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A Bibliography of Geomorphometry, the Quantitative Representation of Topography—*Supplement 2.0*

By RICHARD J. PIKE [1]

Provides over 800 additions and corrections to the 1993 Bibliography of Geomorphometry and its 1995 Supplement 1.0, with a brief update on recent advances

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A Bibliography of Geomorphometry, the Quantitative Representation of Topography—*Supplement 2.0*

by
Richard J. Pike

Abstract This report adds more than 800 references on the numerical characterization of topography *(geomorphometry)* to a 1993 review of the literature and its 1995 supplement. Several corrections are included. The report also briefly reviews four recent advances and related topics: fractal modeling of fluvial networks, new sources of digital data (emphasizing Internet access), industrial micro-surface metrology, and morphometry in Japan.

The rapid growth of terrain quantification continues through its many applications in geomorphology, hydrology, geohazards mapping, and land-use evaluation. Geomorphometry (or simply *morphometry*) is an amalgam of Earth science, mathematics, engineering, and computer science; it is known variously as *terrain modeling*, *terrain analysis*, and *quantitative geomorphology*. The discipline has been revolutionized by the computer manipulation of square-grid arrays of terrain heights, or digital elevation models (DEM's), to quantify and portray ground-surface form over large areas. Morphometric procedures are now implemented routinely by programmed algorithms in geographic information systems (GIS).

This is the second update of a bibliography and introductory essay on geomorphometry (Pike, 1993). The first supplement to the listing and a revised essay appeared two years later (Pike, 1995 and 1995a). This report continues my drawing together the diverse, scattered literature on the subject and making it accessible to the research community as a public service. The need for such an effort remains evident from the accelerating use of DEM's in science and technology. Here I add over 800 items to the 2550 in the earlier two listings. More than a dozen references correct the most serious errors in Pike (1993 and 1995). The new entries include both older works overlooked previously and a good sampling of the voluminous material published since the first supplement, which was current through mid-1994. Coverage is inclusive, but not exhaustive.

The appended listing is alphabetized and unannotated, following the format of its two predecessors. The 60-topic organization of geomorphometry developed initially (Pike, 1993, Table 2) and later revised (Pike, 1995a, Table 2) still accommodates most of the latest entries. The various qualifications and caveats on accuracy and completeness stated earlier apply equally to this second supplement, which is current well into late 1996. Preparations for distributing the original bibliography and subsequent updates on-line over the Internet from a U.S. Geological Survey web site continue. The combined reference file now exceeds 3400 entries (a 0.7-mb digital file). Similarly, plans for sorting the listing topically and chronologically—both highly desirable given its size and complexity—have not yet been finalized (the file is not encoded in EndNote or other bibliographic-database format).

Highlighted here briefly are advances in established areas of morphometric research, emphasizing the now-ubiquitous DEM. On the whole, applications of numerical techniques to landscape modeling—commonly combined with nontopographic data, rather than just accounts of technique development and studies of small-area field problems, are more common now than previously. This trend may reflect a maturing of the discipline into a source of reliable tools to solve applied problems of regional scope (for example, computing basin hydrographs and estimating soil erosion and the movement of ground water). Featured in this supplement are four active, albeit not necessarily new, areas that have been identified since the release of Pike (1995) and appear particularly germane to morphometry at this time: fractal representation of channel networks—including developments in self-organized criticality, sources of digital data—emphasizing Internet availability of information, the topography of industrial micro-surfaces, and Japanese work in morphometry.

Fluvial geomorphology and fractal models

Analysis and modeling of fluvial systems continue to lead all other new developments in morphometry (Kovar and Nachtnebel, 1996; Burlando and others, 1996). Several areas are active. Among these are the novel adaptation of stream-branching topology to networks of valley glaciers (using a 90-m-resolution DEM; Bahr and Peckham, 1996) and further applications of the popular DEM-based TOPMODEL algorithm for simulating watershed hydrographs (Band and others, 1995; Quinn and others, 1995; Wolock and McCabe, 1995). Various refinements are still improving the fidelity of stream networks and drainage basins extracted from DEM's (Meisels and others, 1995; Bennett and Armstrong, 1996; Brändli, 1996; Garbrecht and Martz, 1996b; Ichoku and others, 1996; Geosoft, 1996). The approaches differ. Pilotti and others (1996), for example, have created new interactive software for the DEM-to-watershed transformation, whereas the RiverTools package developed by Peckham (1995) is fully automated. A cautionary note is emerging amid the euphoria generated by this breakthrough in morphometry (Pike, 1993, Table 3). Emphasis has shifted from simply automating the transformation to assessing accuracy of the results, with respect to both the numbers of extracted drainage cells (Lee and Chu, 1996) and to the uncertainty of the delimited catchment boundaries (Miller and Morrice, 1996). Other diagnostic work has examined the accuracy of basin slope and other catchment parameters derived from DEM's (Kienzle, 1996; Lagacherie and others, 1996). Aside from biases built into specific DEM-to-watershed algorithms, fidelity of the resulting drainage nets, basins, and parameters appears to depend primarily upon accuracy of the input DEM and its grid spacing.

Many researchers have used DEM-derived channel networks to model the spatial topology of drainage systems. Considerable attention is being devoted to understanding the scale-dependency of such networks, notably their self-similarity as expressed by fractal measures (Maritan and others, 1996; Rigon and others, 1996; Sapozhnikov and Foufoula-Georgiou, 1996b). This field is so active that its many findings, some of them contradictory, have yet to be resolved. Nikora and others (1996) reviewed the prevailing conclusions on fractal structure of channels and their networks and found "no common point of view" among the various investigators. This lack of agreement extends to such recent developments as the applicability of self-organized criticality as well as to the validity of fractality itself.

Recent DEM-based work on the spatial organization of river networks has linked their observed fractal structures with models of self-organization (Phillips, 1995b). "River patterns show consistently fractal and multifractal characteristics through experimental analysis of digital elevation maps" (Rinaldo and others, 1993). This recognition of self-organization in stream patterns has led some authors to ascribe the spatial orderliness to *self-organized criticality*, a generalizing concept adapted from physics that may have great interpretive capability (Takayasu and Inaoka, 1992; Murray and Paola, 1996; Bak, 1996; Hergarten and Neugebauer, 1996). Very briefly, self-organized criticality is a dynamical state linked to principles of energy dissipation (Bak and others, 1988; Phillips, 1995b). It is characterized by fractal (power-law) scaling in space and time, related to the occurrence of spatiotemporal chaos and intermittency in the operation of (here, land-shaping) processes (Stølum, 1996, p. 1711-1712; Sapozhnikov and Foufoula-Georgiou, 1996a, p. 1109-1110). The explanatory power ascribed to self-organized criticality in geomorphology is being challenged. While accepting the self-affinity and self-organization of many fluvial systems (Sapozhnikov and Foufoula-Georgiou, 1996b), these two authors (1996a) argue that current models of river networks and landscape evolution do not exhibit the necessary critical states. Sapozhnikov and Foufoula-Georgiou (1996a) also raise concerns over problems of inference that may arise in testing hypotheses about the multi-fractal character of topography by resorting to computer-simulated, rather than field- or map-derived, landscapes. Without tests based on empirical, morphometric observations, perhaps all that can be concluded thus far of this new development is that "while ... geomorphic evolution *can* be self-organizing, it would not be accurate to say it *is* self-organizing" (Phillips, 1995b).

A reaction to earlier enthusiasm over the putative fractality, or self-similarity over many scales, of topography is emerging in the morphometric literature. It is important, first, to distinguish the two contrasting modes of topographic characterization now prevalent in fractal studies: that of planform pattern (X,Y), typically of stream channels, just discussed above (for example, Claps and Oliveto, 1996) and that of the distribution of continuous elevation, or relief (Z) (for example, Outcalt and others, 1994). The two describe quite different attributes of topography. (I have yet to see a properly controlled experiment comparing values of the fractal dimension **D** computed in each mode for the same piece of terrain.) Although certain spatial attributes of fluvial networks (X,Y) appear to be fractal, other attributes of terrain (Z) do not. Evans and McClean (1995) contend that continuous land-surface relief is not unifractal (monofractal), and may be at most multifractal, while Andrle (1996a, b) finds that even the west coast of Great Britain, widely regarded as one of the classic examples of a fractal planform, is not statistically self-similar over its measured scale range. Rouvray (1996) offers a more general critique from several points of view, stating of computer-drawn fractal landscapes (see also, Evans and McClean, 1995) that "The initial impression of realism is soon followed by the realization that this is an entirely artificial construct." Such recent qualifications of the sweeping claims initially made for the intrinsic fractality of the ground surface mark a healthy step toward a more measured incorporation of the fractal concept into morphometry, geomorphology, and geography.

Access to data and other information

Morphometry has been moving into cyberspace, which offers free or low-cost access to data, software, and references. Digital elevation models and digital line graphs can now be downloaded over the Internet. Providers of digital data in the United States include the Geological Survey (USGS, 1994) at <http://www.nsdi.usgs.gov/nsdi/wais/water/gcip.html>), the National Imagery and Mapping Agency (NIMA, formerly the Defense Mapping Agency, DMA) at <http://www.nima.mil>, as well as commercial firms (Golden Software, 1995; Micropath, 1995b). This trend is nicely exemplified by the recently declassified Geosat data for Earth's seafloor, available at no cost at <http://www.ngdc.noaa.gov/mgg/announcements/announce_predict.html> (Carlowicz, 1995) or at <http://topex.ucsd.edu> (Smith and Sandwell, 1996). Also, the entire Digital Chart of the World (DCW) can now be downloaded at <http://waisqvarsa.er.usgs.gov/public/dcwindex.html>. Bruce Gittings (1996) has been maintaining a master list of available digital elevation data sets at <http://www.geo.ed.ac.uk/geoinfo/dem.send> (or contact him at the University of Edinburgh at <bruce@geo.ed.ac.uk>. Bresnahan (1995) provides a shorter list of on-line sites for accessing elevation data. Unclassified developments at NIMA may be followed in MAPLINES, a newsletter from their Army Customer Support Team, at <http://164.214.2.54/news/maplines>.

Software for morphometric analysis, typically in DOS, WINDOWS, and UNIX environments, is available over the Internet, free (Guth, 1995; Wessel and Smith, 1995) as well as for sale (Golden Software, 1995; at <http://ra.nilenet.com/~theprof/softwright/surfer.html>) or by license (Rüdiger Köthe's program "SARA" for automatic relief analysis is now available; contact him at <koethe@uggg01.dnet.gwdg.de>). Peckham's (1995) "RiverTools" software for fluvial networks is available at <http://cires/people/peckham.scott/RT.html>. A demonstration of results from GRASS software modules for terrain analysis and erosion modeling may be seen at <http://www.brad.ac.uk/cc/documentation/grass/viz/erosion.html>. Few bibliographies of morphometric work are on-line at this time. A listing of over 350 entries, "DTM's, Relief Analysis, Relief and Soils, and Relief and Hydrology", by Rüdiger Köthe (University of Göttingen, Germany) is available at <http://uggg-pc-s1.uni-geog.gwdg.de/pg/sara/litdgm-e.htm>. Köthe's compilation, little of which has been incorporated into this report, contains recent European work on morphometry that is largely unavailable in North America.

The digital terrain data so essential to morphometry, and the analytic or mapping software to manipulate them, have been sold for some time on media other than the Internet, commonly CD-ROM. Among these is Clark University's well-known GIS package IDRISI (Eastman, 1992). Recent additions include Chalk Butte (1995), Florinsky and others, (1995), Micropath (1995a), Natural Systems (1995), Row and Hastings (1994), Russ (1994), the U.S. National Geophysical Data Center (1995 and 1996), and Geosoft (1996). Other data sets and software packages are advertised in scientific, technical, and trade publications. Much general statistics and mathematics software for matrix data can be readily adapted to analyze digital elevation models.

Advances in data compilation continue to improve the quality and quantity of DEM's available for morphometry. The U.S. National Geophysical Data Center (NGDC) has released gridded elevations from the Global Land One-Kilometer Base Elevation (GLOBE) Project for 60% of Earth's land surface (NGDC, 1996). This hybrid data set, compiled from existing information, is projected to be 100% complete in 1997. Similarly, NIMA has released its Digital Terrain Elevation Data (DTED) Level 0 (30 arc-seconds, nominally one-kilometer, posting) for the World (information at <http://164.214.2.59/geospatial/products/DTED/dted.html>). Coverage of this data set, also a hybrid compiled from varied sources, some of them outside the U.S., was still less than 100% as of late 1996 but is expected to be complete by early 1997, when a CD-ROM is scheduled for public availability. This is a thinned data set from NIMA's Level 1 (15 arc-seconds) holdings. A 9-arc-second (about 250 m) DEM, termed the "Geodata 9-second DEM", has just been released for the entire Australian continent (Australian Geological Survey Organization, 1996). Available in 37 tiles or blocks at 1:1,000,000-scale, and in various formats, the DEM is derived from contour-map data believed accurate to better than 10 m. DEM's derived from 1:50,000-scale maps are obtainable, albeit at substantial cost, for all of Great Britain (Ordnance Survey, 1995). The French DEM data are also expensive. These and many other data sets are described in Gittings (1996).

However welcome these new DEM's, such compilations from existing sources must be regarded as only interim data sets. It is the Global Positioning System (GPS) and synthetic aperture radar interferometry (InSAR) that seem to hold the greatest promise for fine-scale regional data on ground-surface form. GPS has revolutionized geodesy—accuracy of heights measured from GPS is now down in the centimeter range (Wu and Lin, 1995), but its future as a direct DEM provider remains unsure. Because economically measuring the large number of GPS heights required for a DEM still poses a problem (Jeyapalan, 1995), morphometric applications of GPS are virtually nil at this time. Only small areas have been contoured at high accuracy from

GPS elevations (Fix and Burt, 1995). Still, current topographic uses of GPS, mainly improved control for new photogrammetric work (Greening and others, 1994) and precise leveling of existing DEM's, are important advances. Synthetic aperture radar Interferometry (variously *InSAR* or *IFSAR*) appears to have greater immediate potential for DEM creation. No fewer than five InSAR missions for DEM generation were under consideration in the United States as of late 1996 (William Acevedo, USGS, personal communication, 1996). While not as new or as accurate a technique as GPS, InSAR derives particular importance from its projected deployment on the Shuttle Radar Topography Mission (SRTM), a joint NASA/DOD plan to map the World's topography in the year 2000. Modified SIR-C hardware will be flown to image 80% of the land surface between 60 degrees north and 56 degrees south latitude. From these data a global DEM, at an anticipated spatial resolution of as little as 3 m locally (10 m coverage worldwide), is to be created (Zebker and others, 1994; Meade and Sandwell, 1996). Accordingly, much attention is being given to evaluating and improving the quality of the anticipated InSAR measurements (Mrstik and others, 1996; Pritt, 1996).

The spectacular, and recently declassified, Geosat altimetry (Smith and Sandwell, 1996) and other digital data needed to create regional bathymetric DEM's (Bourillet and others, 1996; Pratson and Haxby, 1996) continue to advance the practice of seafloor morphometry. Recent results include recognition and quantification of systematic errors in the ETOPO-5 depth data (Levitt and Sandwell, 1996; McNutt and others, 1996), geologic and geophysical interpretation of features on the Pacific seafloor (Auzende and Collot, 1996), improved contour maps of the global ocean floor (Sramek and Johnson, 1996), bathymetric-surface modeling using machine-learning techniques (Dysart, 1996), and numerical maps of seafloor classification, including roughness provinces and morphologic units (Herzfeld and Higginson, 1996). The latter work reveals the remarkable, technique-driven progress in the application of quantitative methods to regional seafloor taxonomy over the last quarter-century (compare, for example, Holcombe and Heezen, 1970).

Micro-surface morphometry

Industrial metrology, the roughness quantification of manufactured surfaces, is an important application of morphometric principles not known to most students of the land surface. The 50 publications referenced here only hint at the rapidly expanding literature; for book-length reviews see Russ (1994) and Stout (1994). Some work in quantifying micro-scale surfaces, notably those of fractured and faulted rock faces, is familiar to Earth scientists (Türk and others, 1987; Power and Tullis, 1991; Ameen, 1995; Brown, 1995). However, a wealth of experience in morphometry is available from high-technology manufacturing and materials science. Metrology, also known in industry as "surface topography", is related to *general* geomorphometry, which treats continuous landscapes that lack well-defined spatial structure (Pike, 1993), although some micro-surfacing processes can create such structure (Amar and Family, 1996). Metrology is highly applied and practical. It arose from the needs of mechanical engineers (together with the advent of the necessary equipment) to quantify surface wear of moving parts, typically metal bearings, and relate surface measurements to the properties of lubricants, the composition of bearing alloys, and methods of surface finish (Thomas and Charlton, 1981). More recently surface measurements have been correlated with processes by which thin films of materials are deposited on smooth substrates, and other applications in materials science (Amar and Family, 1996; Singh and others, 1996). Much of this work appears in *Wear, Surface Topography, Industrial Metrology, Precision Engineering, the Journal of Computer-Assisted Microscopy*, and other specialized serials. The key role of advanced materials in current manufacturing suggests that metrology will continue to develop fresh descriptive approaches that feed into land-surface morphometry.

Metrology has progressed steadily since World War II, from central-tendency and dispersion descriptions of micro-profiles on metal bearings (Myers, 1962; Thomas, 1981), through the modeling of continuous metal surfaces as random, isotropic Gaussian fields using autocorrelation and spectral analysis (Whitehouse and Phillips, 1978), to a major shift just now underway. This change, the advent of digital 3-D imaging and micro-topographic mapping (Russ, 1994; Stout, 1994) of metal, semiconductor, and even organic surfaces (Mechaber and others, 1996), is revolutionizing metrology. Methodological limitations of the traditional profile sampling by contact and noncontact stylus (El-Soudani, 1978; Nowicki, 1985; Sherrington and Smith, 1987) have been overcome by such precision instruments as the scanning tunneling and atomic force microscopes and optical interferometers (Wickramasinghe, 1989; Robinson and others, 1991). These instruments image and measure industrial surfaces at very fine resolution and enable contour maps to be created down to the atomic scale. With the linear microtopographic profile thus giving way to the continuous surface as the preferred sampling design (Stout, 1994), all the techniques of spatial analysis have become available to micro-morphometry. Recent results by Rosén and others (1996) exemplify the significant improvement in information content of 3-D surface parameters over 2-D measures. The descriptive methods of 3-D analysis in metrology, one of the first disciplines to apply fractal concepts to surfaces (Thomas and Thomas, 1986; Brown and others, 1993; Russ, 1993 and 1994), now rival those of Earth science in their complexity (Dong and others, 1994a, b; Amar and Family, 1996).

Morphometry in Japan

Over 70 references, all obtained since Pike (1995), improve access to Japanese work not commonly well-known outside that country. Although some terrain quantification was evident in Japan before World War II (Tada, 1934; Imamura, 1937; and a few other early references in Pike, 1993), the pace has accelerated with recent advances in computers and digital data. A good sampling of older postwar Japanese-language work in morphometry, which explored much the same suite of geomorphic problems addressed elsewhere at the time (Tokunaga, 1966; Hirano and Yokota, 1976; Kohchi, 1981), is included here. Communication of results remains something of a problem, as many Japanese papers still have only an English abstract and figure captions (Iwahashi, 1994; Yoshiyama, 1994; Lu and others, 1995; Takeda, 1995), but the trend in Japan is toward increasing publication in English (Lu and others, 1996). (The trend in the opposite direction is non-existent.) Morphometry in Japan typically is practiced by academic geomorphologists and geographers, as well as by government technicians responsible for quantitative map-based input to land-use policy and public safety. The country is completely covered by several digital data sets, including topography and geology. These data are used for large-area morphometric analyses based on the Japanese national standard DEM at resolutions of 1 km and 250 m, and on samples of the still incomplete 50-m DEM (Gittings, 1996).

Much of the new DEM-based work in Japan is regional slope mapping and hazard evaluation (Akagiri and Momikura, 1985; Kobashi and others, 1985; Kobashi, 1987; Ohmori and Sugai, 1995). These are immediately practical issues in humid and mountainous Japan, where the population is concentrated downstream on alluvial flats flanked by steep slopes. Closely related concerns are Holocene channeling and sedimentation (Oguchi, 1995, 1996). Digital-cartographic problems encountered in the course of manipulating the DEM data are similar to those addressed elsewhere (Shiono and others, 1985; Lu and others, 1989, 1995, 1996). Development of the software needed for morphometric analysis has also progressed, from relatively simple applications (Nogami, 1983) to multi-function packages based on image-processing concepts (Nogami, 1995; Lu and others, 1996). Among the more exciting of the new Japanese results is the three-parameter morphometric classification of Iwahashi (1994), who used the 1-km DEM to map 16 terrain types across all of Japan. This paper, which is being translated into English, marks a major advance over prior Japanese research in numerical terrain taxonomy (for example, Yoshida and Akojima, 1986). A particularly influential study has been that of Takayasu and Inaoka (1992), who simulated the evolution of eroding stream networks and concluded that their fractal-scaled model showed evidence of self-organized criticality (see, for example, discussions by Phillips, 1995b; Sapozhnikov and Foufoula-Georgiou, 1996a).

