1.33 |
| 51        | 2221   | 2213   | 2099   | 329     | 2.79 |
| 52        | 2258   | 2294   | 2173   | 99      | 0.96 |
| 53        | 2385   | 2351   | 2265   | 132     | 1.28 |
| 54        | 2470   | 2449   | 2386   | 107     | 1.46 |
| 55        | 2349   | 2344   | 2289   | 81      | 1.41 |
| 56        | 2189   | 2205   | 2106   | 260     | 2.86 |
| 57        | 2236   | 2256   | 2160   | 168     | 1.75 |
| 58        | 2220   | 2215   | 2145   | 127     | 1.75 |
| 59        | 2397   | 2326   | 2219   | 96      | 0.67 |
| 60        | 2477   | 2591   | 2249   | 126     | 0.44 |
| 61        | 2339   | 2331   | 2237   | 50      | 0.51 |

Table 5

Data which is used for determination of $V$ ratio index.

| Valley no. | $A_v$ | $h$ | $A_c$ | $V$ ratio |
|------------|-------|----|-------|-----------|
| 1          | 3636  | 61 | 5842  | 0.62      |
| 2          | 6480  | 87 | 11,883| 0.55      |
| 3          | 8284  | 90 | 12,717| 0.65      |
| 4          | 278   | 16 | 402   | 0.69      |
| 5          | 6923  | 80 | 10,048| 0.69      |
| 6          | 10,847| 85 | 11,343| 0.96      |
| 7          | 8101  | 88 | 12,158| 0.67      |
| 8          | 1498  | 49 | 3770  | 0.40      |
| 9          | 2265  | 48 | 3617  | 0.63      |
| 10         | 7482  | 97 | 14,772| 0.51      |
| 11         | 211   | 15 | 353   | 0.60      |
| 12         | 8179  | 105| 17,309| 0.47      |
| 13         | 7392  | 106| 17,641| 0.42      |
Table 5 (continued)

| Valley no. | $A_v$ | h   | $A_c$ | V ratio |
|------------|-------|-----|-------|---------|
| 14         | 2187  | 52  | 4245  | 0.52    |
| 15         | 14,598| 120 | 22,608| 0.65    |
| 16         | 14,755| 119 | 22,233| 0.66    |
| 17         | 3971  | 58  | 5281  | 0.75    |
| 18         | 11,190| 103 | 16,656| 0.67    |
| 19         | 4715  | 72  | 8139  | 0.58    |
| 20         | 6640  | 67  | 7048  | 0.94    |
| 21         | 26,013| 181 | 51,435| 0.51    |
| 22         | 4620  | 64  | 6431  | 0.72    |
| 23         | 9863  | 100 | 15,700| 0.63    |
| 24         | 2309  | 38  | 2267  | 1.02    |
| 25         | 4205  | 57  | 5101  | 0.82    |
| 26         | 1776  | 39  | 2388  | 0.74    |
| 27         | 2028  | 40  | 2512  | 0.81    |
| 28         | 2416  | 47  | 3468  | 0.70    |
| 29         | 3863  | 54  | 4578  | 0.84    |
| 30         | 3902  | 58  | 5281  | 0.74    |
| 31         | 1377  | 34  | 1815  | 0.76    |
| 32         | 1657  | 37  | 2149  | 0.77    |
| 33         | 1065  | 28  | 1231  | 0.87    |
| 34         | 28,612| 148 | 34,389| 0.83    |
| 35         | 5284  | 59  | 5465  | 0.97    |
| 36         | 2854  | 48  | 3617  | 0.79    |
| 37         | 4012  | 58  | 5281  | 0.76    |
| 38         | 507   | 19  | 567   | 0.89    |
| 39         | 651   | 20  | 628   | 1.04    |
| 40         | 1139  | 29  | 1320  | 0.86    |
| 41         | 2055  | 35  | 1923  | 1.07    |
| 42         | 2123  | 42  | 2769  | 0.77    |
| 43         | 5109  | 65  | 6633  | 0.77    |
| 44         | 1710  | 32  | 1608  | 1.06    |
| 45         | 1243  | 27  | 1145  | 1.09    |
| 46         | 1068  | 25  | 981   | 1.09    |
| 47         | 4830  | 60  | 5652  | 0.85    |
| 48         | 27,017| 129 | 26,126| 1.03    |
| 49         | 5799  | 67  | 7048  | 0.82    |
| 50         | 4624  | 68  | 7260  | 0.64    |
| 51         | 19,535| 114 | 20,404| 0.96    |
| 52         | 9052  | 85  | 11,343| 0.80    |
| 53         | 9107  | 86  | 11,612| 0.78    |
| 54         | 13,919| 103 | 16,656| 0.84    |
| 55         | 3525  | 55  | 4749  | 0.74    |
| 56         | 11,173| 83  | 10,816| 1.03    |
| 57         | 15,774| 96  | 14,469| 1.09    |
| 58         | 5679  | 70  | 7693  | 0.74    |
| 59         | 10,109| 107 | 17,975| 0.56    |
| 60         | 41,221| 228 | 81,615| 0.51    |
| 61         | 7950  | 94  | 13873 | 0.57    |