Updated work

Advances in the research areas of geomorphometry already identified (Pike, 1993, 1995a) continue unabated. Several of these are discussed above. Briefly, other new developments have occurred in hazards modeling (Jakob and Bovis, 1996; Gao and Lo, 1995), viewshed analysis (Fisher, 1996; Wang and others, 1996), GIS implementation of morphometric analysis (more than a dozen papers *in* Kovar and Nachtnebel, 1996), evaluation and improvement of DEM quality (Gesch, 1993 and 1994; Giles and Franklin, 1966), the comparative merits of square-grid DEM vs. TIN (triangulated irregular network) data structures (Kumler, 1994), delimitation of ecoregions from DEM's and other map data (Gallant and others, 1995), parsing the fluvial landscape into sub-basin facets (Dymond and Harmsworth, 1994; Dymond and others, 1995), evaluating the relation between topography and properties of vegetative cover (Florinsky and Kuryakova, 1996), creating complex digital images to visualize and interpret geomorphic features (Wester and Lundén, 1996; Shaw and others, 1996), regional meteorology (Briggs and Cogley, 1996; Fu and others, 1995), modeling geomorphic process (Perrin and others, 1993; Prosser and Dietrich, 1995; Schmidt and Montgomery, 1995; Verrecchia, 1996), modeling regional tectonics (Helm, 1995; Kooi and Beaumont, 1996), the interpretation of planetary surfaces (Bridges, 1995; Cabrol and others, 1996), and measurement of Earth's ice surfaces (Bamber, 1994; Jacobsen and Theakstone, 1995; Manninen, 1996). Some of the broader theoretical consequences of this work are developed in Phillips' (1995a) discussion of nonlinear dynamics and the evolution of geomorphic relief. Finally, two new serials, *Fractals* (the first volume was issued in 1993) and the *International Journal of Shape Modeling* (first volume in 1994) provide additional venues for the publication of morphometric research.

Proceedings of the Geomorphometry Symposium at the 1993 meeting of the International Association of Geomorphologists were published as a special issue, Supplementband 101, of the *Zeitschrift für Geomorphologie* edited by Pike and Dikau (1995). The contents include: Pike on pioneering morphometrist Walter F. Wood; Weibel and Brändli on adaptive methods for refining DEM's; Guth on DEM calculations from a morphometric toolbox for personal computers; Nogami on morphometric measures for DEM's; Chorowicz and others on pattern-recognition of geomorphic features; Argialas on structured-knowledge models of landforms; Dikau and others on the morphometry of New Mexico; Evans and McClean on the non-unifractality of the land surface; Ohmori and Sugai on models analyzing landslides in Japanese mountains; McDermid and Franklin on Remote sensing and morphometric discrimination of slope processes; Band and others on the effect of different terrain representations on watershed processes; Richards and others on static, kinematic and dynamic process-form relations; and Pike on progress, practice and prospect in geomorphometry.

New Entries

Again, I encourage additions and corrections to this bibliography from its users. I am especially interested in morphometric work that is unlikely to be available in the United States, for example, non-English-language publications from central and eastern Europe. My files on French work are also inadequate. I will be happy to exchange copies of this report and Pike (1993 and 1995) for such papers. To ensure accuracy and reduce ambiguity, please send reprints or photocopies of proposed contributions rather than just the citations, if at all possible. However, I can entertain new entries if just the following information is provided:

1. photocopy of title page, or
   - title of the work, and
   - the name(s) of author(s); surname plus two initials (or, if one given name, then spelled out)
2. year of publication
3. the exact *and complete* citation of serial or other form of publication (book, conference proceedings, and so forth), including volume number, issue number, and inclusive page numbers. For meetings give location and dates; for books give name of city and publisher

4. for non-English-language publications, an English translation of at least the title.

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References

Pike, R.J., 1993, A bibliography of geomorphometry, with a topical key to the literature and an introduction to the numerical characterization of topographic form: U.S. Geological Survey Open-file Report 93-262A, 132 p. Open-file Report 93-262B, one 3 1/2 inch 1.44 MB diskette. Formatted in Microsoft Word, version 5.0, for Macintosh. Open-file Report 93-262C, one 3 1/2 inch 1.44 MB diskette. Formatted in WordPerfect, version 5.0 for IBM-PC or compatible.

Pike, R.J., 1995, A bibliography of geomorphometry, the quantitative representation of topography—Supplement 1.0: U.S. Geological Survey, Open-file Report 95-046, 30 p. [paper copy only; 124 kb if in digital format]

BIBLIOGRAPHY OF GEOMORPHOMETRY

ADDITIONS

A

Abrahams, A.D., 1980, Channel link density and ground slope: Annals of the Association of American Geographers, v. 70, no. 1, p. 80-93.

Abrahams, A.D., 1982, The relation of chain length to chain curvature in natural channel networks: Earth Surface Processes and Landforms, v. 7, no. 5, p. 469-473.

Ackers, Peter, and Charlton, F.G., 1970, Meander geometry arising from varying flows: Journal of Hydrology, v. 11, no. 3, p. 230-252.

Adler, J.E.M., and Salisbury, J.W., 1969, Circularity of lunar craters: Icarus, v. 10, no. 1, p. 37-52.

Ahnert, Frank, 1980, A note on measurements and experiments in geomorphology: Zeitschrift für Geomorphologie, Supplementband 35, p. 1-10.

Akagiri, Takekazu, and Momikura, Yoshimasa, 1985, On the application of slope zone mapping to geomorphological mapping for applied purposes—Introduction on the geomorphological map of Umeura-Sabae (in Japanese with English summary): Chizu, Journal of the Japan Cartographic Association, v. 23, no. 2, p. 36-41.

Akojima, Isao, 1972, A map of erosion rate in mountains (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 47, no. 12, p. 776-783.

Alexopoulos, J.S., and McKinnon, W.B., 1992, Multiringed impact craters on Venus—An overview from Arecibo and Venera images and initial Magellan data: Icarus, v. 100, no. 2, p. 347-363.

Allam, M., 1987, Aplicaciones del DTM en la cartografía topográfica (in Spanish): Revista Cartográfica, no. 51/52, p. 51-63.

Allan, Stuart, 1995, Converting from manual to digital production in a small cartographic operation: Cartography and Geographic Information Systems, v. 22, no. 2, p. 149-153.

Amar, J.G., and Family, Fereydoon, 1996, Characterization of surface morphology in epitaxial growth: Surface Science, v. 365, no. 1, p. 177-185.

Ameen, M.S., 1995, Fractography—fracture topography as a tool in fracture mechanics and stress analysis. An introduction, *in* Ameen, M.S., ed., Fractography—fracture topography as a tool in fracture mechanics and stress analysis: London, Geological Society Special Publication No. 92, p. 1-10.

Anderson, M.G., 1977, Measure of three dimensional drainage basin form: Water Resources Research, v. 9, no. 2, p. 378-383.

Andrle, Robert, 1996a, Complexity and scale in geomorphology— statistical self-similarity vs. characteristic scales: Mathematical Geology, v. 28, no. 3, p. 275-293.

Andrle, Robert, 1996b, The west coast of Britain—statistical self-similarity vs. characteristic scales in the landscape: Earth Surface Processes and Landforms, v. 21, no. 10, p. 955-962.

Andrle, Robert, 1996c, Measuring channel planform of meandering rivers: Physical Geography, v. 17, no. 3, p. 270-281.

Angevine, C.L., and Turcotte, D.L., 1984, Geometrical form of aseismic ridges, volcanoes, and seamounts: Journal of Geophysical Research, v. 89, no. B13, p. 11,287-11,292.

Aniya, Masamu, 1974, Model for cirque morphology: Geographical Review of Japan, v. 47, no. 7, p. 413-425.

Argialas, D.P., 1995, Towards structured-knowledge models for landform representation, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 85-108.

Arrowsmith, J.R., Pollard, D.D., and Rhodes, D.D., 1996, Hillslope development in areas of active tectonics: Journal of Geophysical Research, v. 101, no. B3, p. 6255-6275.

Arthur, D.W.G., 1974, Lunar crater depths from Orbiter IV long-focus photographs: Icarus, v. 23, no. 1, p. 116-133.

Aspinall, Richard, Miller, David, Finch, Paul, and Fon, T.C., 1994, A model of DEM and orthophotograph quality using aerial photography, *in* GIS/LIS '94, Annual Conference and Exposition, Phoenix, AZ, October 25-27, ASPRS/ ACSM, Proceedings, p. 24-33.

Astaras, Th.A., and Soulakellis, N.A., 1992, Contribution of digital image analysis techniques on Landsat-5 TM imageries for drainage network delineation—a case study from the Olympus Mountain, W. Macedonia, Greece, *in* Annual Conference of the Remote Sensing Society (UK), 18th, University of Dundee, Scotland: Proceedings, p. 163-172.

Australian Geological Survey Organization, 1996, A digital elevation model for the Australian continent: Aus•Geo News, No. 36, October, p. 4.

Auzende, J.-M., and Collot, J.-Y., eds., 1996, Seafloor Mapping in the West, Southwest, and South Pacific—Results and Applications: Marine Geophysical Researches, v. 18, nos. 2-4, p. 119-506.

Aydan, Ömer, and Shimizu, Yasuhiro, 1995, Surface morphology characteristics of rock discontinuities with particular reference to their genesis, *in* Ameen, M.S., ed., Fractography—fracture topography as a tool in fracture mechanics and stress analysis: London, Geological Society Special Publication No. 92, p. 11-26.

B

Bagnold, R.A., 1961, Some aspects of the shape of river meanders: U.S. Geological Survey Professional Paper 282-E, p. 135-144.

Bahr, D.B., and Peckham, S.D., 1996, Observations and analysis of self-similar branching topology in glacier networks: Journal of Geophysical Research, v. 101, no. B11, p. 25,511-25,521.

Bak, Per, 1996, How Nature Works, the science of self-organized criticality: New York, Copernicus (Springer), 212 p.

Bak, Per, Tang, Chao, and Wiesenfeld, Kurt, 1988, Self-organized criticality: Physical Review A, v. 38, no. 1, p. 364-374.

Baldwin, R.B., 1965, The crater diameter-depth relationship from Ranger VII photographs: Astronomical Journal, v. 70. no. 10, p. 545-547.

Bamber, J.L., 1994, A digital elevation model of the Antarctic ice sheet derived from ERS-1 altimeter data and comparison with terrestrial measurements: Annals of Glaciology, v. 20, p. 48-54.

Bamber, J.L., and Bentley, C.R., 1994, A comparison of satellite-altimetry and ice-thickness measurements of the Ross Ice Shelf: Annals of Glaciology, v. 20, p. 357-364.

Band, L.E., and Moore, I.D., 1995, Scale—Landscape attributes and geographical information systems: Hydrological Processes, v. 9, No. 3/4, p. 401-422.

Band, L.E., Vertessy, Rob, and Lammers, R.B., 1995, The effect of different terrain representations and resolution on simulated watershed processes, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 187-199.

Banks, Richard, 1991, Contouring algorithms: Geobyte, v. 6, no. 5, p. 15-23.

Bauer, J., 1985, User's Guide to the Digital Relief Model: Braunschweig, Germany, Technical University, paging unknown.

Bauer, J., Rohdenburg, H., and Bork, H.-R., 1985, Ein Digitales Reliefmodell als Voraussetzung für ein deterministisches Modell der Wasser- und Stoff-Flüsse (in German): Landschaftsgenese und Landschaftsökologie (Braunschweig), v. 10, p. 1-15.

Baulig, Henri, 1928, Les hauts niveaux d'érosion eustatique dans le Bassin de Paris (in French): Annales de Géographie, v. 37, p. 288, 385.

Baulig, Henri, 1962, Sur une méthode altimètrique d'analyse morphologique appliquée à la Bretagne

Péninsulaire (in French): Bulletin de l'Association de Géographes Français, no. 10, paging unknown.

Beauvais, A., Montgomery, D.R., and Dubois, J., 1994, Planform scaling properties of rivers and channel networks (abs.): Eos, Transactions of the American Geophysical Union, v. 75, no. 44, Supplement, p. 303.

Beauvais, A.A., and Montgomery, D.R., 1996, Influence of valley type on the scaling properties of river planforms: Water Resources Research, v. 32, no. 5, p. 1441-1448.

Bennett, B.S., 1991, High resolution DEM's from DLG's: U.S. Geological Survey, Western Mapping Center, Menlo Park, CA, Internal report 89-2, 7 p.

Bennett, D.A., and Armstrong, M.P., 1996, An inductive knowledge-based approach to terrain feature extraction: Cartography and Geographic Information Systems, v. 23, no. 1, p. 3-19.

Bennett, J.M., Jahanmir, Jay, Podlesny, J.C., Balter, T.L., and Hobbs, D.T., 1995, Scanning force microscope as a tool for studying optical surfaces: Applied Optics, v. 34, no. 1, p. 213-230. ["SFM", formerly "AFM"]

Bennett, J.M., Tehrani, M.M., Jahanmir, Jay, Podlesny, J.C., and Balter, T.L., 1995, Topographic measurements of supersmooth dielectric films made with a mechanical profiler and a scanning force microscope: Applied Optics, v. 34, no. 1, p. 209-212.

Bennett, M., 1990, The cwms of Snowdonia—A morphometric analysis: London, Queen Mary and Westfield College, Department of Geography, Research Paper No. 2, 48 p.

Benosky, C.P., and Merry, C.J., 1995, Automatic extraction of watershed characteristics using spatial analysis techniques with application to groundwater mapping: Journal of Hydrology, v. 173, Nos. 1-4, p. 145-163.

Bergeron, N.E., 1996, Scale-space analysis of stream-bed roughness in coarse gravel-bed streams: Mathematical Geology, v. 28, no. 5, p. 537-561.

Bernard, Antoine, 1982, Digitization of relief data and exploitation of digital terrain models at I.G.N (France), *in* International Symposium on Computer-Assisted Cartography, 5th, Crystal City, VA, August 22-28, ISPRS IV—Proceedings, p. 65-73.

Berry, J.K., 1993, Beyond Mapping—concepts, algorithms, and issues in GIS: Fort Collins, CO, GIS World Books, 246 p. [esp. chapters 17, 18, 27, and 31]

Beven, Keith, 1995, Linking parameters across scales—subgrid parameterizations and scale dependent hydrological models, *in* Kalma, J.D., and Sivapalan, Murugesu, eds., Scale Issues in Hydrological Modelling (special issue): Hydrological Processes, v. 9, No. 5/6, p. 507-525.

Beymer, David, and Poggio, Tomaso, 1996, Image representation for visual learning: Science, v. 272, no. 5270, p. 1905-1909.

Bilgin, T., 1960, A contribution to the morphometrical investigation of Turkey: Review of the Geographical Institute of Istanbul, v. 6, p. 74-77.

Bills, B.G., and Nerem, R.S., 1995, A harmonic analysis of Martian topography: Journal of Geophysical Research, v. 100, no. E12, p. 26,317-26,326.

Bindlish, Rajat, and Barros, A.P., 1996, Aggregation of digital terrain data using a modified fractal interpolation scheme: Computers and Geosciences, v. 22, no. 8, p. 907-917.

Bindschadler, R.A., and Vornberger, P.L., 1994, Detailed elevation map of Ice Stream C, Antarctica, using satellite imagery and airborne radar: Annals of Glaciology, v. 20, p. 327-335.

Bjørke, J.T., and Midtbø, 1993, Generalization of digital surface models: International Cartographic Conference, 16th, Cologne, Germany: Proceedings, p. 363-371.

Boer, M.M., Del Barrio, Gabriel, and Puigdefábregas, Juan, 1996, Mapping soil depth classes in dry Mediterranean areas using terrain attributes derived from a digital elevation model: Geoderma, v. 72, nos. 1-2, p. 99-118.

Böhme, Rolf, compiler, 1991, Inventory of World Topographic Mapping, Volume 2, South America, Central America and Africa: London, Elsevier Applied Science Publishers, for The International Cartographic Association, 524 p.

Bolton, M.J.P., and Tam, C.C., 1974, Computer method for radar site selection: The Cartographic Journal, v. 11, no. 2, p. 117-120.

Borst, T.H., Münzinger, P.C., and Weis, O., 1994, Characterization of undoped and doped homoepitaxial diamond layers produced by microwave plasma CVD: Diamond and Related Materials, v. 3, nos. 4-6, p. 515-519.

Bouligand, G., 1929, Sur la notion d'ordre de mesure d'un ensemble fermé (in French): Bull. Sci. math., v. 52, p. 185-192. [early fractal work]

Bourillet, J.F., Edy. C., Rambert, F., Satra, C., and Loubrieu, B., 1996, Swath mapping system processing—bathymetry and cartography: Marine Geophysical Researches, v. 18, nos. 2-4, p. 487-506.

Bouska, Jirí, 1967, Crater diameter-depth relationship from Ranger lunar photographs: Nature, v. 213, January 14, p. 166.

Boyko, K.J., 1987, Producción de modelos altimétricos digitales mediante la digitalización de estereomodelos (in Spanish): Revista Cartográfica, no. 51/52, p. 65-78.

Bradley, J.N., 1970, Hydraulics of Bridge Waterways (2nd edition, reprinted 9/73): U.S. Department of Transportation/Federal Highway Administration, Hydraulic Design Series No. 1, 111 p.

Brandes, Donald, 1983, Sources for relief representation techniques: The Cartographic Journal, v. 20, no. 2, p. 87-94.

Brändli, Martin, 1991, Oberflächeninterpolation aus Höhenkurvendaten: Geographisches Institut, Universität Zürich, M.Sc. Thesis, 106 p.

Brändli, Martin, 1992, A triangulation-based method for geomorphological surface interpolation from contour lines: European Conference on Geographical Information Systems, 3rd, Munich (EGIS '92), Proceedings, v. 1, p. 691-700.

Brändli, Martin, 1995, Extraction of terrain features from DTMs based on the concept of interlocking ridge and channel networks, *in* Joint European Conference on Geographical Information, The Hague, Proceedings, v. 1, p. 96-101.

Brändli, Martin, 1996, Hierarchical models for the definition and extraction of terrain features, *in* Burrough, Peter, and Frank, A.U., eds., Natural Objects with Indeterminate Boundaries, GISDATA series 2: London, Taylor and Francis, p. 257-270.

Brändli, Martin, and Schneider, Bernhard, 1994, Shape modeling and analysis of terrain: International Journal of Shape Modeling, v. 1, no. 2, p. 167-189.

Bresnahan, Tom, 1995, Take a tour of online sites offering digital data—Stop 1, Elevation data (DEM) sites: COGS•letter (of the Computer Oriented Geological Society): November/December, p. 3-4.

Bribiesca, Ernesto, 1982, Shapes classification on digital images, *in* International Symposium on Computer-Assisted Cartography, 5th, Crystal City, VA, August 22-28, ISPRS IV—Proceedings, p. 95-103.

Bridges, N.T., 1995, Submarine analogs to Venusian pancake domes: Geophysical Research Letters, v. 22, no. 20, p. 2781-2784.

Briggs, P.R., and Cogley, J.G., 1996, Topographic bias in mesoscale precipitation networks: Journal of Climate, v. 9, no. 1, p. 205-218.

Brivio, P.A., Furini, P., Righetti, M., and Marini, Daniele, 1994, Synthesis of multispectral images of natural landscapes, *in* Brunet, P., and Jansen, F.W., eds., Photorealistic Rendering in Computer Graphics: New York, Springer Verlag, p. 240-250.

Brook, G.A., and Hanson, M., 1991, Double Fourier analysis of cockpit and doline karst near Browns Town, Jamaica: Physical Geography, v. 12, no. 1, p. 37-54.

Brook, G.A., and Mitchelson, R.L., 1981, Single and double Fourier series analysis of cockpit karst in Puerto Rico: International Congress of Speleology, 8th, Proceedings, v. 1, p. 53-55.

Brookes, A., 1987, Restoring the sinuosity of artificially straightened stream channels: Environmental Geology and Water Sciences, v. 19, no. 1, p. 33-41.

Brown, A.E., 1963, Matrix methods for terrain profile simulation (Project CATVAR): Buffalo, NY, Cornell Aeronautical Laboratory, Report No. VT-1810-G-1, 81 p.

Brown, C.A., and Savary, G., 1991, Describing ground surface texture using contact profilometry and fractal analysis: Wear, v. 141, no. 2, p. 211-226.

Brown, C.A., Charles, P.D., Johnsen, W.A., and Chesters, S., 1993, Fractal analysis of topographic data by the patchwork method: Wear, v. 161, nos. 1-2, p. 61-67.

Brown, C.D., and Grimm, R.E., 1966, Floor subsidence and rebound of large Venus craters: Journal of Geophysical Research, v. 101, no. E11, p. 26,057-26,067.

Brown, S.R., 1988, Correction to "A note on the description of surface roughness using fractal dimension": Geophysical Research Letters, v. 15, no. 3, p. 286.

Brown, S.R., 1995, Simple mathematical model of a rough fracture: Journal of Geophysical Research, v. 100, No. B4, p. 5941-5952.

Bruno, B.C., and Taylor, G.J., 1995, Morphologic identification of Venusian lavas: Geophysical Research Letters, v. 22, no. 14, p. 1897-1900.

Bryant, E.S., Ricketts, T.H., Birnie, R.W., and Kimball, K.D., 1991, Use of digital elevation data, Landsat TM, and vector map data to model treeline in the northeastern U.S.: Thematic Conference on Remote Sensing, 8th, Denver, CO, April 29-May 2, Environmental Research Institute of Michigan, Ann Arbor, Proceedings, p. 1111-1121.

Buchanan, Mark, 1996, Travels on rugged landscapes: Nature, v. 382, no. 6589, p. 302-303. [report on conference, Landscape Paradigms in Physics and Biology, May 13-17, Los Alamos National Laboratory, NM]

Bucknam, R.C., and Anderson, R.E., 1979, Estimation of fault-scarp ages from a scarp-height/slope-angle relationship: Geology, v. 7, no. 1, p. 11-14.

Bullard, J.E., Thomas, D.S.G., Livingstone, I., and Wiggs, G.F.S., 1995, Analysis of linear sand dune morphological variability, southwestern Kalahari Desert: Geomorphology, v. 11, no. 3, p. 189-203.

Bulmer, M.H., and Guest, J.E., 1996, Modified volcanic domes and associated debris aprons on Venus, *in* McGuire, W.J., Jones, A.P., and Neuberg, Jurgen, eds., Volcano Instability on the Earth and Other Planets: London, UK, Geological Society Special Publication No. 110, p. 349-371.

Burkhardt, Rudolf, 1984, Métodos e instrumentos análogos (in Spanish): Revista Cartográfica, n. 45, p. 65-160.

Burlando, P., Menduni, G., and Rosso, R., eds., 1996, Fractals, Scaling and Nonlinear Variability in Hydrology (special issue): Journal of Hydrology, v. 187, nos. 1-2, 264 p.

Busoni, E., Sanchis, P.S., Calzolari, C., and Romagnoli, A., 1995, Mass movement and erosion hazard patterns by multivariate analysis of landscape integrated data—the Upper Orcia River Valley (Siena, Italy) case: Catena, v. 25, nos. 1-4, p. 169-185.

C

Cabral, M., and Burges, S.J., 1992, DEMON—A new method for the automated extraction of contributing areas and drainage networks from rectangular DEMs (abs.): Eos, Transactions of the American Geophysical Union, v. 73, no. 43, Supplement, p. 202-203.

Cabrol, N.A., Grin, E.A., and Dawidowicz, Gilles, 1996, Ma'adim Vallis revisited through new topographic data—evidence for an ancient intravalley lake: Icarus, v. 123, no. 2, p. 269-283.

Campbell, B.A., and Shepard, M.K., 1996, Lava flow roughness and depolarized radar scattering: Journal of Geophysical Research, v. 101, no. E8, p. 18,941-18,951.

Campbell, R.H., Bernknopf, R.L., and Soller, D.R., 1994, Mapping time-dependent changes in soil slip-debris flow probability: U.S. Geological Survey, Open-file Report 94-699, 66 p.

Canfield, Dan, and Samaranayake, V.A., 1996, Digital elevation model test for LIDAR and IFSARE sensors: Rolla, MO, U.S. Geological Survey Open-File Report 96-401, 55 p. [Interferometric SAR for Elevation]

Cape, M.R., 1986, Hill-shading and half-tone reproduction: The Cartographic Journal, v. 23, no. 2, p. 99-105.

Cardenas-Garcia, J.F., and Severson, G.R., 1996, Optical, noncontact, automated experimental techniques for three-dimensional reconstruction of object surfaces using projection moiré, stereo imaging, and phase-measuring profilometry: Denver, CO, U.S. Geological Survey, Open-File Report 95-433, 130 p.

Carlowicz, Michael, 1995, New map of seafloor mirrors surface: Eos Transactions of the American Geophysical Union, v. 76, no. 44, p. 441-442.

Cayley, Arthur, 1857, On the theory of the analytical forms called trees: The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science, v. 13, 4th Series, Jan.-June, no. 85, p. 172-176.

Chalk Butte, Inc., 1995, U.S. GIS (color shaded-relief digital images of the 48 United States, in blocks, computed from USGS 3" DEM's, on CD-ROM, combined with software to display and query data): 137 Steele Lane, Boulder, WY 82923. [Macintosh only, as of 1995; *reviewed in* GIS World, Nov. 1995, p. 102 & 104]

Chandler, J.H., and Brunsden, Denys, 1995, Steady state behaviour of the Black Ven mudslide—the application of archival analytical photogrammetry to studies of landform change: Earth Surface Processes and Landforms, v. 20, no. 3, p. 255-275.

Chavez, P.S., Jr., and Karl, H.A., 1995, Detection of barrels and waste disposal sites on the seafloor using spatial variability analysis on sidescan sonar and bathymetric images: Marine Geodesy, v. 18, no. 3, p. 197-211.

Chong, A.K.F., and Lieu, D.K., 1993, Contour mapping of precision defects with laser Doppler vibrometry: Precision Engineering, v. 15, no. 2, p. 166-172.

Chorley, R.J., 1966, The application of statistical methods to geomorphology, *in* Dury, G.H., ed., Essays in Geomorphology: Frome and London, UK, Butler & Tanner; also New York, Elsevier, p. 275-387.

Chorley, R.J., 1995, Classics in physical geography revisited—"Horton, R.E., 1945, Erosional development of streams and their drainage basins, hydrophysical approach to quantitative morphology: Geological Society of America Bulletin, 56, p. 275-370": Progress in Physical Geography, v. 19, no. 4, p. 533-554.

Chorowicz, Jean, Parrot, J.-F., Taud, Hind, Hakdaoui, M., Rudant, J.-P., and Rouis, T., 1995, Automated pattern-recognition of geomorphic features from DEMs and satellite images, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 69-84.

Chrisman, N.R., 1995, Beyond Stevens—A revised approach to measurement for geographic information, *in* American Society for Photogrammetry and Remote Sensing / American Congress on Surveying and Mapping, Annual Convention, Charlotte, NC, February 27 - March 2: Technical Papers, v. 4 (AutoCarto 12), p. 271-280.

Christofoletti, Antonio, 1969, Análise morfométrica de bacias hidrográficas: Notícia Geomorfológica, v. 9, no. 18, p. 35-64.

Christofoletti, Antonio, 1971a, Análise morfométrica das bacias hidrográficas: Boletim Geográfico (Rio de Janeiro), v. 30, no. 220, p. 132-159.

Christofoletti, Antonio, 1971b, Correlação de variáveis para o estudo comparativo de bacias hidrográficas: Boletim Geográfico (Rio de Janeiro), v. 30, no. 224, p. 101-106.

Christofoletti, Antonio, 1978, Procedimentos expeditos para o cálculo da densidade de drenagem: Boletim Geográfico (Rio de Janeiro), v. 36, no. 256, p. 96-104.

Church, E.L., 1988, Fractal surface finish: Applied Optics, v. 27, no. 8, p. 1518-1526.

Church, E.L., and Berry, H.C., 1982, Spectral analysis of the finish of polished optical surfaces: Wear, v. 83, no. 1, p. 189-201.

Claps, Pierluigi, and Oliveto, Giuseppe, 1996, Reexamining the determination of the fractal dimension of river networks: Water Resources Research, v. 32, no. 10, p. 3123-3135.

Clarke, A.L., Gruen, A., and Loon, J.C., 1982, A contour-specific interpolation algorithm for DEM generation: Symposium on Mathematical Models, Accuracy Aspects and Quality Control, Helsinki University of Technology, Finland, June 7-11, Proceedings, p. 68-81.

Cleave, Richard, and Technion-Israel Instutute of Technology, 1995, Satellite revelations—new views of the Holy Land: National Geographic, v. 187, no. 6, p. 88-105.

Clifford, N.J., 1996, Classics in physical geography revisited—"Leopold, L.B., and Maddock, Thomas, Jr., 1953, The hydraulic geometry of stream channels and some physiographic implications: U.S. Geological Survey Professional Paper 252, 56 p.": Progress in Physical Geography, v. 20, no. 1, p. 81-87.

Cluis, Daniel, Martz, Lawrence, Quentin, Emmanuelle, and Rechatin, Cécile, 1996, Coupling GIS and DEM to classify the Hortonian pathways of non-point sources to the hydrographic network, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 37-44.

Coates, D.R., 1958, Quantitative geomorphology of small drainage basins of southern Indiana: Department of Geology, Columbia University, NY, Office of Naval Research, Geography Branch, Project NR 389-042, Technical Report No. 10, 124 p. [Ann Arbor, University Microfilms: publ. no. 17, MicA 56-2237]

Coffman, D.M., Keller, E.A., and Melhorn, W.N., 1972, New topologic relationship as an indicator of drainage network evolution: Water Resources Research, v. 8, no. 6, p. 1497-1505.

Coleman, N.L., 1981, A note on topological matrices and characteristic polynomials of fourth-magnitude drainage net maps: Earth Surface Processes and Landforms, v. 6, no. 5, p. 485-491.

Collins, G., 1989, A fast recursive parallel algorithm for triangulation of unordered DTMs: Cartography, v. 18, no. 1, p. 21-25.

Collins, S.H., 1981, Algorithms for dense digital terrain models: Photogrammetric Engineering and Remote Sensing, v. 47, no. 1, p. 71-76.

Colosimo, C., and Mendicino, G., 1996, Scale definition in an integrated GIS hydrological model—a case study, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 385-393.

Common, R., 1961, A suggestion for terrain profiles, based on the thalweg and watershed lines: The Irish Geographer, v. 4, no. 3, p. 209-212.

Connors, Chris., 1995, Determining heights and slopes of fault scarps and other surfaces on Venus using Magellan stereo radar: Journal of Geophysical Research, v. 100, no. E7, p. 14,361-14,381.

Corr, D., 1993, Production of DEMs from ERS-1 radar data: Mapping Awareness, v. 7, p. 18-22.

Costa-Cabral, M.C., and Burges, S.J., 1995, Topologic dependence of geomorphologic laws and the question of channel networks randomness (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F248.

Coster, M., and Chermant, J.-L., 1989, Précis d'analyse d'images (in French): Paris, Presses du Centre National de la Recherche Scientifique, 560 p.

Cox, B.L., and Wang, J.S.Y., 1993, Fractal surfaces—measurement and applications in the Earth sciences: Fractals, v. 1, no. 1, p. 87-115.

Crave, Alain, 1995, Quantification de l'organisation des reseaux hydrographiques (largely in French, but including three sections in English): Rennes, France, doctoral thesis, Université de Rennes, Mémoires de Géosciences Rennes, No. 65, 210 p.

Croft, S.K., 1992, Proteus—geology, shape and catastrophic destruction: Icarus, v. 99, no. 2, p. 402-419.

Cronin, Terry, 1992, Automated interpretation of topographic maps: Army Conference on Applied Mathematics and Computing, 10th, West Point, NY, Transactions (ARO Report 93-1), p. 173-193.

Cronin, Terry, 1995, Automated reasoning with contour maps: Computers and Geosciences, v. 21, no. 5, p. 609-618.

Cross, C.A., 1954, The geometry of crater shadows: Journal of the British Astronomical Association, v. 64, p. 167-171.

Csathó, B.M., 1995, Mapping ice sheet topography with laser altimetry in Greenland (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F194.

Culling, W.E.H., 1988, Dimension and entropy in the soil-covered landscape: Earth Surface Processes and Landforms, v. 13, no. 7, p. 619-648.

Culling, W.E.H., 1989, The characterization of regular/irregular surfaces in the soil-covered landscape by Gaussian Random Fields: Computers and Geosciences, 15, no. 2, p. 219-226.

D

Dalrymple, R.W., and Rhodes, R.N., 1995, Estuarine dunes and bars, *in* Perillo, G.M.E., ed., Geomorphology and Sedimentology of Estuaries: Amsterdam, Elsevier, Developments in Sedimentology 53, p. 359-442.

Dauteuil, O., 1995, Fault pattern from Seabeam processing—the Western part of the Blanco Fracture Zone (NE Pacific): Marine Geophysical Researches, v. 17, no. 1, p. 17-35.

Davis, E.J., Stout, K.J., and Sullivan, P.J., 1990, The scope of three-dimensional surface topography: Industrial Metrology, v. 1, p. 193-216.

Davis, J.C., 1976, Contouring algorithms, *in* AutoCarto II—International Symposium on Computer-Assisted Cartography, September 21-25, 1975, U.S. Bureau of the Census/American Congress on Surveying and Mapping, Proceedings, p. 352-359.

Daviss, Bennett, 1996, Snap happy under the sea: The New Scientist, 22 June, p. 34-37. [synthetic aperture sonar for detailed seafloor bathymetry (SAS)]

Dawes, W.R., Short, D.L., O'Loughlin, E.M., and Wilson, C.J., 1989, A contour-based procedure for modelling hillslope hydrology in complex topography (abs.): Eos, Transactions, American Geophysical Union, v. 70, no. 43, p. 1094.

Day, Michael, 1976, The morphology and hydrology of some Jamaican karst depressions: Earth Surface Processes, v. 1, no. 2, p. 111-129.

De Floriani, Lelia, Falcidieno, Bianca, and Pienovi, Caterina, 1985, DeLaunay-based representation of surfaces defined over arbitrarily shaped domains: Computer Vision, Graphics, and Image Processing, v. 32, p. 127-140.

Defense Mapping Agency, 1986, Product specifications for digital terrain elevation data (DTED) (2nd ed.): St. Louis, MO, Defense Mapping Agency Aerospace Center, 26 p.

DeMoustier, C., 1988, State of the art in swath bathymetry survey systems: International Hydrographic Review, v. 65, no. 1, p. 25-54.

DeMulder, M.L., 1994, Elevation data to support the National Geospatial Data Framework, *in* GIS/LIS '94, Annual Conference and Exposition, Phoenix, AZ, October 25-27, ASPRS/ ACSM, Proceedings, p. 218-222.

Depraetère, Christian, 1987, Classification automatique interrégionale à partir de MNT issus de la BDZ (in French): Paris, Institut Géographique Nationale, ANGEO/DELI/SCME Rapport 4, paging unknown.

Depraetère, Christian, and Moniod, F., 1991, Contribution des modèles numériques de terrain à la simulation des écolements dans un réseau hydrographique—Example du bassin de Bras-David (Guadeloupe): Hydrol. Continent., v. 6, no. 1, p. 29-53.

DeRose, R.C., 1996, Relationship between slope morphology, regolith depth, and the incidence of shallow landslides in eastern Taranaki hill country: Zeitschrift für Geomorphologie, Supplementband 105, p. 49-60.

DeRose, R.C., Trustrum, N.A., and Blaschke, P.M., 1991, Geomorphic change implied by regolith-slope relationships on steepland hillslopes, Taranaki, New Zealand: Catena, v. 18, no. 5, p. 489-514.

Deschaux, Vincent, and Souriau, Marc, 1996, Topography of large-scale watersheds—fractal texture and global drift. Application to the Mississippi basin: Earth and Planetary Science Letters, v. 143, no. 4, p. 257-267.

Desmet, P.J.J., and Govers, G., 1995, GIS-based simulation of erosion and deposition patterns in an agricultural landscape—A comparison of model results with soil map information: Catena, v. 25, nos. 1-4, p. 389-401.

Dietler, Giovanni, and Zhang, Y.-C., 1992, Fractal aspects of the Swiss landscape, *in* Bunde, Armin, ed., Fractals and Disorder: Physica A, v. 191, nos. 1-4, p. 213-219.

Dietrich, W.E., Reiss, Robert, Hsu, M.-L., and Montgomery, D.R., 1995, A process-based model for colluvial soil depth and shallow landsliding using digital elevation data: Hydrological Processes, v. 9, no. 3/4, p. 383-400.

Dikau, Richard, Brabb, E.E., Mark, R.K., and Pike, R.J., 1995, Morphometric landform analysis of New Mexico, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 109-126.

DiNardo, N.J., 1994, Nanoscale Characterization of Surfaces and Interfaces: Weinheim, GER, VCH Publ., 163 p.

Ding, Yuemin, and Densham, P.J., 1994, A loosely synchronous, parallel algorithm for hill shading digital elevation models: Cartography and Geographic Information Systems, v. 21, no. 1, p. 5-14.

Dixon, T.H., ed., 1995, SAR Interferometry and Surface Change Detection: Workshop held in Boulder, CO, February 3-4, 1994, Univ. Miami, FL, RSMAS Technical Report TR 95-003, 97 p.

Dixon, T.H., ed., 1995, Technology—Existing and planned data-collection systems, *in* SAR Interferometry and Surface Change Detection: Workshop held in Boulder, CO, February 3-4, 1994, Univ. Miami, FL, RSMAS Technical Report TR 95-003, p. 71-85

Dong, W.P., and Stout, K.J., 1995, An integrated approach to the characterization of surface wear, I—qualitative characteristics: Wear, v. 181-183, no. II, p. 700-716.

Dong, W.P., Sullivan, P.J., and Stout, K.J., 1992, Comprehensive study of parameters for characterizing three-dimensional surface topography, I—some inherent properties of parameter variation: Wear, v. 159, no. 2, p. 161-171.

Dong, W.P., Sullivan, P.J., and Stout, K.J., 1994a, Comprehensive study of parameters for characterizing three-dimensional surface topography, III—parameters for characterizing amplitude and some functional properties: Wear, v. 178, nos. 1-2, p. 29-43.

Dong, W.P., Sullivan, P.J., and Stout, K.J., 1994b, Comprehensive study of parameters for characterizing three-dimensional surface topography, IV—parameters for characterizing spatial and hybrid properties: Wear, v. 178, nos. 1-2, p. 45-60.

Douglas, D.H., 1994, Least-cost path in GIS using an accumulated cost surface and slopelines: Cartographica, v. 31, no. 3, p. 37-51.

Downie, C., and Wilkinson, P., 1962, The explosion craters of Basotu, Tanganyika Territory: Bulletin Volcanologique, v. 24, p. 389-420.

Dozier, Jeff, and Frew, James, 1986, Topographic similarity analysis of the Konza Prairie site (abs.): Eos, Transactions, American Geophysical Union, v. 67, no. 16, p. 280.

Dreher, Stephane, Maia, Marcia, Gente, Pascal, Durand, Cecile, and Goff, J.A., 1995, Quantitative analysis of the topography for the Mid-Atlantic Ridge between 20°N and 24°N (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F555.

Duffy, C.J., 1996, A two-state integral-balance model for soil moisture and groundwater dynamics in complex terrain: Water Resources Research, v. 32, no. 8, p. 2421-2434.

Dumont, J.F., Mering, Catherine, Parrot, J.F., and Taud, Hind, 1996, Morphological and mathematical analysis of asymmetrical fluvial pattern—a study case from the Ucayali River (Peru): Zeitschrift für Geomorphologie, Supplementband 103, p. 269-282.

Dunkerley, D.L., 1977, Frequency distribution of stream link lengths and the development of channel networks: Journal of Geology, v. 85, no. 4, p. 459-470.

Dunkerley, D.L., 1977, Somo comments on stream ordering systems: Geographical Analysis, v. 7, no. 4, p. 429-431.

Dury, G.H., 1952, Morphometric analysis (Chapter 15) *in* Map Interpretation: London, Pitman & Sons, p. 167-179.

Dymond, J.R., 1992, Ridges extracted from DTMs, *in* Australasian Remote Sensing Conference, 6th, Wellington, New Zealand: Proceedings, v. 3, p. 21-25.

Dymond, J.R., and Harmsworth, G.R., 1994, Towards automated land resource mapping using digital terrain models: ITC Journal 1994-2, p. 129-138.

Dymond, J.R., and Luckman, P.G., 1994, Direct induction of compact rule-based classifiers for resource mapping: International Journal of Geographical Information Systems, v. 8, no. 4, p. 357-367.

Dymond, J.R., Derose, R.C., and Harmsworth, G.R., 1995, Automated mapping of land components from digital elevation data: Earth Surface Processes and Landforms, v. 20, no. 2, p. 131-137.

Dysart, P.S., 1996, Bathymetric surface modeling—A machine learning approach: Journal of Geophysical Research, v. 101, No. B4, p. 8093-8105.

E

Eastman, Ronald, 1992, IDRISI (GIS software), version 4.0, Technical Reference: Worcester, MA, Clark University, Graduate School of Geography, 363 p.

Eatson, W., and Woods, A., 1988, The 3-D representation of engineering surfaces: Surface Topography, v. 1, no. 2, p. 165-182.

Ebert, H., 1889, Über die Ringgebirge des Mondes (in German): Astronomische Nachrichten, v. 122, no. 2929, p. 263-264.

Ebisemiju, F.S., and Ekiti, Ado, 1989, A morphometric approach to gully analysis: Zeitschrift für Geomorphologie, v. 33, no. 3, p. 307-322.

Edwards, M.H., Arvidson, and Guinness, E.A., 1984, Digital image processing of Seabeam bathymetric data for structural studies of seamounts near the East Pacific Rise: Journal of Geophysical Research, v. 89, no. B13, p. 11,108-11,116.

Ekholm, Simon, 1996, A full coverage, high-resolution, topographic model of Greenland computed from a variety of digital elevation data: Journal of Geophysical Research, v. 101, no. B10, p. 21,961-21,972.

Eklundh, Lars, and Martensson, Ulrik, 1995, Rapid generation of digital elevation models from topographic maps: International Journal of Geographical Information Systems: v. 9, no. 3, p. 329-340.

El-Soudani, S.M., 1978, Profilometric analysis of fractures: Metallography, v. 11, no. 3, p. 247-336.

Elfick, M.H., 1979, Contouring by use of a triangular mesh: The Cartographic Journal, v. 16, no. 1, p. 24-29.

Elson, J.M., and Bennett, J.M., 1995, Calculation of the power spectral density from surface profile data: Applied Optics, v. 34, no. 1, p. 201-208.

Ervin, S.M., 1994, Digital terrain modeling: Landscape Architecture Magazine, January, p. 31-35.

Evans, I.S., and Cox, N.J., 1995, The form of glacial cirques in the English Lake District, Cumbria: Zeitschrift für Geomorphologie, v. 39, no. 2, p. 175-202.

Evans, I.S., and McClean, C.J., 1995, The land surface is not unifractal—variograms, cirque scale and allometry, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 127-147.

Evans, J.R., and Vickers, Wayne, 1995, Map production using print-on-demand capabilities: U.S. Geological Survey, Open-file Report 95-653, 34 p.

Evertsz, C.J.G., and Mandelbrot, B.B., 1992, Multifractal measures, *in* Peitgen, H.-O., Jürgens, Hartmut, and Saupe, Dietmar, eds., Chaos and Fractals—New Frontiers of Science: New York, Springer, p. 921-953.

Eyles, R.J., 1974, Bifurcation ratio, a useless index?: New Zealand Geographer, v. 30, no. 2, p. 166-171.