Funding sources

This work is part of a MSc thesis of Ali Fadaie Kermani and was funded by Shahid Bahonar University of Kerman, Iran (93127003).

Acknowledgments

The authors thank Dr. Ahmad Abbasnejad and Dr. Shahbaz Radfar for their scientific and helpful comments.
Transparency document. Supplementary material

Transparency document associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2017.08.052.

References

[1] R. Derakhshani, S. Eslami, A new viewpoint for seismotectonic zoning, Am. J. Environ. Sci 7 (3) (2011) 212–218.
[2] E.A. Keller, N. Pinter, Active Tectonics: Earthquakes, Uplift, and Landscape, Prentice Hall, USA, (2002) 362.
[3] A. Das, G. Chauhan, S. Prizomwala, M. Thakkar, B. Rastogi, Tectonic variability along the South Katrol Hill Fault, Kachchh, Western India: insights from geomorphic indices, Z. Geomorphol. 60 (3) (2016) 209–218.
[4] B.S. Kotlia, P.K. Goswami, L.M. Joshi, A.K. Singh, A.K. Sharma, Sedimentary environment and geomorphic development of the uppermost Siwalik molasse in Kumaun Himalayan Foreland Basin, North India, Geol. J. (2017).
[5] J.V. Pérez-Peña, A. Azor, J.M. Azañón, E.A. Keller, Active tectonics in the Sierra Nevada (Betic Cordillera, SE Spain): insights from geomorphic indexes and drainage pattern analysis, Geomorphology 119 (1) (2010) 74–87.
[6] S. Prizomwala, T. Solanki, G. Chauhan, A. Das, N. Bhatt, M. Thakkar, et al., Spatial variations in tectonic activity along the Kachchh Mainland Fault, Kachchh, western India: implications in seismic hazard assessment, Nat. Hazards 82 (2) (2016) 947.
[7] M.T. Ramirez-Herrera, Geomorphic assessment of active tectonics in the Acambay Graben, Mexican volcanic belt, Earth Surf. Process. Landf. 23 (4) (1998) 317–332.
[8] P.G. Silva, J. Goy, C. Zazo, T. Bardaji, Fault-generated mountain fronts in southeast Spain: geomorphologic assessment of tectonic and seismic activity, Geomorphology 50 (1) (2003) 203–225.
[9] H. Vijith, V. Prasannakumar, M. Sharath Mohan, M. Ninu Krishnan, P. Pratheesh, River and basin morphometric indexes to detect tectonic activity: a case study of selected river basins in the South Indian Granulite Terrain (SIGT), Phys. Geogr. 38 (4) (2017) 360–378.