F

Fahmy, Y., Russ, J.C., and Koch, C.C., 1991, Application of fractal geometry measurements to the evaluation of fracture toughness of brittle intermetallics: Journal of Materials Research, v. 6, no. 9, p. 1856-1861.

Faires, J., 1982, A program for contour-to-grid interpolation: Austin, TX, Zycor Inc., paging unknown.

Fan, G.-W., and Lay, T., 1996, Empirical relationships between regional phases and topographic parameters—A case study in western China (abs.): Fall Meeting Supplement to Eos, Transactions of the American Geophysical Union, v. 77, no. 46, p. F10.

Farr, T.G., and Kobrick, Michael, 1996, The Shuttle Radar Topography Mapper (abs.): Fall Meeting Supplement to Eos, Transactions of the American Geophysical Union, v. 77, no. 46, p. F52.

Farr, Tom, and seven others, 1995a, The Global Topography Mission gains momentum: Eos, Transactions American Geophysical Union, v. 76, no. 21, p. 213 and 218.

Farr, Tom, and seven others, 1995b, Mission in the works promises precise global topographic data: Eos, Transactions American Geophysical Union, v. 76, no. 22, p. 225, 228, and 229.

Faust, Dominik, and Herkommer, Martin, 1995, Rillerosion in lower Andalusia: Zeitschrift für Geomorphologie, Supplementband 99, p. 17-28.

Fauth, Philip, 1894, Neue Beiträge zur Begründung einer Modernen Selenologie (in German): Astronomische Nachrichten, v. 137, no. 3266, p. 17-26.

Fauth, Philip, 1936, Unser Mond (in German): Breslau, Verlag Dr. Hermann Eschenhagen, 592 p.

Ferguson, R.I., 1977, On determining distances through stream networks: Water Resources Research, v. 13, no. 3, p. 672-674.

Ferguson, R.I., 1986, Hydraulics and hydraulic geometry: Progress in Physical Geography, v. 10, no. 1, p. 1-31.

Ferrill, D.A., and six others, 1996, Quaternary slip history of the Bare Mountain fault (Nevada) from the morphology and distribution of alluvial fan deposits: Geology, v. 24, no. 6, p. 559-562.

Feuchtwanger, M., and Blais, J.A.R., 1989, Phenomena-based terrain data modelling, *in* GIS National Conference, Ottawa, Canada: Proceedings, p. 1013-1025.

Fielding, E.J., Werner, C.L., Farr, T.G., and Peltzer, G.F., 1995, Geomorphic applications of digital elevation models derived from ERS-1 and SIR-C SAR interferometry (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F64.

Finn, V.S., Baker, V.R., Dolginov, A.Z., Gabitov, I., and Dyachenko, A., 1995, Large-scale spatial patterns in topography at Alpha Regio, Venus: Geophysical Research Letters, v. 22, no. 14, p. 1901-1904.

Fisher, P.F., 1996, Extending the applicability of viewsheds in landscape planning: Photogrammetric Engineering and Remote Sensing, v. 62, no. 11, p. 1297-1302.

Fisher, Peter, 1989, CENTER, a point-pattern analysis package for DOS machines: American Association of Geographers, Microcomputer Specialty Group. [technical details unknown]

Fix, R.E., and Burt, T.P., 1995, Global positioning system—an effective way to map a small area or catchment: Earth Surface Processes and Landforms, v. 20, no. 9, p. 817-827.

Flanagan, D.C., Huang, C., Norton, L.D., and Parker, S.C., 1995, Laser scanner for erosion plot measurements: Transactions of the American Society of Argricultural Engineers, v. 38, no. 3, p. 703-710.

Florinsky, I.V., 1996, Quantitative topographic method of fault morphology recognition: Geomorphology, v. 16, no. 2, p. 103-119.

Florinsky, I.V., Grokhlina, T.I., and Mikhailova, N.I., 1995, LANDLORD 2.0—software for analysis and mapping of geometrical characteristics of relief (in Russian): Geodesiya i Cartographiya, v. 5, p. 46-51.

Florinsky, I.V., and Kuryakova, G.A., 1996, Influence of topography on some vegetation cover properties: Catena, v. 27, no. 2, p. 123-141.

Ford, P.G., 1994, Radar scattering properties of steep-sided domes on Venus: Icarus, v. 112, no. 1, p. 204-218.

Forte, M., 1995, Scientific visualization and archaeological landscape—the case study of a terramara, Italy, *in* Lock, Gary, and Stancic, Zoran, eds., Archaeology and Geographical Information Systems—A European Perspective: London, Taylor and Francis, p. 232-238.

Fourneau, R., 1961, Contribution a l'étude des versants dans le sud de la Moyenne-Belgique et dans le nord de l'Entre-Sambre-et-Meuse (in French): Cercle des Géogr. Liègois, v. 120, p. 123-151.

Franklin, S.E., Wulder, M.A., and Lavigne, M.B., 1996, Automated derivation of geographic window sizes for use in remote sensing digital image texture analysis: Computers and Geosciences, v. 22, no. 6, p. 665-673.

Franklin, W.R., and Ray, C.K., 1994, Higher isn't necessarily better—visibility algorithms and experiments: International Symposium on Spatial Data Handling, 6th, Edinburgh, UK: Proceedings, v. 2, p. 751-763.

Friend, P.F., and Sinha, R., 1993, Braiding and meandering parameters, *in* Best, J.L., and Bristow, C.S., eds., Braided Rivers: London, Geological Society Special Publication No. 75, p. 105-111.

Fu, Hailiang, Tajchman, S.J., and Kochenderfer, J.N., 1995, Topography and radiation exchange of a mountainous watershed: Journal of Applied Meteorology, v. 34, no. 4, p. 890-901.

G

Gallant, A.L., Binnian, E.F., Omernik, J.M., and Shasby, M.B., 1995, Ecoregions of Alaska: U.S. Geological Survey Professional Paper 1567, 73 p. + color map at 1:5,000,000.

Gallant, J.C., and Wilson, J.P., 1996, TAPES-G, a grid-based terrain analysis program for the environmental sciences: Computers and Geosciences. v. 22, no. 7, p. 713-722.

Gan, K.C., McMahon, T.A., and Finlayson, B.L., 1992, Fractal dimensions and lengths of rivers in south-east Australia: The Cartographic Journal, v. 29, no. 1, p. 31-34.

Gao, Jay, 1992, Modeling Landslide Susceptibility from a DTM in Nelson County, Virginia—a Remote-Sensing-GIS Approach: unpublished Ph.D. dissertation, Athens, University of Georgia, 235 p.

Gao, Jay, 1994, A *C* program for detecting slope forms from grid DEMs: Earth Surface Processes and Landforms, v. 19, no. 11, p. 827-837.

Gao, Jay, 1995, Comparison of sampling schemes in constructing DTMs from topographic maps: ITC Journal 1995-1, p. 18-22.

Gao, Jay, and Lo, C.P., 1995, Micro-scale modelling of terrain susceptibility to landsliding from a DEM—a GIS approach: Geocarto International, v. 10, no. 4, p. 15-30.

Gao, Jay, and Xia, Zong-guo, 1996, Fractals in physical geography: Progress in Physical Geography, v. 20, no. 2, p. 178-191.

Garbrecht, Jurgen, and Martz, L.W., 1993, Generation of network and subwatershed parameters from digital elevation models. Part II—Application of DEDNM to low relief landscape, *in* GIS'93 conference, GIS in Forestry, Environmental and Natural Resources Management, Vancouver, BC: Proceedings, p. 345-352.

Garbrecht, Jurgen, and Martz, L.W., 1996a, Comment on "Digital elevation model grid size, landscape representation, and hydrologic simulations" by Weihua Zhang and David R. Montgomery: Water Resources Research, v. 32, no. 5, p. 1461-1462.

Garbrecht, Jurgen, and Martz, Lawrence, 1996b, Digital landscape parameterization for hydrological applications, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 169-173.

Garbrecht, Jurgen, and Starks, P.J., 1995, Note on the use of USGS level-1 7.5-minute DEM coverages for landscape drainage analyses: Photogrammetric Engineering and Remote Sensing, v. 61, no. 5, p. 519-522.

Garster, J.K., 1995, Elevation determination by using GPS, *in* American Society for Photogrammetry and Remote Sensing / American Congress on Surveying and Mapping, Annual Convention, Charlotte, NC, February 27-March 2: Technical Papers, v. 1 (ACSM), p. 195-199.

Garvin, J.B., 1996, Topographic characterization and monitoring of volcanoes via airborne laser altimetry, *in* McGuire, W.J., Jones, A.P., and Neuberg, Jurgen, eds., Volcano Instability on the Earth and Other Planets: London, UK, Geological Society Special Publication No. 110, p. 137-152.

Garvin, J.B., and Frawley, J.J., 1995, Topographic ruggedness properties of Venus and Earth: Geoscientist (Bath, UK), v. 5, no. 2, p. 13-15.

Gauss, C.F., 1827, Disquisitiones generales circa superficies curvas (in Latin): Gott. gel. Anz., No. 177, p. 1761-1768.

Gelbman, E., 1981, Generalization of the DTM to represent slopes and curvatures (in Hebrew): Haifa, The Technion, unpublished M.S. thesis, paging unknown.

Geodetska uprava Slovenije (Geodetic Office of Slovenia), 1991, Stometrski digitalni model reliefa Slovenije (in Slovene; 100-m DEM): Ljubljana, Baza podatkov.

Geosoft, Ltd., 1996, HYDROSCOPE—river network and drainage basin analysis from digital elevation models in Microsoft Windows: Unit 3M, Springfield House, Hyde Terrace, Leeds, UK LS2 9LN (tel. 0113-234-4000/ fax 0113-246-5071). ["dynamic water flow and drainage analysis software for simulating arth surface processes"]

Gesch, D.B., 1993, Identification of requirements and sources for global digital topographic data, *in* Land Information from Space-based Systems: Pecora 12 Symposium, Sioux Falls, SD, August 24-26, U.S. Geological Survey, Proceedings, p. 35-44.

Gesch, D.B., 1994, Topographic data requirements for EOS global change research: U.S. Geological Survey, Open-file Report 94-0626, 60 p.

GETECH, 1995, Global DTM5 (5' x 5' global digital terrain model on CD-ROM): Leeds, UK, Geophysical Exploration Technology c/o Department of Earth Sciences, University of Leeds LS2 9JT. [upgrade of ETOPO5]

Giebels, M., and Weber, W., 1982, Höhenliniendigitalisierung nach Verfahren der Rasterverarbeitung: Nachrichten aus dem Karten- und Vermessungswesen, Series 1, v. 88, p. 61-75.

Giles, P.T., and Franklin, S.E., 1996, Comparison of derivative topographic surfaces of a DEM generated from stereoscopic SPOT images with field measurements: Photogrammetric Engineering and Remote Sensing, v. 62, no. 10, p. 1165-1171.

Gillings, M., 1995, Flood dynamics and settlement in the Tisza valley of north-east Hungary—GIS and the Upper Tisza project, *in* Lock, Gary, and Stancic, Zoran, eds., Archaeology and Geographical Information Systems—A European Perspective: London, Taylor and Francis, p. 67-84.

Girard, W.W., 1976, Size, shape and symmetry of the cross-profles of glacial valleys: Iowa City, unpublished Ph.D. thesis, University of Iowa, 90 p.

Gittings, B.M., 1996ff, Digital elevation data catalogue: University of Edinburgh, Internet access via <http://www.geo.ed.ac.uk/geoinfo/dem.send> (E-mail <bruce@geo.ed.ac.uk>), about 0.22 mb of data.

Goff, J.A., 1995, Multi-scale spectral analysis of Hydrosweep, AMS-120, and Mesotech profiles from the ONR Atlantic Natural Lab (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F554.

Gold, C.M., and Condal, A.R., 1995, A spatial data structure integrating GIS and simulation in a marine environment: Marine Geodesy, v. 18, no. 3, p. 213-228.

Golden Software, 1995, SURFER 6 for Windows (3.1 or 95 and NT): Contouring and 3D surface mapping for scientists and engineers. [809 14th St., Golden, CO, 80401; 800-972-1021 or 303-279-1021]

Goldspiel, J.M., Squyres, S.W., and Jankowski, D.G., 1993, Topography of small Martian valleys: Icarus, v. 105, no. 2, p. 479-500.

Goldspiel, J.M., Squyres, S.W., Slade, M.A., Jurgens, R.F., and Zisk, S.H., 1993, Radar-derived topography of low southern latitudes of Mars: Icarus, v. 106, no. 2, p. 346-364.

Goodchild, M.F., and Tate, N.J., 1992, Description of terrain as a fractal surface, and application to digital elevation model quality assessment (Forum): Photogrammetric Engineering and Remote Sensing, v. 58, no. 11, p. 1568-1570.

Goodchild, M.F., Parks, B.O., and Steyaert, L.T., eds., 1993, Environmental Modeling with GIS: New York, Oxford Univ. Press, 488 p.

Goodwillie, A.M., and Fisher, R.L., 1995, Towards the best digital topographic database of the Indian Ocean (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F571.

Goodwin, A.H., and Vaughn, D.G., 1995, A topographic origin for double-ridge features in visible imagery of ice divides in Antarctica: Journal of Glaciology, v. 41, no. 139, p. 483-489.

Gorlenko, O.A., 1981, Assessment of surface roughness parameters and their interdependence: Precision Engineering, v. 3, no. 2, p. 105-108.

Gorte, B.G.H., and Koolhoven, W., 1990, Interpolation between isolines based on the Bogefors distance transform: ITC Journal 1990-3, p. 245-248.

Gouraud, Henri, 1971, Continuous shading of curved surfaces: IEEE Transactions on Computers, v. C-20, no. 6, p. 623-629.

Gràcia, Eulàlia, Canals, Miquel, Farràn, M.-L., Prieto, M.J., Sorribas, Jordi, and the GEBRA Team, 1996, Morphostructure and evolution of the Central and Eastern Bransfield Basins (NW Antarctic Peninsula): Marine Geophysical Researches, v. 18, v. 2/4, p. 429-448.

Graf, W.L., 1970, The geomorphology of the glacial valley cross-section: Arctic and Alpine Research, v. 2, p. 303-312.

Graf, W.L., 1975, A cumulative stream-ordering system: Geographical Analysis, v. 7, p. 335-340.

Graf, W.L., 1977, Measuring stream order—a reply: Geographical Analysis, v. 9, no. 4, p., 431-433.

Gråsjo, Mikael, Kvist, Björn, Andersson, Christer, and Öberg, Mats, 1991, Remote sensing and digital terrain analysis—a tool for engineering and construction services: Thematic Conference on Remote Sensing, 8th, Denver, CO, April 29-May 2, Environmental Research Institute of Michigan, Ann Arbor, Proceedings, p. 829-836.

Greco, Michele, 1996, Erosion processes at the hillslope scale: Hydrological Processes, v. 10, no. 7, p. 985-994.

Green, Ronald, 1967, The spectrum of a set of measurements along a profile: Engineering Geology, v. 2, no. 3, p. 163-168.

Greene, G., Outcalt, S.I., and Tobler, W.R., undated, Reconstruction and parsing of topographic data: Ann Arbor, University of Michigan, Department of Geography, unpublished working paper, 6 p.

Greening, W.J.T., Chaplin, B.A., Sutherland, D.G., and DesRoche, D.E., 1994, Commercial applications of GPS-assisted photogrammetry, *in* GIS/LIS '94, Annual Conference and Exposition, Phoenix, AZ, October 25-27, ASPRS/ ACSM, Proceedings, p. 391-402.

Gregory, K.J., and Walling, D.E., 1973, Drainage basin form and process: New York, John Wiley, 456 p.

Griffiths, P.G., Webb, R.H., and Melis, T.S., 1994, Morphometric and geologic controls on the frequency of debris flows in Grand Canyon, Arizona (abs.): Eos, Transactions of the American Geophysical Union, v. 75, no. 44, Supplement, p. 272.

Guerico, Roberto, and Soccodato, F.M., 1996, GIS procedure for automatic extraction of geomorphological attributes from TIN-DTM, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 175-182.

Gustafson, G.C., 1973, Quantitative investigation of the morphology of drainage basins using orthophotography: Münchener Geographische Abhandlungen, 157 p.

Guth, P.L., 1991, Combining imagery and digital elevation models on a personal computer: Thematic Conference on Remote Sensing, 8th, Denver, CO, April 29-May 2, Environmental Research Institute of Michigan, Ann Arbor, Proceedings, p. 921-929.

Guth, P.L., 1995, Slope and aspect calculations on gridded digital elevation models—examples from a geomorphometric toolbox for personal computers, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 31-52.

Gyasi-Agyei, Yeboah, 1993, Geomorphologic investigations for catchment hydrologic response modelling using a digital elevation model: Brussels, Free University, unpublished Ph.D. dissertation, 229 p.

Gyasi-Agyei, Yeboah, Willgoose, Garry, and De Troch, F.P., 1995, Effects of vertical resolution and map scale of digital elevation models on geomorphological parameters used in hydrology: Hydrological Processes, v. 9, no. 3/4, p. 363-382.

H

Haecker, M.A., 1992, Convergent gridding—a new approach to surface reconstruction: Geobyte, v. 7, no. 3, p. 48-53.

Haines-Young, Roy, and Chopping, Mark, 1996, Quantifying landscape structure—A review of landscape indices and their application to forested landscapes: Progress in Physical Geography, v. 20, no. 4, p. 418-445.

Hall, J.K., 1993, The GSI digital terrain model (DTM) project completed, *in* Bogoch, R., and Eshet, Y., eds., Geological Survey of Israel Current Research, v. 8, p. 47-50.

Hall, J.K., 1994, Three-dimensional map of Israel and vicinity: Geological Survey of Israel, Jerusalem, one sheet (with physiographic provinces, in Hebrew, by E. Zilberman and R. Bogoch), scale 1:500,000.

Hall, J.K., Udintsev, G.B., and Odinokov, Y.Yu., 1994, The bottom relief of the Levantine Sea, *in* Krashennikov, V.A., and Hall, J.K., eds., Geological Structure of the Northeastern Mediterranean: Jerusalem, Historical Productions/Hall Ltd., p. 5-31.

Hamblin, M.G., and Stachowiak, G.W., 1994, Measurement of fractal surface profiles obtained from scanning electron and laser scanning microscope images and contact profile meter: Journal of Computer-Assisted Microscopy, v. 6, no. 4, p. 181-194.

Hamilton, S.K., Melack, J.M., Goodchild, M.F., and Lewis, W.M., 1992, Estimation of the fractal dimension of terrain from lake size distribution, *in* Carling, P.A., and Petts, G.E., eds., Lowland Floodplain Rivers—Geomorphological Perspectives: Chichester, UK, Wiley, p. 145-163.

Haralick, R.M., 1979, Statistical and structural approaches to texture: Proceedings of the IEEE, v. 67, no. 5, p. 786-804.

Harbor, J.M., 1990, A discussion of Hirano and Aniya's (1988, 1989) explanation of glacial-valley cross profile development: Earth Surface Processes and Landforms, v. 15, no. 4, p. 369-377.

Harbor, J.M., 1995, Development of glacial-valley cross sections under sonditions of spatially variable resistance to erosion: Geomorphology, v. 14, no. 2, p. 99-107.

Harbor, J.M., and Wheeler, D.A., 1992, On the mathematical description of glaciated-valley cross sections: Earth Surface Processes and Landforms, v. 17, no. 5, p. 477-485.

Harmsworth, G.R., Dymond, J.R., and McLeod, Malcolm, 1995, Automated mapping of soils in hilly terrain using DTMs–A New Zealand example: ITC Journal 1995-2, p. 87-94.

Harris, T.M., 1988, Digital terrain modelling and three-dimensional surface graphics for landscape and site analysis in archaeology, *in* Ruggles, C.L.N., and Rahtz, S.P.Q., eds., Computer Applications and Quantitative Methods in Archaeology 1987: Oxford, British Archaeological Reports International Series 393, p. 161-169.

Harrison, J.M., and Lo, C.-P., 1996, PC-based two-dimensional discrete Fourier transform programs for terrain analysis: Computers and Geosciences, v. 22, no. 4, p. 419-424.

Hartshorn, J.H., 1967, Geologic descriptions of USGS topographic maps: Journal of Geological Education, v. 15, no. 5, p. 188-196.

Hasenaka, Toshiaki, 1994, Size, distribution, and magma output rate for shield volcanoes of the Michoacán-Guanajuato volcanic field, Central Mexico: Journal of Volcanology and Geothermal Research, v. 63, nos. 1-2, p. 13-31.

Hasenaka, Toshiaki, and Carmichael, I.S.E., 1985, A compilation of location, size, and geomorphological parameters of volcanoes of the Michoacán-Guanajuato volcanic field, central Mexico: Geofisica Internacional, v. 24, no. 4, p. 577-607. [revised very slightly as 'A compilation ... small monogenetic cones ... Mexico' *in* Aoki, K., 1992, Appendix 1, p. 213-230]

Hasfurther, V.R., 1985, The use of meander parameters in restoring hydrologic balance to reclaimed stream beds, *in* Gore, J.A., ed., The Restoration of Rivers and Streams: Boston, MA, Butterworth, p. 21-40.

Hastings, D.A., and Dunbar, P.K., 1995, History and future of digital representations of topography (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F148.

Hastings, D.A., Dunbar, P.K., and Hittelman, A.M., 1996, Digital representations of topography—attempting to characterize the Earth's surface (abs.): International Geological Congress, 3oth, Beijing, China, August 4-14: Proceedings, v. 1, p. 471.

He, D.-C., and Wang, Li, 1991, Texture features based on the texture spectrum: Pattern Recognition, v. 24, no. 5, p. 391-399.

Heidenreich, Conrad, 1964, Some observations of the shape of drumlins: The Canadian Geographer, v. 8, no. 2, p. 101-107.

Heinzmann, Uta, and Zollinger, Gaby, 1995, Validation of representativeness with relief parameters based on the comparison of two landuse classifications: Catena, v. 24, no. 1, p. 69-87.

Heirtzler, J.R., 1993, Topography, *in* Gurney, R.J., Foster, J.L., and Parkinson, C.L., eds., Atlas of satellite observations related to global change: Cambridge University Press, p. 297-300.

Heller, Martin, 1990, Triangulation algorithms for adaptive terrain modelling, *in* International Symposium on Spatial Data Handling, 4th, Zürich, Switzerland, July 23-27: 1990, Proceedings, v. 1, p. 163-174.

Helm, J.M., 1995, Quaternary faulting in the Stansbury Fault Zone, Toole County, Utah, *in* Lund, W.R., ed., Environmental and Engineering Geology of the Wasatch Front Region: Utah Geological Association Publication 24, p. 31-44.

Hergarten, S., and Neugebauer, H.J., 1996, A physical statistical approach to erosion: Geologische Rundschau, v. 85, no. 1, p. 65-70.

Herrick, R.R., and Phillips, R.J., 1994, Implications of a global survey of Venusian impact craters: Icarus, v. 111, no. 2, p. 387-416.

Herzfeld, U.C., and Higginson, C.A., 1996, Automated geostatistical seafloor classification—principles, parameters, feature vectors, and discrimination criteria: Computers and Geosciences, v. 22, no. 1, p. 35-52.

Herzfeld, U.C., Kim, I.I., and Ocutt, J.A., 1995, Is the ocean floor a fractal?: Mathematical Geology, v. 27, no. 3, p. 421-462.

Herzfeld, U.C., Lingle, C.S., and Lee, Li-Her, 1994, Recent advance of the grounding line of Lambert Glacier, Antarctica, deduced from satellite-radar altimetry: Annals of Glaciology, v. 20, p. 43-47.

Hibler, W.D. III, and LeSchack, L.A., 1972, Power spectrum analysis of undersea and surface sea-ice profiles: Journal of Glaciology, v. 11, no. 63, p. 345-356.

Hickey, R., Smith, A., and Janowski, P., 1994, Slope length calculations from a DEM within ARC/INFO GRID: Computers, Environment and Urban Systems, v. 18, p. 365-380.

Hindmarsh, R.C.A., 1996, Sliding of till over bedrock—scratching, polishing, comminution and kinematic-wave theory: Annals of Glaciology 22, p. 41-47.

Hiramatsu, T., and Shimazu, Y., 1970, Simulation of drainage network-system and concept of entropy in geomorphology: Journal of Physics of the Earth, v. 18, no. 2, p. 181-191.

Hirano, Masashige, 1967, Continuous uplifting and development of slope profile—an analytical approach (in Japanese): Earth Science (Chikyû Kagaku), v. 21, no. 5 (no. 92), p. 27-36.

Hirano, Masashige, 1969, A morphometric analysis of the drainage basins on the west slope of the Ikoma Range, central Japan (in Japanese with English summary): Geographical Review of Japan, v. 42, no. 4, p. 266-278.

Hirano, Masashige, 1971, Quantitative representation of the erosional stage by HRT (relief) diagram (in Japanese with English summary): Geographical Review of Japan, v. 44, no. 9, p. 628-637.

Hirano, Masashige, 1972, Theory on graded slopes (in Japanese with English summary): Geographical Review of Japan, v. 45, no. 10, p. 703-715.

Hirano, Masashige, and Aniya, Masamu, 1988, A rational expanation of cross-profile morphology for glacial valleys and of glacial valley development: Earth Surface Processes and Landforms, v. 13, no. 8, p. 707-716. [see also, Reply, ESPL, v. 15, no. 4, p. 379-381.]

Hirano, Masashige, and Yokota, Shuichiro, 1976, Numerical analysis in geomorphology by means of electronic computer with reference to examples from southwest Japan (in Japanese with English summary): Geographical Review of Japan, v. 49, no. 7, p. 440-454.

Hobbs, Frank, 1995, The rendering of relief images from digital contour data: The Cartographic Journal, v. 32, no. 2, p. 111-116.

Hodgson, M.E., 1995, What cell size does the computed slope/aspect angle represent?: Photogrammetric Engineering and Remote Sensing, v. 61, no. 5, p. 513-517.

Hofmann, H.J., 1976, Stromatoid morphometrics, *in* Walter, M.R., ed., Stromatolites: Developments in Sedimentology, v. 20, Amsterdam, Elsevier, p. 45-54.

Hogg, J., McCormack, J.E., Roberts, S.A., Gahegan, M.N., and Hoyle, B.S., 1993, Automated derivation of stream-channel networks and selected catchment characteristics from digital elevation models, *in* Mather, P.M., ed., Geographical Information Handling—Research and Applications: Chichester, UK, John Wiley and Sons, p. 207-235.

Holcombe, T.L., and Heezen, B.C., 1970, Patterns of relative relief, slope, and topographic texture in the North Atlantic Ocean: Palisades, NY, Lamont-Doherty Geological Laboratory of Columbia University, Technical Report No. 8, CU-8-70, Project SR-104-0301, Task 8112, Contract N00024-67-C-1186, 133 p. + six fold-out color maps.

Hooke, J.M., 1984, Changes in river meanders—A review of techniques and results of analyses: Progress in Physical Geography, v. 8, no. 4, p. 473-508.

Hooke, R. LeB., 1979, Geometry of alluvial fans—effects of discharge and sediment size: Earth Surface Processes, v. 4, no. 2, p. 147-166.

Hopmann, Josef, 1965, Die Genauigkeit der Angaben von relativen Höhen auf dem Monde Neue Werte für 163 punkte (in German): Vienna, Sitzungsberichten der Österreichischen Akademie der Wissenschaften, Abt. 2, Bd. 174, p. 57-84.

Houghton, K., Prestegaard, K., Muriceak, D., Smith, S., Norton, M.M., Shane, B., and Smith, B., 1995, Misuse of data on meandering river characteristics for channel restoration projects (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F254.

Howard, Alan D., 1995, Simulation modeling and statistical classification of escarpment planforms, *in* Whiting, P.J., and Furbish, D.J., eds., Predicting Process from Form (special issue): Geomorphology, v. 12, no. 3, p. 187-214.

Howard, Alan D., and Hemberger, A.T., 1991, Multivariate characterization of meandering: Geomorphology, v. 4, nos. 3/4, p. 161-186.

Hoy, D.R., and Taylor, J.A., 1962, A descriptive classification of terrain (abs.): Annals of the Association of American Geographers, v. 53, no. 4, p. 598.

Huang, C., and Bradford, J.M., 1992, Applications of a laser scanner to quantify soil microtopography: Journal of the Soil Science Society of America, v. 56, no. 1, p. 14-21.

Huang, J., and Turcotte, D.L., 1990, Reply to comment by J.A. Goff on 'Fractal mapping of digitized images': Journal of Geophysical Research, v. 95, no. B4, p. 5161.

Humboldt, Alexander von, 1816, Sur l'élévation des montagnes de l'Indie (in French): Annales de Chimie et de Physique, v. 3, p. 297ff.

Humboldt, Alexander von, 1825, De quelques phénomènes physiques et géologiques qu'offrent les Cordilléres des Andes et de Quito et la partie occidentale de l'Himalaya (in French): Annales des Sciences Naturelles, v. 4, p. 225ff.

Humboldt, Alexander von, 1828, Höhenbestimmungen in der peruanischen

Andeskette (in German): Annalen der Physik und Chemie, v. 13, no. 3, art. XV, p. 514-522.

Hunter, G.J., and Goodchild, M.F., 1995, Dealing with error in spatial databases—a simple case study: Photogrammetric Engineering and Remote Sensing, v. 61, no. 5, p. 529-537.

Hurtrez, J.-E., 1996, Is the tectonic signal recorded in landforms? An analysis from topogaphic data of Himalaya (abs.): Fall Meeting Supplement to Eos, Transactions of the American Geophysical Union, v. 77, no. 46, p. F235.

I

Ichoku, Charles, Karnieli, Arnon, and Verchovsky, Irina, 1996, Application of fractal techniques to the comparative evaluation of two methods of extracting channel networks from digital elevation models: Water Resources Research, v. 32, no. 2, p. 389-399.

Imamura, Gakuro, 1937, Climatic conditions during the Japanese Ice Age: Zeitschrift für Gletscherkunde, v. 25, p. 184-189.

Intergraph, 1992a, MGE digital terrain model translators (MGE_DT) user's guide: Huntsville, AL, Intergraph Corporation, Document DJA054630, 88 p.

Intergraph, 1992b, MGE grid analyst (MGGA) reference manual: Huntsville, AL, Intergraph Corporation, Document DJA052960, 426 p.

Iso, Nozomi, Yamakawa, Katsumi, Yonezawa, Hiroshi, and Matsubara, Toshiko, 1980, Accumulation rates of alluvial cones, constructed by debris-flow deposits, in the drainage basin of the Takahara River, Gifu Prefecture, central Japan (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 53, no. 11, p. 699-720.

Ivanov, P.V., 1951, Methods for quantitative description of longitudinal river-profile forms (in Russian): Izv. Vses. Geogr. Obschestva, v. 6, paging unknown.

Iwahashi, Junko, 1994, Development of landform classification using digital elevation model (in Japanese with English synopsis and figure captions): Annuals, Disaster Prevention Research Institute (Kyoto University), No. 37 B-1, p. 141-156.

J

Jacobsen, F.M., and Theakstone, W.H., 1995, The use of planimetric surface area in glacier mass-balance calculations—a potential source of errors: Journal of Glaciology, v. 41, no. 139, p. 441-444.

Jakob, Matthias, and Bovis, M.J., 1996, Morphometric and geotechnical controls of debris flow activity, southern Coast Mountains, British Columbia, Canada: Zeitschrift für Geomorphologie, Supplementband 104, p. 13-26.

James, L.A., 1996, Polynomial and power functions for glacial valley cross-section morphology: Earth Surface Processes and Landforms, v. 21, no. 5, p. 413-432.

Jankowski, D.G., and Squyres, S.W., 1992, The topography of impact craters in "softened" terrain on Mars: Icarus, v. 100, no. 1, p. 26-39.

Jau, J.Y., and Chin, R.T., 1990, Shape from texture using the Wigner distribution: Computer Vision, Graphics, and Image Processing, v. 52, no. 2, p. 248-263.

Jefferson, M.S.W., 1902, Limiting width of meander belts: National Geographic Magazine, v. 13, no. 4?, p. 373-384.

Jensen, J.R., 1995, Issues involving the creation of digital elevation models and terrain corrected orthoimagery using soft-copy photogrammetry: Geocarto International, v. 10, no, 1, p. 5-21.

Jessell, M.W., Cox, S.J.D., Schwarze, Phillip, and Power, W.L., 1995, The anisotropy of surface roughness measured using a digital photogrammetric technique, *in* Ameen, M.S., ed., Fractography—fracture topography as a tool in fracture mechanics and stress analysis: London, Geological Society Special Publication No. 92, p. 27-37.

Jeyapalan, K., 1995, Contouring by kinematic GPS, *in* American Society for Photogrammetry and Remote Sensing / American Congress on Surveying and Mapping, Annual Convention, Charlotte, NC, February 27-March 2: Technical Papers, v. 1 (ACSM), p. 187-194.

Jian, Xiaodong, Olea, R.A., and Yu, Yun-Sheng, 1996, Semivariogram modeling by weighted least squares: Computers and Geosciences, v. 22, no. 4, p. 387-397.

Johnsen, W.A., and Brown, C.A., 1994, Comparison of several methods for calculating fractal-based topographic characterization parameters: Fractals, v. 2, no. 3, p. 437-440.

Johnson, F.A., 1970, The measurement of gradation using surveyed cross sections: Water Resources Research, v. 6, no. 4, p. 1230-1234.

Johnson, V.A., 1988, Digital terrain modeling applied to the Alberta 1:20,000 mapping project: Edmonton, University of Alberta, Department of Geography, unpublished Ph.D. thesis, paging unknown.

Jones, A.W., 1965, The problems of off-the-road mobility: Washington, D.C., Institute for Defense Analysis (IDA), Research Paper P-189, paging unknown.

Jones, N.L., and Nelson, James, 1992, Geoscientific modeling with TINs: Geobyte, v. 7, no. 4, p. 44-49.

Joughin, Ian, Tulaczyk, Slawek, Fahnestock, Mark, and Kwok, Ron, 1996, A mini-surge on the Ryder Glacier, Greenland, observed by satellite radar interferometry: Science, v. 274, 11 Oct., p. 228-230.

Joughin, Ian, Winebrenner, Dale, Fahnestock, Mark, Kwok, Ron, and Krabill, William, 1996, Measurement of ice-sheet topography using satellite-radar interferometry: Journal of Glaciology, v. 42, no. 140, p. 10-22.

Junkins, J.L., Miller, G.W., and Jancaitis, J.R., 1973, A weighting function approach to modeling of irregular surfaces: Journal of Geophysical Research, v. 78, no. 11, p. 1794-1803.

K

Kalma, J.D., and Sivapalan, Murugesu, eds., 1995, Scale issues in hydrological/environmental modelling: Hydrological Processes (special issue), v. 9, no. 3/4, p. 237-482.

Kalmar, J., 1986, Digital surface model on a triangular base: Acta Geodaetica Geophys. et Montanist. Hungarica, v. 21, no. 1, p. 71-79.

Kao, J.J., 1992, Determining drainage pattern using DEM data for nonpoint-source water quality modeling: Water Science and Technology, v. 26, p. 1431-1438.

Kao, J.J., 1996, Postscript routines for display of watershed data: Computers and Geosciences, v. 22, no. 6, p. 701-704.

Karlinger, M.R., Over, T.M., and Troutman, B.M., 1994, Relating thin and fat-fractal scaling of river-network models: Fractals, v. 2, no. 4, p. 557-565.

Kashiwaya, Kenji, 1979, On the stochastic model of rill development in slope system (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 52, no. 2, p. 53-65.

Kashiwaya, Kenji, Yokoyama, Kóji, and Okuda, Setsuo, 1974, A study on gully morphology (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 47, no. 7, p. 413-425.

Kayane, Isamu, 1972, On the relation between drainage area and main stream length (in Japanese with English summary): Geographical Review of Japan, v. 45, no. 8, p. 588-590.

Kayane, Isamu, and Shimano, Yasuo, 1974, Simulation of drainage network by biased random-walk models: Tokyo Geographical Papers, v. 18, no. 3, p. 39-52.

Kelly, A.D., and Nielson, G.M., 1988, Terrain simulation using a model of stream erosion: Computer Graphics, v. 22, no. 4, p. 263-268.

Kennedy, B.A., 1984, On Playfair's law of accordant junctions: Earth Surface Processes and Landforms, v. 9, no. 2, p. 153-173.

Kennedy, S.K., and Lin, W., 1986, FRACT—a FORTRAN subroutine to calculate the variables necessary to determine the fractal dimension of closed forms: Computers and Geosciences, v. 12, no. 5, p. 705-712.

Kidner, D.B., Jones, C.B., Knight, D., and Smith, D.H., 1990, Digital terrain models for radio path profiles, *in* International Symposium on Spatial Data Handling, 4th, Zürich, Switzerland, July 23-27: Proceedings, v. 1, p. 240-249.

Kienzle, S.W., 1996, Using DTMs and GIS to define input variables for hydrological and geomorphological analysis, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 183-190.

Kikuchi, Lawrence, Guevara, J.A., Mark, D.M., and Marble, D.F., 1982, Rapid display of digital elevation models in a mini-computer environment, *in* Fifth International Symposium on Computer-Assisted Cartography, Crystal City, VA, August 22-28, ISPRS IV—Proceedings, p. 297-307.

King, C.A.M., 1974, Morphometry in glacial geomorphology, *in* Coates, D.R., ed., Glacial Geomorphology: London, Allen and Unwin, p. 147-162.

Kirkby, M.J., 1986, A two-dimensional simulation model for slope and stream evolution, *in* Abrahams, Athol, ed., Hillslope Processes: Boston, MA, Allen and Unwin, p. 203-222.

Kishimoto, Haruko, 1968, Cartometric Measurements: Geographisches Institut der Universität Zürich, 143 p.

Klein, Micha, 1976, Hydrograph peakedness and basin area: Earth Surface Processes, v. 1, no. 1, p. 27-30.

Klein, Micha, 1981, Drainage area and the variation of channel geometry downstream: Earth Surface Processes and Landforms, v. 6, no. 6, p. 589-593.

Knighton, A.D., 1981, Asymmetry of river channel cross-sections—Part I. Quantitative indices: Earth Surface Processes and Landforms, v. 6, no. 6, p. 581-588.

Kohchi, Nobuo, 1981, Wavelength of free meanders in Japan—a multiple regression analysis (in Japanese with English abstract and figure captions): Geographical Sciences (University of Hiroshima), v. 36, no. 9, p. 16-22.

Kohchi, Nobuo, 1987, Elements of meander geometry (in Japanese with English figure captions): Geographical Sciences (University of Hiroshima), v. 42, no. 3, p. 167-174.

Kooi, Henk, and Beaumont, Christopher, 1996, Large-scale geomorphology—Classical concepts reconciled and integrated with contemporary ideas via a surface proceses model: Journal of Geophysical Research, v. 101, no. B2, p. 3361-3386.

Kopal, Zdenek, ed., 1961, Studies in Lunar Topography: Bedford MA, U.S. Air Force Geophysics Directorate, 205 p.

Köstli, A., and Sigle, M., 1986, The random access data structure of the DTM program SCOP: International Archives of Photogrammetry and Remote Sensing, v. 26, no. B4, p. 128-137.

Köthe, Rüdiger, 1996, Literary references for DTM, relief analysis, relief and soil, and relief and hydrology: <http://uggg-pc-s1.uni-geog.gwdg.de/pg/sara/litdgm-e.htm> [as of February 1996, about 350 entries]

Kovar, K., and Nachtnebel, H.P., eds., 1996, Application of Geographic Information Systems in Hydrology and Water Resources Management: HydroGIS'96 Conference, Vienna, April 16-19, Proceedings, International Association of Hydrological Sciences (IAHS) Publication No. 235., 711 p.

Kumar, Anil, and Pandey, R.N., 1982a, Quantitative analysis of relief of the Hazaribagh Plateau, *in* Sharma, H.S., ed., Perspectives in Geomorphology, v. 4, Essays on Indian Geomorphology: New Delhi, Concept Publishing Co., p. 235-257.

Kumar, Anil, and Pandey, R.N., 1982b, Salient characteristics of slope profiles of Hazaribagh Plateau, *in* Sharma, H.S., ed., Perspectives in Geomorphology, v. 4, Essays on Indian Geomorphology: New Delhi, Concept Publishing Co., p. 259-269.

Kumler, M.P., 1994, An intensive comparison of triangulated irregular networks (TINs) and digital elevation models (DEMs): Cartographica, v. 31, no. 2 (Monograph 45), 99 p.

Kwok, Ronald, and Fahnstock, M.A., 1996, Ice sheet motion and topography from radar interferometry: IEEE Transactions on Geoscience and Remote Sensing, v. 34, no. 1, p. 189-200.

L

Lacey, A., Ockendon, J.R., and Turcotte, D.L., 1981, On the geometrical form of volcanoes: Earth and Planetary Science Letters, v. 54, p. 139-143.

Lagacherie, Philippe, Moussa, Roger, Cormary, Didier, and Molenat, Jerome, 1996, Effects of DEM data source and sampling pattern on topographical parameters and on a topography-based hydrological model, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 191-199.

Lanari, Riccardo, and ten others, 1996, Generation of digital elevation models by using SIR-C/X-SAR multifrequency two-pass interferometry—the Etna case study: IEEE Transactions on Geoscience and Remote Sensing, v. 34, no. 5, p. 1097-1114.

Land Operations Department, 1965, A proposal for terrain characterization and simulation using spectral methods: Santa Barbara, CA, General Motors Research Laboratories, Proposal P65-76, 25 p.

Lapen, D.R., 1991, Modelling the redistribution of snow in a prairie agricultural landscape using digital terrain and spatial entropy analysis: Saskatoon, University of Saskatchewan, M.Sci. Thesis, 290 p.

Lapen, D.R., and Martz, L.W., 1996, An investigation of the spatial association between snow depth and topography in a Prairie agricultural landscape using digital terrain analysis: Journal of Hydrology, v. 184, no. 3-4, p. 277-298.

Lathrop, R.G., and Peterson, D.L., 1992, Identifying structural self-similarity in mountainous landscapes: Landscape Ecology, v. 6, no. 4, p. 233-238.

Lauer, S., 1972, Anwendung der skalaren Prädikion auf das Problem des digitalen Höhenmodelles (in German): Nachrichten aus dem Karten- und Vermessungswesen, Series 1, v. 51, p. 105-116.

Lawler, Andrew, 1995, Sea-floor data flow from postwar era: Science, v. 270, no. 5237, p. 727.

Lea, N.J., 1992, An aspect driven kinematic routing algorithm, *in* Parsons, A.J., and Abrahams, A.D., eds., Overland Flow—Hydraulics and erosion mechanics: New York, Chapman and Hall, p. 393-407.

Leberl, F.W., Kropatsch, W., and Lipps, V., 1981, Interpolation of raster heights from digitized contour lines: Archives of the International Society for Photogrammetry, v. 23, Part B, no. 3, p. 458-468.

Lechthaler, M., 1986, Entropie der Geländedarstellung durch Höhenlinien an einer Reihe topographischer Karten: Vienna, Tech. Univ., Dissertation, Auszug und Summary (translated from the Croatian), 138 p.

Lee, Jay, 1989, Coverage and visibility problems on topographic surfaces: London, Canada, Department of Geography, University of Western Ontario, unpublished Ph.D. thesis, paging unknown.

Lee, Jay, and Chu, C.-J., 1996, Spatial structures of digital terrain models and hydrological feature extraction, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 201-206.

Lee, Jay, and Marion, L.K., 1994, Analysis of spatial autocorrelation of USGS 1:250,000 digital elevation models, *in* GIS/LIS '94, Annual Conference and Exposition, Phoenix, AZ, October 25-27, ASPRS/ ACSM, Proceedings, p. 504-513.

Leheny, R.L., and Nagel, S.R., 1993, Model for the evolution of river networks: Physical Review Letters, v. 71, no. 9, p. 1470-1473.

Leopold, L.B., and Wolman, M.G., 1957, River channel patterns—braided, meandering, and straight: U.S. Geological Survey Professional Paper 282-B, p. 39-84.

Letts, P.J., and Rochon, G., 1980, Generation and use of digital elevation data for large areas: Canadian Symposium on Remote Sensing, 6th, Halifax, Nova Scotia, Proceedings, p. 597-602.

Levitt, D.A., and Sandwell, D.T., 1966, Modal depth anomalies fom multibeam bathymetry—is there a

South Pacific superswell?: Earth and Planetary Science Letters, v. 139, nos. 1-2, p. 1-16.

Lewis, S.M., Barfield, B.J., and Storm, D.E., 1994, A method for developing probability distributions for rill flow and density: Transactions of the American Society of Agricultural Engineers, v. 37, no. 6, p. 1879-1887.

Li, Rongxing, Qian, Liming, and Blais, J.A.R., 1995, A hypergraph-based conceptual model for bathymetric and related data management: Marine Geodesy, v. 18, no. 3, p. 173-182.

Li, Zhilin, 1995, An examination of algorithms for the detection of critical points on digital cartographic lines: The Cartographic Journal, v. 32, no. 2, p. 121-125.

Lindenberger, J., 1991, Methods and results of high precision airborne laser profiling: Photogrammetric Week, 43rd, Department of Photogrammetry, University of Stuttgart, Germany, Proceedings, v. 15, p. 83-92.

Ling, F.F., 1990, Fractals, engineering surfaces and tribology: Wear: v. 136, no. 1, p. 141-156.

Linsley, R.K., Kohler, M.A., and Paulus, J.L.H., 1949, Applied Hydrology: New York, McGraw-Hill, 689 p. [2nd ed., 1975]

Linton, D.L., 1958, Morphological mapping: Geography (UK), v. 43, no. 1, p. 10-17.

Lockard, D.M., 1974, The LAUNI-2 code—a program for calculating crater volume: Kirtland Air Force Base, New Mexico, Air Force Weapons Laboratory Technical Report 73-265, 102 p.

Lord, E.A., and Wilson, C.B., 1984, The mathematical description of shape and form: Chichester (UK), Halsted Press, 260 p.

Loudon, T.V., 1964, Computer analysis of orientation data in structural geology: Office of Naval Research, Geography Branch, ONR Task No. 389-135, Technical Report 13, 129 p.

Loudon, T.V., 1967, The use of eigenvector methods in describing surfaces, *in* Merriam, D.F., and Cocke, N.C., eds., Computer Applications in the Earth Sciences: Lawrence, KS, State Geological Survey, The University of Kansas, Computer Contribution 12, p. 12-15.

Louis, H., 1957, Der Reliefsockel als Gestaltungsmerkmal des Abtragungsreliefs (in German): Stuttgart Geogr. Studien (Lautensach-Festschrift), v. 69, p. 65-70.

Lu, Minjiao, Koike, Tosio, and Hayakawa, Norio, 1989, A model using distributed data of radar rain and and altitude (in Japanese): Proc. Japanese Society of Civil Engineers, v. 411, no. 11-12, p. 135-142.

Lu, Minjiao, Koike, Tosio, and Hayakawa, Norio, 1995, Computation of hydrologically sound grid-based DEM from contour lines considering the position of valleys and ridges (in Japanese): Ann. J. Hydraul. Engng., JSCE, v. 39, p. 127-132.

Lu, Minjiao, Koike, Tosio, and Hayakawa, Norio, 1996, A distributed hydrological modelling system linking GIS and hydrological models, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 141-148.

Lucchitta, B.K., 1971, Evaluation of photometric slope derivation, *in* Analysis of Apollo 10 Photography and Visual Observations: National Aeronautics and Space Administration, Special Publication 232, p. 31-35.

Lugo, J.A., and Clarke, K.C., 1995, Implementation of triangulated quadtree sequencing for a global relief data structure, *in* American Society for Photogrammetry and Remote Sensing / American Congress on Surveying and Mapping, Annual Convention, Charlotte, NC, February 27-March 2: Technical Papers, v. 4 (AutoCarto 12), p. 147-156.

Lustig, L.K., 1969, Quantitative analysis of desert topography, *in* McGinnies, W.G., and Goldman, B.J., eds., Arid Lands in Perspective: Tucson, University of Arizona Press, p. 47-58.

M

MacDonald, T.L., 1929, The altitudes of lunar craters: Journal of the British Astronomical Association, v. 39, p. 314-324.

MacDonald, T.L., 1931, On the determination of relative lunar altitudes: Journal of the British Astronomical Association, v. 41, p. 367-379.

MacDonald, T.L., 1931, The number and area of lunar objects: Journal of the British Astronomical Association, v. 41, p. 288-290.

MacDonald, T.L., 1932, Considerations on lunar slopes: Journal of the British Astronomical Association, v. 42, p. 291-294.

MacKay, M.E., Rowland, S.K., Garbeil, H., and Mouginis-Mark, P.J. 1996, Hawaii topography—the limits of radar interferometry (abs.): Fall Meeting Supplement to Eos, Transactions of the American Geophysical Union, v. 77, no. 46, p. F52-F53.

Maddox, John, 1986, Gentle warning on fractal fashions: Nature, v. 322, no. 6077, p. 303.

Mainsah, E., and Stout, K.J., 1993, Second international workshop on the development of methods for the characterization of roughness in 3-D: Precision Engineering, v. 15, no. 4, p. 287-288.

Majumdar, A., and Bhushan, B., 1990, Role of fractal geometry in roughness characterization and contact mechanics of surfaces: ASME Journal of Tribology, v. 112, no. 2, p. 205-216.

Majumdar, A., and Bhushan, B., 1991, Fractal model of elastic-plastic contact between rough surfaces: ASME Journal of Tribology, v. 113, no. 1, p. 1-11.

Makarovic, Branko, 1983, A test on compression of digital terrain model data: ITC Journal 1983/2, p. 133-138.

Manninen, A.T., 1996, Surface morphology and backscattering of ice-ridge sails in the Baltic Sea: Journal of Glaciology, v. 42, no. 140, p. 141-156.

Marcus, A.H., 1967, Statistical model of a flooded random surface and applications to lunar terrain: Journal of Geophysical Research, v. 72, no. 6, p. 1721-1726.

Maritan, Amos, Colaiori, Francesca, Flammini, Alessandro, Cieplak, Marek, and Banavar, J.R., 1996, Universality classes of optimal channel networks: Science, v. 272, no. 5264, p. 984-986.

Mark, D.M., 1974, A comparison of computer-based terrain storage methods with respect to the evaluation of certain geomorphometric measures: Vancouver, Canada, Department of Geography, University of British Columbia, unpublished M.A. thesis, 171 p.

Mark, D.M., and Goodchild, M.F., 1982, Topologic model for drainage networks with lakes: Water Resources Research, v. 18, no. 2, p. 275-280.

Markov, A.V., 1966, On the relative depths of the Moon's annular rings and craters in Mare Nubium: Doklady Akad. Nauk. SSSR, v. 167, p. 63-64.

Martz, L.W., and Garbrecht, Jurgen, 1993c, Generation of network and subwatershed parameters from digital elevation models. Part I—Algorithms and system design of DEDNM, *in* GIS'93 conference, GIS in Forestry, Environmental and Natural Resources Management, Vancouver, BC: Proceedings, p. 338-343.

Martz, L.W., and Garbrecht, Jurgen, 1995, Automated recognition of valley lines and drainage networks from grid digital elevation models: a review and a new method—Comment: Journal of Hydrology, v. 167, nos. 1-4, p. 393-396.

Mason, R.L., McCombs, W.M., and Cramblit, D.C., 1964, Engineering Lunar Model Surface (ELMS): JFK Space Center, Future Studies Branch, Launch Support Equipment Engineering Division, Tech. Report TR-83-D, paging unknown.

Masuoka, P.M., Hoppin, A.D., and Lowman, P.D., Jr., 1995, A study of the Sudbury Basin, Ontario, using radar combined with digital elevation data—preliminary results, *in* American Society for Photogrammetry and Remote Sensing / American Congress on Surveying and Mapping, Annual Convention, Charlotte, NC, February 27-March 2: Technical Papers, v. 3 (ASPRS), p. 704-713.

Mather, P.M., 1979, Theory and quantitative methods in geomorphology: Progress in Physical Geography, v. 3, no. 4, p. 471-487.

Matsukura, Yukinori, and Nasuno, Isao, 1992, Rock-landform relations in Nantai-san area, northwestern part of Ibaraki Prefecture: Institute of Geoscience, University of Tsukuba, Annual Report, no. 18, p. 33-38.

Matsushita, Mitsugu, and Ouchi, Shunji, 1989, On the self-affinity of various curves: Journal of the

Physical Society of Japan, v. 58, no. 5, p. 1489-1492.

Mattsson, Lars, and Wågberg, Pia, 1993, Assessment of surface finish on bulk scattering materials—a comparison between optical laser stylus and mechanical stylus profilometers: Precision Engineering, v. 15, no. 3, p. 141-149.

McCarroll, Danny, and Nesje, Atle, 1996, Rock surface roughness as an indicator of degree of rock surface weathering: Earth Surface Processes and Landforms, v. 21, no. 10, p. 963-977.

McClean, C.J., 1991, The scale-free and scale-bound properties of land surfaces—fractal analysis and specific geomorphometry from digital terrain models: University of Durham, UK, Department of Geography, Ph.D. thesis, 308 p.

McCormack, J.E., Gahegan, M.N., Roberts, S.A., Hogg, J., and Hoyle, B.S., 1993, Feature-based derivation of drainage networks: International Journal of Geographic Information Systems, v. 7, no. 3, p. 263-279.

McDermid, G.J., and Franklin, S.E., 1995, Remote sensing and geomorphometric discrimination of slope processes, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 165-185.

McDonnell, J.J., Freer, Jim, Hooper, Rick, Kendall, Carol, Burns, Doug, Beven, Keith, and Peters, Jake, 1996, New method developed for studying flow on hillslopes: Eos, Transactions of the American Geophysical Union, v. 77, no. 47, p. 465, 472.

McDonnell, R.A., 1996, Including the spatial dimension—using geographical information systems in hydrology: Progress in Physical Geography, v. 20, no. 2, p. 159-177.

McEwen, A.S., 1991, Photometric functions for photoclinometry and other applications: Icarus, v. 92, no. 2, p. 298-311.

McGillem, C.D., and Miller, B.P., 1962, Lunar surface roughness from crater statistics: Journal of Geophysical Research, v. 67, no. 12, p. 4787-4794.

McGrain, Preston, and Currens, J.C., 1978, Topography of Kentucky: Kentucky Geological Survey Special Publication 25, 76 p.

McIsaac, G.F., Mitchell, J.K., Hirschi, M.C., and Yen, B.C., 1996, Rill cross-sectional geometry and soil erosion as influenced by soil and tillage—Part I. Empirical study: Transactions of the American Society of Agricultural Engineers, v. 39, no. 3, p. 891-903.

McNutt, M.K., Sichoix, Lydie, and Bonneville, Alain, 1996, Modal depths from shipboard bathymetry—there IS a South Pacific superswell: .Geophysical Research Letters, v. 23, no. 23, p. 3397-3400.

McQueen, J.T., Draxler, R.R., and Rolph, G.D., 1995, Influence of grid size and terrain resolution on wind field predictions from an operational mesoscale model: Journal of Applied Meteorology, v. 34, no. 10, p. 2166-2181.

Meade, Charles, and Sandwell, D.T., 1996, Synthetic-aperture radar for geodesy: Science, v. 273, 30 August, p. 1181-1182.

Meakin, Paul, Feder, Jens, and Jøssang, Torstein, 1991, Simple statistical models for river networks: Physica A, v. 176, no. 3, p. 409-429.

Mechaber, W.L., Marshall, D.B., Mechaber, R.A., Jobe, R.T., and Chew, F.S., 1996, Mapping leaf surface landscapes: Proceedings of the National Acacdemy of Sciences of the USA, v. 93, no. 10 (May), p. 4600-4603.

Meisels, Amnon, Raizman, Sonia, and Karnieli, Arnon, 1995, Skeletonizing a DEM into a drainage network: Computers and Geosciences, v. 21, no. 1, p. 187-196.

Mellor, C.A., and Paull, C.K., 1994, Sea Beam bathymetry of the Manteo 467 Lease Block off Cape Hatteras, North Carolina: Deep-Sea Research II, v. 41, no. 4-6, p. 711-718.

Melton, M.A., 1958, Use of punched cards to speed statistical analysis of geomorphic data: Geological Society of America Bulletin, v. 69, no. 3, p. 355-358.

Merlin, P., 1966, Résultat d'une analyse morphométrique de quelques massifs montagneux Nord-Africains: (in French): Acta Geographica (Paris), v. 61, no. 1, p. 14-15.

Merot, Ph., Ezzahar, B., Walter, C., and Aurousseau, P., 1995, Mapping waterlogging of soils using digital terrain models: Hydrological Processes, v. 9, no. 1, p. 27-34.

Merriam, D.F., and Sneath, P.H.A., 1966, Quantitative comparison of contour maps: Journal of Geophysical Research, v. 71, no. 4, p. 1105-1115.

Messmore, J.A., Fatale, L.A., Ackeret, J.R., Wu, D., and Walker, J.C., 1995, Field line-of-sight collection experiences and statistical analyses, *in* American Society for Photogrammetry and Remote Sensing / American Congress on Surveying and Mapping, Annual Convention, Charlotte, NC, February 27-March 2: Technical Papers, v. 1 (ACSM), p. 335-343.

Micropath Corp., 1995a, 3-Arc-Second Digital Elevation Data as distributed by USGS (the old Army data; in ASCII format for PC's in self-extracting DOS archived files on CD-ROM): 2023 Montane Drive East, Golden, CO, 80401, (303-526-5454). [data: one-degree blocks for contiguous US, Alaska, Hawaii, Puertp Rico, Virgin Islands]

Micropath Corp., 1995b, MapExplorer for Windows (DOS): 2023 Montane Drive East, Golden, CO, 80401, (303-526-5454). [applications software manipulates USGS 30-meter DEMs, DLGs, and maps in various ways: convert, display, search and select]

Micropath Corp., 1995c, U.S. Geological Survey 30 meter (7.5') digital elevation models (DEMs): 2023 Montane Drive East, Golden, CO, 80401, (303-526-5454). [data: all currently available (as of 06/95, 34,625) USGS 30-m ASCII DEMs; also available by state]

Microphotonics, 1995, Proscan 1000: Software for profiling and measuring microtopographic surfaces. [determines roughness and compares a sample's surface with that of a standard; P.O. Box 3129, Allentown, PA 18106-0129]

Miller, D.R., and Morrice, J.G., 1996, An assessment of the uncertainty of delimited catchment boundaries, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 445-457.

Miller, D.R., Morrice, J.G., Horne, P.L., and Aspinall, R.J., 1994, The use of geographic information systems for analysis of scenery in the Caingorm mountains, Scotland, *in* Price, M.F., and Heywood, D.I., eds., Mountain Environments and Geographic Information Systems: London, Taylor and Francis, p. 119-131.

Miller, J.R., and Ritter, J.B., 1996, An examination of the Rosgen classification of natural rivers: Catena, v. 27, nos. 3-4, p. 295-299.

Millman, P.M., 1956, A profile study of the New Quebec crater: Ottawa, Canada, Publications of the Dominion Observatory, no. 18, p. 61-82.

Milne, John, 1878, On the form of volcanoes: Geological Magazine, v. 15, no. 8, p. 337-345.

Milne, John, 1879, Further notes on the forms of volcanoes: Geological Magazine, v. 16, no. 11, p. 506-514.

Milwitsky, Benjamin, 1959, Study of taxiing problems associated with runway roughness: National Aeronautics and Space Administration Memo 2-21-59L, March, 12 p.

Mino, Y., 1942, Basic Theories of Geomorphology (in Japanese): Tokyo, Kokon-Shoin, 517 p.

Mitchell. Kristen, and Marks, Danny, 1994, Quantifying the effect of DEM grid resolution change on environmental modeling (abs.): Eos, Transactions of the American Geophysical Union, v. 75, no. 44, Supplement, p. 207.

Mitzutani, Takeshi, 1971, Theoretical analysis on the process of slope development based on morphometric measurements (in Japanese with English abstract and figure captions): Journal of Geography (Tokyo): v. 80, no. 3, p. 28-46.

Miyagi, Toyohiko, 1977, Statistical analysis of dissecting valley in hilly land: Science Reports of Tohoku University, Series 7 (Geography), v. 27, p. 163-181.

Moellering, Harold, and Rayner, J.N., 1979, Measurement of shape in geography and cartography: Ohio State University, Report of the Numerical Cartography Laboratory, NSF Grant No. SOC77-11318, 109 p.

Moglen, G.E., and Bras, R.L., 1995, The effect of spatial heterogeneities on geomorphic expression in a model of basin evolution: Water Resources Research, v. 31, no. 10, p. 2613-2623.

Moglen, G.E., and Bras, R.L., 1995, The importance of spatially heterogeneous erosivity and the cumulative area distribution within a basin evolution model, *in* Whiting, P.J., and Furbish, D.J., eds., Predicting Process from Form (special issue): Geomorphology, v. 12, no. 3, p. 173-185.

Mohr, P.A., 1961, The geology, structure, and origin of the Bishoftu (Ethiopia) explosion craters: Addis Ababa Geophysical Observatory Bulletin, v. 2, no. 2, p. 65-101.

Molnar, L., and Waldhaeusel, P., 1991, SCOP-DEM package to create, maintain, and apply digital terain models: Vienna, Institute for Photogrammetry and Remote Sensing, Vienna University of Technology (Gushausstr. 27-29, A-1040, Vienna, Austria), Product Information, paging unknown.

Monckton, C.G., 1994, An investigation into the spatial structure of error in digital elevation data, *in* Worboys, M.F., ed., Innovations In GIS 1: London, Taylor & Francis, p. 201-211.

Montello, D.R., Sullivan, C.N., and Pick, H.L., Jr., 1994, Recall memory for topographic maps and natural terrain—effects of experience and task performance: Cartographica, v. 31, no. 3, p. 18-36.

Montgomery, D.R., 1996, Reply to 'Comment on "Digital elevation model grid size, landscape representation, and hydrologic simulations"' by Weihua Zhang and David R. Montgomery: Water Resources Research, v. 32, no. 5, p. 1463-1465.

Moran, C.J., and Vézina, Guy, 1993, Visualizing soil surfaces and crop residues: IEEE Journal of Computer Graphics and Applications, v. 13, no. 2, p. 40-47.

Morariu, T., Savu, Al., ans Dumbravâ, 1957, Relief energy in Romania (in Romanian): Stud. Cercet. Geol., Geogr. (Cluj.), v. 8, nos. 3-4.

Morgan, R.P.C., 1971, A morphometric study of some valley systems on the English chalk-lands: Transactions and Papers of the Institute of British Geographers, v. 54, p. 33-44.

Moriya, Ichio, 1986, Morphometry of pyroclastic cones in Japan (in Japanese with English abstract and figure captions): Geographical Reports of Kanazawa University, No. 3, p. 5876.

Morris, D.G., and Flavin, R.W., 1990, A digital terrain model for hydrology, *in* International Symposium on Spatial Data Handling, 4th, Zürich, Switzerland, July 23-27: Proceedings, v. 1, p. 250-262.

Morris, Kevin, 1991, Using knowledge-base rules to map the three-dimensional nature of geological features: Thematic Conference on Remote Sensing, 8th, Denver, CO, April 29-May 2, Environmental Research Institute of Michigan, Ann Arbor, Proceedings, p. 989-1002.

Morris, S.E., 1995, Geomorphic aspects of stream-channel restoration: Physical Geography, v. 16, no. 5, p. 444-459.

Mosely, F., 1961, Erosion surfaces in the Forest of Bowland: Proceedings of the Yorkshire Geological Society (Hull University), v. 33, pt. 2, no. 9, p. 173-196.

Mottershead, Derek, 1996, A study of solution flutes (Rillenkarren) at Lluc, Mallorca: Zeitschrift für Geomorphologie, Supplementband 103, p. 215-241.

Mouginis-Mark, Peter, Garbeil, H., Zisk, S., Fryer, G., MacKay, M., Rowland, S.K., and Zebker, H., 1995, Volcano topographic mapping and surface change (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F63.

Mower, J.E., 1994, Data-parallel procedures for drainage basin analysis: Computers and Geosciences, v. 20. no. 9, p. 1365-1378.

Mrstik, Vincent, VanBlaricum, Glenn Jr., Cardillo, Gerard, and Fennell, Mark, 1996, Terrain height measurement accuracy of interferometric synthetic aperture radars: IEEE Transactions on Geoscience and Remote Sensing, v. 34, no. 1, p. 219-228.

Müller, P., and Holloway, G., 1995, Workshop revisits topographic effects in ocean: Eos, Transactions of the American Geophysical Union, v. 76, no. 30, p. 300, 303.

Munkres, J.R., 1975, Topology—A First Course: Englewood Cliffs, NJ, Prentice Hall, paging unknown.

Muntz, Richard, Mesrobian, Edmond, and Mechoso, C.R., 1995, Integrating data analysis, visualization, and data management in a heterogeneous distributed environment: Science Information Systems Newsletter, Pasadena, CA, NASA, Office of Space Science, Issue 36 (July), p. 7-13.

Murata, Teizo, 1966, A theoretical study of the forms of alluvial fans: Geographical Reports of Tokyo Metropolitan University, v. 1, p. 33-43.

Murray, A.B., and Paola, Chris, 1996, A new quantitative test of geomorphic models, applied to a model of braided streams: Water Resources Research, v. 32, no. 8, p. 2579-2587.

Murray, J.B., and Guest, J.E., 1970, Circularities of craters and related structures on Earth and moon: Modern Geology, v. 1, no. 2, p. 149-159.

Myers, N.O., 1962, Characterization of surface roughness: Wear, v. 5, no. 2, p. 182-189.

N

Nackman, L.R., 1984, Two-dimensional critical point configuration graphs: IEEE Transactions on Pattern Analysis and Machine Intelligence, v. 6, no. 4, p. 442-450.

Nakamura, Yoshio, 1962, Some relations between dissecting valleys and erosional relief in the Southwestern part of the Abukuma Plateau: Science Reports of the Tohoku University, v. 11, p. 45-59.

Nakamura, Yoshio, 1965, Relief distribution in the Aizu Mountains: Science Reports of the Tohoku University, v. 14, p. 39-53.

Nakata, J.K., and Mark, R.K., 1995, Make fractal landscapes and fly-through animations using USGS digital elevation models (DEM's) (abs.): American Association of Petroleum Geologists Bulletin, *in* AAPG Pacific meeting; abstracts, v. 79, no. 4, p. 594-595.

National Geographic Society, 1995, Above the Rockies through digital eyes (map): Washington, D.C., July, scale 1:2,847,000.

Natural Systems Pty Ltd, 1995, WaterWay 4.1: P.O. Box 430, Jamison Centre, ACT 2614, Australia. [grid-based DEM-to-watershed software for PC-DOS; cost is a function of data-set size]

Nelson, E.J., and Jones, N.L., 1995, Reducing elevation roundoff errors in digital elevation models: Journal of Hydrology, v. 169, nos. 1-4, p. 37-49.

Neumann, G.A., and Forsyth, D.W., 1995, High resolution statistical estimation of seafloor morphology—oblique and orthogonal fabric on the flanks of the Mid-Atlantic Ridge, 34°-35.5° S: Marine Geophysical Researches, v. 17, no. 3, p. 221-250.

Niedda, Marcello, 1996, Use of network algorithms in spatially distributed models for the study of river basin response, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 207-214.

Niemann, K.O., and Howes, D.E., 1991, Applicability of digital terrain models for slope stability assessment: ITC Journal 1991-3, p. 127-137.

Nikora, Vladimir, Ibbitt, Richard, and Shankar, Ude, 1996, On channel network fractal properties—a case study of the Hutt River basin, New Zealand: Water Resources Research, v. 32, no. 11, p. 3375-3384.

Nogami, Michio, 1983, PASCAL program for processing of channel-net structures (in Japanese with English abstract): Transactions of the Japanese Geomorphological Union, v. 4, no. 1, p. 89-96.

Nogami, Michio, 1995, Geomorphometric measures for digital elevation models, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 53-67.

Nordin, C.F. Jr., 1971, Statistical properties of dune profiles: U.S. Geological Survey Professional Paper 562-F, 41 p. [PSD of alluvial flume dunes]

Nordyke, M.D., 1962, An analysis of cratering data from desert alluvium: Journal of Geophysical Research, v. 67, no. 5, p. 1965-1974.

Norman, S.A., Schaetzl, R.J., and Small, T.W., 1995, Effects of slope angle on mass movement by tree uprooting: Geomorphology, v. 14, no. 1, p. 19-27.

Nowicki, A.L., 1961, Topographic mapping at the Army Map Service: Washington, D.C., AMS Technical Report no. 37, 20 p.

Nowicki, Bogdan, 1985, Multiparameter representation of surface roughness: Wear, v. 102, no. 3, p. 161-176.

Nye, J.F., 1970, Glacier sliding without cavitation in a linear viscous approximation: Proceedings of the Royal Society of London, v. 315A, no. 1522, p. 381-403.

Nye, J.F., 1973, A note on the power spectra of sea-ice profiles: Arctic Ice Dynamics Joint Experiment (AIDJEX) Bulletin, No. 21 (July), p. 20-21.

O

O'Neill, M.P., 1987, Meandering channel patterns—analysis and interpretation: State University of New York, Buffalo, unpublished Ph.D. dissertation, 212 p.

O'Neill, M.P., and Abrahams, A.D., 1986, Objective identification of meanders and bends: Journal of Hydrology, v. 83, no. 3/4, p. 337-353.

Oberbeck, V.R., Aoyagi, M., and Murray, J.B., 1972, Circularity of martian craters: Modern Geology, v. 3, no. 4, p. 195-199.

Oberbeck, V.R., Aoyagi, M., Greeley, R., and Lovas, M., 1972, Planimetric shapes of lunar rilles: Apollo 16 Preliminary Science Report, National Aeronautics and Space Administration, Special Paper 315, p. 29-80 to 29-88.

Odeh, I.O.A., McBratney, A.B., and Chittleborough, D.J., 1995, Further results on prediction of soil properties from terrain attributes—heterotopic cokriging and regression-kriging: Geoderma, v. 67, nos. 3-4, p. 215-226.

Ogievsky, A.V., 1952, Land Hydrology, general and engineering (in Russian): Moscow, Gosud. Izd. selskohoz. literatury, paging unknown. [quotes early 20th Cent. Russian work]

Oguchi, Takashi, 1995, A morphometric approach to post-glacial channel development in the mountains of central Japan : Geographical Review of Japan, v. 68B, no. 2, p. 151-165.

Oguchi, Takashi, 1996, Factors affecting the magnitude of post-glacial hillslope incision in Japanese mountains: Catena, v. 26, nos. 3-4 p. 171-186.

Oguchi, Takashi, and Ohmori, Hiroo, 1994, Analysis of relationships among alluvial fan area, source basin area, basin slope, and sediment yield: Zeitschrift für Geomorphologie, v. 38, no. 4, p. 405-420.

Ohmori, Hiroo, 1972, Physiographic development of the southern part of the Matsumae Peninsula in Hokkaido—a statistical analysis of stepped topographies of a mountain mass (in Japanese with English abstract and figure captions: Journal of Geography (Tokyo): v. 81, no. 6, p. 1-31.

Ohmori, Hiroo, 1972, Selection of the reasonable mesh-scale in the choromorphometric measurement (in Japanese with English summary and figure captions): Chizu, Journal of the Japan Cartographic Association, v. 10, no. 3, p. 1-6.

Ohmori, Hiroo, 1979, A statistical approach to asymmetry in roughness of mountain slopes in Japan from the viewpoint of climatic geomorphology: Bulletin of the Department of Geography, University of Tokyo, v. 11, p. 77-92.

Ohmori, Hiroo, and Sugai, Toshihiko, 1995, Toward geomorphometric models for estimating landslide dynamics and forecasting landslide occurrence in Japanese mountains, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 149-164.

Olea, R.A., 1992, Kriging—understanding allays intimidation: Geobyte, v. 7, no. 5, p. 12-17.

Olyphant, G.A., 1981, Allometry and cirque evolution: Geological Society of America Bulletin, Part I, v. 92, no. 9, p. 679-685.

Omura, Hiroshi, and Yoshimoto, Hironori, 1986, Geomorphological relationship between multiple ridges and big landslide in Akaishi Mountain Range (in Japanese with English abstract and figure captions): Shin-Sabo (Journal of the Japanese Society of Erosion Control Engineers), v. 38, no. 6 (no. 143), p. 3-11.

Onda, Yuichi, and Tokunaga, Eiji, 1987, Laws of the composition of divide-segment system and drainage basin morphology (in Japanese with

English summary and figure captions): Geographical Review of Japan, v. 60 (ser. A), no. 9, p. 593-612.

Onorati, G., Ventura, R., Poscolieri, M., and Cinque, A., 1991, Landsat TM and DEM analysis for geomorphological units discrimination in the area surrounding the Gulf of Naples: Thematic Conference on Remote Sensing, 8th, Denver, CO, April 29-May 2, Environmental Research Institute of Michigan, Ann Arbor, Proceedings, p. 1257-1270.

Ordnance Survey, 1995, Digital Data Catalogue: Ordnance Survey, Southampton, UK, paging unknown.

Orford, J.D., and Whalley, W.B., 1991, Quantitative grain form analysis, *in* Syvitski, J.P.M., ed., Principles, Methods, and Application of Particle Size Analysis: Cambridge University Press, p. 88-108.

Orlowski, L.A., Schumm, S.A., and Mielke, P.W. Jr., 1995, Reach classifications of the lower Mississippi River: Geomorphology, v. 14, no. 3, p. 221-234.

Otake, Yoshinori, 1973, Characteristics of small drainage basins in hill areas (in Japanese with English abstract): Geographical Sciences (University of Hiroshima), no. 20, p. 31-42.

Otsuki, Kenshiro, Kurokawa, Ken, and Hasenaka, Toshiaki, 1992, Some characteristics of spatial distribution of volcanoes in the Michoacan-Guanajuato volcanic field, central Mexico, *in* Aoki, Ken'Ichiro, ed., Subduction Volcanism and Tectonics of Western Mexican Volcanic Belt: International Scientific Research Program (No. 03041014), Japanese-Mexico Co-operative research, Sendai, Tohoku University, pp, 104-114.

Outcalt, S.I., Hinkel, K.M., and Nelson, F.E., 1994, Fractal physiography?: Geomorphology, v. 11, no. 2, p. 91-106.

P

Parkhilovskiy, I.G., and Zaitzeva, I., 1965, Statistical investigation of automotive vibrations on an analog computer (translation from the Russian): Journal of Terramechanics, v. 2, no. 1, paging unknown.

Parkhilovskiy, I.G.,1961, Spekralnya Plotnost Raspredelenya nerovnosti mikroprofilya dorog ("Spectral density of road roughness", in Russian): Avtomobilnya Promyshlennost, no. 10, paging unknown.

Parsons, A.J., 1979, Plan form and profile form of hillslopes: Earth Surface Processes, v. 4, no. 4, p. 395-402.

Parsons, A.J., 1982, Slope profile variability in first-order drainage basins: Earth Surface Processes and Landforms, v. 7, no. 1, p. 71-78.

Pawling, J.W., 1970, Morphometric analysis of the Southern Peninsula of Michigan (abs.): East Lansing, Michigan State University, Dissertation Abstracts International, v. 31, p. 4770-B.

Pazner, Micha, Thies, Nancy, and Chávez, Roberto, 1994, Simple Computer Imaging and Mapping: London, Ontario, Think Space Inc., 135 p.

Peckham, S.D., 1995, Self-similarity in the three-dimensional geometry and dynamics of large river basins: Boulder, CO, University of Colorado, Program in Geophysics, Ph.D. dissertation, 286 p.

Peckham, S.D., and Gupta, V.K., 1993, Toward a geometry-based theory of scale-invariance for river networks (abs.): Eos, Transactions of the American Geophysical Union, v. 74, no. 43, Supplement, p. 296.

Péguy, Ch.P., 1951, Morphométrie et écoulement—recherches effectuées dans le cadre des Alpes Françaises du Sud: Assoc. Int. Hydrol., Proc. Assoc. Gén. Bruxelles, v. 3, no. 34, p. 252-257.

Peleg, Shmuel, Naor, Joseph, Hartley, Ralph, and Avnir, David, 1984, Multiple resolution texture analysis and classification: IEEE Transactions in Pattern Analysis and Machine Intelligence, v. 6, no. 4, p. 518-523.

Pelletier, J.D., and Turcotte, D.L., 1996, Scale-invariant topography and porosity variations in fluvial sedimentary basins: Journal of Geophysical Research, v. 101, no. B12, p. 28,165-28,175.

Pentland, A.P., 1990, Linear shape from shading: International Journal of Computer Vision, v. 4, no. 2, p. 153-162.

Perko, Drago, 1991, Digitalni model reliefa kot osnova za geografiski informacijski sistem (in Slovene): Geodetski vestnik (Ljubljana), v. 35, no. 4, p. 269-274.

Perko, Drago, 1993, Ekspozicije v Sloveniji (in Slovene): Geografski obzornik (Ljubljana), v. 40, no. 4, p. 22-25.

Perko, Drago, 1994, Relief aspects in Slovenia: Geografski Zbornik / Acta Geographica (Ljubljana), v. 34, p. 119-147.

Perrin, M., Roudier, P., and Peroche, B., 1993, Computer aided 3D erosional modeling operated on geologically diversified folded and faulted terrains, *in* Nishiwaki, Niichi, ed., Recent Advances in Geomathematics and Geoinformatics—papers presented at Section 22 Symposium, 29th International Geological Congress, Kyoto: Geoinformatics, v. 4, no. 3 (special issue), p. 161-166.

Pethick, J.S., 1975, A note on the drainage density-basin area relationship: Area, v. 7, no. 3, p. 217-222.

Peucker, T.K., Mark, D.M., and Pfaltz, J.L., 1973, Geographic Data Structures: U.S. Office of Naval Research, project report after one year, Research Report No. 1, NTIS, 121+ p.

Pevzner, Y.M., and Tikhonov, A.A., 1964, Issledovanye statistitcheskih svoystv mikroprofilya osnovnyh tipov avtomobilnyh dorog ("Statistical properties of highway profiles", in Russian): Avtomobilnya Promyshlennost, v. 30, no. 1, paging unknown.

Phillips, J.D., 1995a, Nonlinear dynamics and the evolution of relief: Geomorphology, v. 14, no. 1, p. 57-64.

Phillips, J.D., 1995b, Self-organization and landscape evolution: Progress in Physical Geography, v. 19, no. 3, p. 309-321.

Phillips, R.J., 1979, An experiment with contour lines: The Cartographic Journal, v. 16, no. 2, p. 72-76.

Pichard, S., 1960, Étude statistique des formes des appareils volcaniques de la partie ouest du Massif du Tibesti (Sahara): Cahiers Géologique, no. 58-61, p. 594-598.

Pickett, S.T.A., and Cadenasso, M.L., 1995, Landscape ecology—spatial heterogeneity in ecological systems: Science, v. 269, no. 5222, p. 331-334.

Pike, R.J., 1967, Schroeter's rule and the modification of lunar crater impact morphometry: Journal of Geophysical Research, v. 72, no. 8, p. 2099-2106.

Pike, R.J., 1995a, Geomorphometry—progress, practice and prospect, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 221-238.

Pike, R.J., 1995b, Introduction, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 1-3.

Pike, R.J., 1995c, Walter F. Wood and his science of quantitative terrain analysis, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 5-11.

Pike, R.J., and Dikau, Richard, eds., 1995, Advances in Geomorphometry—Proceedings of the Walter F. Wood Memorial Symposium, August 23-28, 1993, Hamilton, Ontario, McMaster University: Zeitschrift für Geomorphologie, Supplementband 101, 238 p.

Pilotti, Marco, Gandolfi, Claudio, and Bischetti, G.B., 1996, Identification and analysis of natural channel networks from digital elevation models: Earth Surface Processes and Landforms, v. 21, no. 11, p. 1007-1020.

Pinchemel, Ph., 1950, L'étude des réseaux hydrographiques: Bulletin Assoc. Géogr. fr., p. 72-80.

Pinchemel, Ph., 1953, La méthode descriptive en géographie: Mélanges géographiques Ph. Arbos, Paris, Les Belles-Lettres, p. 15-18.

Pitty, A.F., 1966, Some problems in the location and delimitation of slope-profiles: Zeitschrift für Geomorphologie, v. 10, no, 4, p. 454-461.

Pitty, A.F., 1969, A scheme for hillslope analysis: Hull University Occasional Papers in Geography, no. 9, p. 62-69.

Playán, E., Faci, J.M., and Serreta, A., 1996, Characterizing microtopographical effects on level-basin irrigation performance: Agricultural Water Management, v. 29, no. 2, p. 129-145.

Pohn, H.A., 1963, New measurements of steep lunar slopes: Publications of the Astronomical Society of the Pacific, v. 75, no. 443 (May), p. 186-187.

Pope, K.O., Ocampo, A.C., Kinsland, G.L., and Smith, Randy, 1996, Surface expression of the Chicxulub crater: Geology, v. 24, no. 6, p. 527-530.

Power, W.L., and Tullis, T.E., 1991, Euclidean and fractal models for the description of rock surface roughness: Journal of Geophysical Research, v. 96, no. B1, p. 415-424.

Powers, P.S., Chiarle, Marta, and Savage, W.Z., 1996, A digital photogrammetric method for measuring horizontal surficial movements on the Slumgullion earthflow, Hinsdale County, Colorado: Computers and Geosciences, v. 22, no. 6, p. 651-663.

Pratson, L.F., and Haxby, W.F., 1996, What is the slope of the U.S. continental slope?: Geology, v. 24, no. 1, p. 3-6.

Priestnall, Gary, and Downs, P.W., 1996, Automated parameter estimation for catchment scale river channel studies—the benefits of raster-vector integration, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 215-223.

Pritt, M.D., 1996, Phase unwrapping by means of multigrid techniques for interferometric SAR: IEEE Transactions on Geoscience and Remote Sensing, v. 34, no. 3, p. 728-738.

Prorok, Philip, 1968, Probability foundations of terrain slope analysis: Buffalo, NY, Cornell Aeronautical Laboratories, Report No. 166, 94 p.

Prosser, I.P., and Abernathy, Bruce, 1996, Predicting the topographic limits to a gully network using a digital terrain model and process thresholds: Water Resources Research, v. 32, no. 7, p. 2289-2298.

Prosser, I.P., and Dietrich, W.E., 1995, Field experiments on erosion by overland flow and their implication for a digital terrain model of channel initiation: Water Resources Research, v. 31, no. 11, p. 2867-2876.

Putnam, T.M., 1917, Mathematical forms of certain eroded mountains: American Math. Monthly, v. 24, no. 10, p. 451-453.

Q

Quinn, P.F., Beven, K.J., and Lamb, R., 1995, The ln(a/tanβ) index—how to calculate it and how to use it within the TOPMODEL framework: Hydrological Processes, v. 9, no. 2, p. 161-182.

R

Rackham, T.W., 1967, Measurements and reductions of relative lunar altitudes, *in* Kopal, Zdenek, and Goudas, C., eds., Measure of the Moon: New York, Gordon and Breach/Science Publishers, p. 414-423.

Radovan, D., 1992, Analiticno kartografsko sencenje DMR-ja s psevdoslucajnostnimi rastri (in Slovene): Geodetski vestnik (Ljubljana), v. 36, no. 3, p. 250-255.

Rappaport, Yoay, Zhengrong, J.L., Naar, D.F., Barton, C., and Hey, R.N., 1995, Seamounts surrounding Easter Island follow power law distribution (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F328.

Reddy, S.L., 1996, Optimal land grading based on genetic algorithms: Journal of Irrigation and Drainage Engineering, v. 122, no. 4, p. 183-188.

Richards, K.S., 1982, Rivers—Form and Process in Alluvial Channels: London, Methuen, 358 p.

Richards, Keith, Arnold, Neil, Lane, Stuart, Chandra, Shobhit, El-Hames, Ahmed, Mattikalli, Nandesh, and Chandler, Jim, 1995, Numerical landscapes—static, kinematic and dynamic process-form relations, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry:

Zeitschrift für Geomorphologie, Supplementband 101, p. 201-220.

Rigon, Riccardo, Rodriguez-Iturbe, Ignacio, Maritan, Amos, Giacometti, Achille, Tarboton, D.G., and Rinaldo, Andrea, 1996, On Hack's law: Water Resources Research, v. 32, no. 11, p. 3367-3374.

Rinaldo, Andrea, Dietrich, W.E., Rigon, Riccardo, Vogel, G.K., and Rodriguez-Iturbe, Ignacio, 1995, Geomorphological signatures of varying climate: Nature, v. 374, no. 6523, p. 632-635.

Rinaldo, Andrea, Rodríguez-Iturbe, Ignacio, Rigon, Riccardo, Ijjasz-Vasquez, E.J., and Bras, R.L., 1993, Self-organized fractal river networks: Physical Review Letters, v. 70, no. 6, p. 822-825.

Rinaldo, Andrea, Vogel, G.K., Rigon, Riccardo, and Rodriguez-Iturbe, Ignacio, 1995, Can one gauge the shape of a basin?: Water Resources Research, v. 31, no. 4, p. 1119-1127.

Ritter, Paul, 1987, A vector-based slope and aspect generation algorithm: Photogrammetric Engineering and Remote Sensing, v. 53, no. 8, p. 1109-1111.

Robert, André, and Richards, K.S., 1988, On the modelling of sand bedforms using the semivariogram: Earth Surface Processes and Landforms, v. 13, no. 5, p. 459-473.

Robinson, G.M., Perry, D.M., and Peterson, R.W., 1991, Optical interferometry of surfaces: Scientific American, v. 265, no. 1, p. 66-71.

Robinson, J.E., 1975, Frequency analysis, sampling, and errors in spatial data, *in* Davis, J.C., and McCullagh, M.J., eds., Display and Analysis of Spatial Data: London, Wiley, p. 78-95.

Romer, E., 1931, Une nouvelle representation géographique de l'hypsométrie (in French): Paris, Congrès Internat. de Géographie, Comptes Rendue, v. I, p. 328ff.

Ronca, L.B., and Salisbury, J.W., 1966, Lunar history as suggested by the circularity index of lunar craters: Icarus, v. 5, no. 2, p. 130-138.

Rosen, P., Hensley, S., Lou, Y., Shaffer, S., and Fielding, E., 1995, A digital elevation model from Oregon to Mexico derived from SIR-C radar interferometry (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F64.

Rosén, B.-G., Ohlsson, R., and Thomas, T.R., 1996, Wear of cylinder bore microtopography: Wear, v. 198, nos. 1-2, p. 271-279.

Rosgen, D.L., 1996, A classification of natural rivers—reply to the comments by J.R. Miller and J.B. Ritter: Catena, v. 27, nos. 3-4, p. 301-307.

Rossi, M.J., 1996, Morphology and mechanism of eruption of postglacial shield volcanoes in Iceland: Bulletin of Volcanology, v. 57, no. 7, p. 530-540.

Roth, Giorgio, 1987, Three-dimensional morphometric analysis of a river network (abs.): Eos, Transactions, American Geophysical Union, v. 68, no. 44, p. 1276.

Roumilhac, M., 1960, Étude statistique des formes des appareils volcaniques de la partie ouest du Massif de l'Edjéré-Settéfet (Sahara): Cahiers Géologique, no. 58-61, p. 589-593.

Rouvray, D.H., 1996, The geometry of nature: Endeavour (new series), v. 20, no. 2, p. 79-85.

Row, L.W., and Hastings, D.A., 1994, TerrainBase worldwide digital terrain data documentation manual and CD-ROM: Boulder, CO, National Geophysical Data Center, paging unknown.

Roy, A.G., and Robert, André, 1990, Fractal techniques and the surface roughness of talus slopes—A comment: Earth Surface Processes and Landforms, v. 15, no. 3, p. 283-285.

Ruhe, R.V., 1975, Geomorphology—geomorphic processes and surficial geology: Boston, Houghton Mifflin, 246 p.

Russ, J.C., 1990, Computer-Assisted Microscopy, the Measurement and Analysis of Images: New York, Plenum Press, 453 p. [esp. Chap. 7, Image measurements, p., 175-220]

Russ, J.C., 1991, Measurement of the fractal dimension of surfaces: Journal of Computer-Assisted Microscopy, v. 3, no. 3, p. 127-143.

Russ, J.C., 1993, Light scattering from fractal surfaces: Journal of Computer-Assisted Microscopy, v. 5, no. 2, p. 171-189.

Russ, J.C., 1994, Fractal Surfaces: New York, Plenum Press, 309 p. [includes software on two diskettes; for both PC and Macintosh]

S

Sabbagh, G.J., Storm, D.E., and Haan, C.T., 1994, Digital terrain model to estimate watershed characteristics for hydrologic and water quality modeling: ASAE Paper No. 94-2034, St. Joseph, MI, paging unknown.

Sabin, T.J., and Holliday, V.T., 1995, Playas and lunettes on the southern High Plains—morphometric and spatial relationships: Annals of the Association of American Geographers, v. 85, no. 2, p. 286-305.

Saito, Kyoji, 1980, Classification of alluvial fans in Tohoku District based on cluster analysis (in Japanese with English summary): Geographical Review of Japan, v. 53, no. 11, p. 721-729.

Saito, Kyoji, 1982, Classification of alluvial fans in Japan by topographical and geological data of drainage basins (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 47, no. 7, p. 413-425.

Saito, Kyoji, 1983, Changes of debris supplies and channel fluctuation presumed by statistical analyses of alluvial fan features and structures (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 56, no. 2, p. 61-80.

Saito, Kyoji, 1993, Effectiveness of a dynamic equilibrium model for alluvial fans in the Japanese Islands and Taiwan Island: Journal of Saitama University, v. 42, no. 1, p. 33-48.

Sakaguchi, Yutaka, 1969a, A theory of relief forming: Bulletin of the Department of Geography, University of Tokyo, v. 1, p. 33-66.

Sakaguchi, Yutaka, 1969b, Development of drainage basins—an introduction to statistical geomorphology: Bulletin of the Department of Geography, University of Tokyo, v. 1, p. 67-74.

Sakaguchi, Yutaka, 1992, Hypsometric characteristics of Eurasia: Bulletin of the Department of Geography, University of Tokyo, V. 4, p. 13-16.

Sandwell, D.T., 1995, Ocean basin tectonics revealed with declassified Geosat altimeter data (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F149.

Sapozhnikov, V.B., and Foufoula-Georgiou, Efi, 1996a, Do the current landscape evolution models show self-organized criticality?: Water Resources Research, v. 32, no. 4, p. 1109-1112.

Sapozhnikov, V.B., and Foufoula-Georgiou, Efi, 1996b, Self-affinity in braided rivers: Water Resources Research, v. 32, no. 5, p. 1429-1439.

Sard, A., 1942, The measure of the critical values of differentiable maps: Bulletin of the American Mathematical Society, v. 48, no. 2, p. 883-890.

Savigear, R.A.G., and Waters, R.S., 1959, Land Form Survey: Department of Geography, University of Sheffield, UK, The Geographical Association, Report No. 1, p. i-iii, 24 p., 3 plates. [report and critique of the meeting at Sheffield on November 29, 1958]

Saxena, P.B., and Prakash, Satya, 1982, A study of the morphometric determinants of the stage of cycle of erosion in the Nayar Basin (Garhwal Himalaya), *in* Sharma, H.S., ed., Perspectives in Geomorphology, v. 4, Essays on Indian Geomorphology: New Delhi, Concept Publishing Co., p. 77-92.

Sayles, R.S., and Thomas, T.R., 1977, The spatial representation of surface roughness by means of the structure function—a practical alternative to correlation: Wear, v. 42, no. 2, p. 263-276.

Sayles, R.S., and Thomas, T.R., 1979, Measurements of the statistical microgeometry of engineering surfaces: Journal of Lubrication Technology, Transactions of the ASME, v. 101, p. 409-418.

Schmid-McGibbon, Gesche, 1995, Generalization of digital terrain models for use in landform mapping: Cartographica, v. 32, no. 3, p. 26-38.

Schmidt, J.F.J., 1878, Die Charte der Gebirges des Mondes (in German): Berlin, Dietrich Reimer, 303 p.

Schmidt, K.M., and Montgomery, D.R., 1995, Limits to relief: Science, v. 270, no. 5236, p. 617-620.

Schmittbuhl, Jean, Schmitt, François, and Scholz, Christopher, 1995, Scaling invariance of crack surfaces: Journal of Geophysical Research, v. 100, No. B4, p. 5953-5973.

Schrutka-Rechtenstamm, Guntram, 1954, Relative Höhenbestimmungen auf dem Monde mittels des Pariser Mondatlasses und visueller Messungen am fernrohr (Determination of relative lunar altitudes based on the Paris Atlas and telescopic measures, in German): Vienna, Sitz. Öst. Akad. der Wiss. Mathem.-naturw. Klasse, Abt. 2, Bd. 163, Heft 5-7, p. 179-213.

Schuler, D.L., Lee, J.-S., and De Grandi, Gianfranco, 1996, Measurement of topography using polarimetric SAR images: IEEE Transactions on Geoscience and Remote Sensing, v. 34, no. 5, p. 1266-1277.

Scientific Assessment and Strategy Team (SAST), 1994, Terrain analysis, *in* Chapter 4 (Physiography) *of* Science for Floodplain Management into the 21st Century, A Blueprint for Change, Part V: Washington, D.C., Report of the Interagency Floodplain Management Review Committee to the Administration Floodplain Management Task Force, Preliminary Report, p. 55-64.

Sharma, H.S., and Padmaja, G., 1982, Quantitative fluvial characteristics of streams of the Mej Basin (Rajasthan), *in* Sharma, H.S., ed., Perspectives in Geomorphology, v. 2, Quantitative Fluvial Geomorphology: New Delhi, Concept Publishing Co., p. 143-190.

Sharpton, V.L., Herrick, R.R., and Klaus, K., 1994, Topography of Venusian craters and implications for cratering mechanics (abs.): Eos, Transactions of the American Geophysical Union, v. 75, no. 44, Supplement, p. 413.

Shary, P.A., 1991, The topographic second derivative method (in Russian), *in* Geometry of the Land Surface Structures: Poushchino, Poushchino Scientific Center, p. 28-58.

Shary, P.A., 1995, Land surface in gravity points classification by a complete system of curvatures: Mathematical Geology, v. 27, no. 3, p. 373-390.

Shary, P.A., and Stepanov, I.N., 1991, On the second derivatives method in geology: Doklady AN SSSR, v. 319, no. 1, p. 456-460. [info from DEM's]

Shary, P.A., Kurjakova, G.A., and Florinsky, I.V., 1991, On an international experience of topographic methods applications in landscape studies—a concise review (in Russian), *in* Geometry of the Land Surface Structures: Poushchino, Poushchino Scientific Center, p. 13-27.

Shaw, John, Rains, Bruce, Eyton, Ronald, and Weissling, Lee, 1996, Laurentide subglacial outburst floods—landform evidence from digital elevation models: Canadian Journal of Earth Science, v. 33, no. 8, p. 1154-1168.

Shepard, M.K., Brackett, R.A., and Arvidson, R.E., 1995, Self-affine (fractal) topography—surface parameterization and radar scattering: Journal of Geophysical Research, v. 100, no. E6, p. 11,709-11,718.

Shepherd, R.G., 1985, Regression analysis of river profiles: Journal of Geology, v. 93, no. 3, p. 377-384.

Sherrington, I., 1985, The measurement and characterisation of surface topography: Lancaster, UK, Lancashire Polytechnic, Ph.D. thesis, paging unknown.

Sherrington, I., and Smith, E.H., 1987, Parameters for characterizing the surface topography of engineering components: Proceedings of the Institution of Mechanical Engineers, v. 201, no. C4, p. 297-306.

Sherrington, I., and Smith, E.H., 1990, Areal Fourier analysis of surface topography. Part I, Computational methods and sampling considerations: Surface Topography, v. 3, no. 1, p. 43-68.

Shimano, Yasuo, 1975, A study of Hack's law on the relationship between drainage areas and mainstream lengths (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 55, no. 5, p. 334-349.

Shimano, Yasuo, 1978, Geomorphic study of avalanche chute(s) in the upper drainage basin of the Tadami River (in Japanese with English summary): Geographical Review of Japan, v. 53, no. 3, p. 171-188.

Shimano, Yasuo, and Matsukura, Yukinori, 1978, On the observer variability in morphometric analysis of a drainage basin: Institute of Geoscience, University of Tsukuba, Annual Report, no. 4, p. 41-44.

Shimokawa, Kazuo, 1980, On the stochastic model of rill development in slope system (in Japanese with English summary): Geographical Review of Japan, v. 52, no. 2, p. 53-65.

Shiono, K., Wadatsumi, K., and Masumoto, S., 1985, A method for contouring of grid data converted from irregularly spaced data on a personal computer (I: Weighted linear interpolation; II: Principle of total minimum curvature): Geological Data Processing No. 10, p. 65-78, 79-104.

Shulits, Samuel, 1941, Rational equation of river bed profile: Transactions of the American Geophysical Union, v. 22, Part III, p. 622-630.

Shunping, Xie, and Desen, Tian, 1994, To improve tracing isopleth by route grid method: Acta Geodaetica et Cartographica Sinica (Selected papers for English edition), p. 103-109.

Shurr, G.W., Nelson, C.L., and Watkins, I.W., 1993, Recent tectonics in the northern Great Plains as expressed on Landsat and fractal dimensions of drainage networks, *in* Land Information from Space-based Systems: Pecora 12 Symposium, Sioux Falls, SD, August 24-26, U.S. Geological Survey, Proceedings, p. 89-97.

Sievers, J., and eight others, 1994, Validating and improving elevation data of a satellite-image map of Filchner-Ronne Ice Shelf, Antarctica, with results from ERS-1: Annals of Glaciology, v. 20, p. 347-352.

Simcox, G.N., 1995, The changing face of Army topography and its research and development, *in* American Society for Photogrammetry and Remote Sensing / American Congress on Surveying and Mapping, Annual Convention, Charlotte, NC, February 27-March 2: Technical Papers, v. 1 (ACSM), p. 277-280.

Singh, O.P., 1976, A quantitative approach to the classification of morpho-units—A case study of Palamau Upland: The National Geographer (India), v. 11, p. 83ff.

Singh, O.P., 1982, Morphometric evaluation of Landforms in Palamau Upland, *in* Sharma, H.S., ed., Perspectives in Geomorphology, v. 4, Essays on Indian Geomorphology: New Delhi, Concept Publishing Co., p. 109-131.

Singh, R.K., Gilbert, D.R., Fitz-Gerald, J., Harkness, S., and Lee, D.G., 1996, Engineered interfaces for adherent diamond coatings on large thermal-expansion coefficient mismatched substrates: Science, v. 272, no. 5260, p. 396-398.

Singh, R.L., 1974, Morphometric analysis of terrain: N.G.S.I. Bulletin (India), v. 22, no. 1, p. 2ff.

Singh, Savindra, and Upadhyaya, D.P., 1982, Topological and geometric study of drainage network, S.E. Chota Nagpur Region (India), *in* Sharma, H.S., ed., Perspectives in Geomorphology, v. 2, Quantitative Fluvial Geomorphology: New Delhi, Concept Publishing Co., p. 191-233.

Sinha, S.K., and Parker, Gary, 1996, Causes of concavity in longitudinal profiles of rivers: Water Resources Research, v. 32, no. 5, p. 1417-1428.

Skands, U.P.V., and Russ, J.C., 1995, Fractal roughness investigation of isotropically etched surfaces: Journal of Computer-Assisted Microscopy, v. 7, no. 2, p. 101-111.

Smart, J.S., 1972, Quantitative characteristics of channel network structure: Water Resources Research, v. 8, no. 6, p. 1487-1496.

Smart, J.S., and Werner, Christian, 1976, Applications of the random model of drainage basin composition: Earth Surface Processes, v. 1, no. 3, p. 219-233.

Smith, D.E., and Zuber, M.T., 1996, The shape of Mars and the topographic signature of the hemisphere dichotomy: Science, v. 271, no. 5246, p. 184-188.

Smith, Guy-Harold, 1939, The morphometry of Ohio: Annals of the Association of American Geographers, v. 29, p. 94 (ff?).

Smith, Guy-Harold, 1952, The quantitative study of the physical landscape: Columbus, Ohio State University, The Graduate School Record, v. 6, no. 3 (Dec.), p. 4-6.

Smith, M.B., and Vidmar, Andrej, 1994, Data set derivation for GIS-based urban hydrological modeling: Photogrammetric Engineering and Remote Sensing, v. 60, no. 1, p. 67-76.

Smith, W.H.F., and Sandwell, D.T., 1996, New global seafloor topography from satellite imagery (abs.): Fall Meeting Supplement to Eos, Transactions of the American Geophysical Union, v. 77, no. 46, p. F315.

Snaith, B., Edmonds, M.J., and Probert, S.D., 1981, Use of a profilometer for surface mapping: Precision Engineering, v. 3, no. 2, p. 87-90.

Sneath, P.H.A., 1966, Estimating concordance between geographical trends: Systematic Zoology, v. 15, no. 3, p. 250-252.

Snell, John, and Sivapalan, Murugesu, 1995, Application of the meta-channel concept—construction of the meta-channel hydraulic geometry for a natural catchment, *in* Kalma, J.D., and Sivapalan, Murugesu, eds., Scale Issues in Hydrological Modelling (special issue): Hydrological Processes, v. 9, No. 5/6, p. 485-505.

Sobolevsky, P.K., 1932, The modern mining geometry (in Russian): Socialistic Reconstruction and Science, v. 7, p. 42-78. [reprinted 1991 *in* Geometry of the Land Surface Structures: Poushchino, Poushchino Scientific Center, p. 156-197] [introduced plan curvature]

Spooner, C.S., Jr., Dossi, S.W., and Misulia, M.G., 1957, Let's go over the hill—potential benefits of profile scanning the stereo model: Photogrammetric Engineering, v. 23, no. 5, p. 909-920.

Sramek, Steven, and Johnson, Dwight, 1996, Filtered Geosat altimetry as a tool for global bathymetric chart development: Eos, Transactions of the American Geophysical Union, v. 77, no. 28, p. 265, 269.

Stocks, A.M., and Heywood, D.I., 1994, Terrain modelling for mountains, *in* Price, M.F., and Heywood, D.I., eds., Mountain Environments and Geographic Information Systems: London, Taylor and Francis, p. 25-40.

Stølum, H.-H., 1996, River meandering as a self-organization process: Science, v. 271, no. 5256, p. 1710-1713.

Storey, J.C., 1993, Hybrid stereopairs from space-based sensors—a new approach for creating digital terrain models, *in* Land Information from Space-based Systems: Pecora 12 Symposium, Sioux Falls, SD, August 24-26, U.S. Geological Survey, Proceedings, p. 55-60.

Stout, K.J., ed., 1994, Three Dimensional Surface Topography—Measurement, Interpretation, and Applications—A survey and bibliography: London UK and Bristol PA, Penton Press, 236 p.

Strees, L.V., 1958, Stereoscopic profile-scanning for contour line information: Photogrammetric Engineering, v. 24, no. 5, p. 775-779.

Stüwe, Kurt, 1994, Process and age constraints for the formation of Ayers Rock Australia—An example for two-dimensional mass diffusion with pinned boundaries: Zeitschrift für Geomorphologie, v. 38, no. 4, p. 435-455.

Su, Bo, and Li, Zhilin, 1995, An algebraic basis for digital generalization of area-patches based on morphological techniques: The Cartographic Journal, v. 32, no. 2, p. 148-153.

Sugitani, Takashi, 1989, Conversion of the digital land information files for the purpose of drawing river bed profiles (in Japanese with English abstract and figure captions): Journal of Geography (Tokyo), v. 98, no. 4, p. 471-479.

Sun, Tao, Jøssang, Torstein, and Schwartz, Klaus, 1996, A simulation model for meandering rivers: Water Resources Research, v. 32, no. 9, p. 2937-2954. [good bibliography]

Surface Analysis Group, 1968, A preliminary analysis of photometric/ computer terrain data for lunar trafficability models: Houston, TX, NASA Manned Spaceflight Center, Mapping Sciences Laboratory, October 4, unpublished working paper, 75 p.

Sustersic, France, 1985, A method of doline morphometry and computer processing (summary): Acta Carsologica (Ljubljana), v. 13, p. 79-97.

Sustersic, France, 1987, Small scale surface karst and solution dolines at the northeastern border of Planinsko polje (summary): Acta Carsologica (Ljubljana), v. 14, p. 51-82.

Sustersic, France, 1989, Calculation of doline slope inclination as a means for the geological interpretation (summary): Nas Krs (Slovenia), p. 26-27, 121-128.

Sustersic, France, 1994, Classic dolines of classic site, *in* International Karstological School, 1st, "Classical Karst", Lipica, Slovenia, September 20-23, 1993: Acta Carsologica (Ljubljana), v. 23, p. 123-156.

Suzuki, Takasuke, 1969, Rate of erosion in strato-volcanoes in Japan (in Japanese with English abstract and figure captions): Bulletin of the Volcanological Society of Japan, v. 14, no. 3, p. 133-147.

Suzuki, Yuichi, and Shimano, Yasuo, 1981, On the numbers of the first order streams: Institute of Geoscience, University of Tsukuba, Annual Report, no. 7, p. 26-29.

Svensson, Harald, 1958, Morphometrischer Beitrag zur Charakterisierung von Glazialtälern (in German): Zietschrift für Gletscherkunde und Glazialgeologie, v. 4, no. 1-2, p. 99-104.

Svensson, Harald, 1959, Is the cross-section of a glacial valley a parabola?: Jornal of Glaciology, v. 3, no. 25, p. 362-363.

T

Tachikawa, Y., Takasao, T., and Shiiba, M., 1996, TIN-based topographic modelling and runoff prediction using a basin geomorphic information system, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 225-232.

Tada, F., 1934, Relation between the altitude and relief energy of the mountain (in Japanese): Geographical Review of Japan, v. 10, p. 939-967.

Takayama, Shigemi, 1972, Map scale effect on the stream order analysis (in Japanese with English summary): Geographical Review of Japan, v. 45, no. 2, p. 112-119.

Takayasu, Hideki, and Inaoka, Hajime, 1992, New type of self-organized criticality in a model of erosion: Physical Review Letters, v. 68, no. 7, p. 966-969.

Takeda, Ichirou, 1995, Berm height on bar and non-bar beaches (in Japanese with English abstract and figure captions): Transactions, Japanese Geomorphological Union, v. 16, no. 4, p. 361-372.

Tanaka, Yukiya, 1990, The relationship between the evolution of valley side slope and rock properties in Soya Hill and Shiranuka Hill (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 63A, no. 12, p. 836-847.

Tang, Liang, 1992, Automatic extraction of specific geomorphological elements from contours, *in* International Symposium on Spatial Data Handling, 5th, Charleston, SC: Proceedings, v. 2, p. 554-566.

Tarboton, D.G., 1995, A new method for the determination of flow directions and contributing areas in grid digital elevation models (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F268.

Thomas, A.P., and Thomas, T.R., 1986, Engineering surfaces as fractals, *in* Fractal Aspects of Materials: Pittsburgh, PA, Materials Research Society, p. 75-77.

Thomas, D.S.G., 1988, Analysis of linear dune sediment-form relationships in the Kalihari dune desert: Earth Surface Processes and Landforms, v. 13, no. 6, p. 545-553.

Thomas, T.R., 1975, Recent advances in surface measurement and analysis of surface microgeometry: Wear, v. 33, no. 2, p. 205-233.

Thomas, T.R., 1981, Characterization of rough surfaces: Precision Engineering, v. 3, no. 2, p. 97-104.

Thomas, T.R., and Charlton, G., 1981, Variation of roughness parameters on some typical manufactured surfaces: Precision Engineering, v. 3, no. 2, p. 91-96.

Thomas, T.R., and Thomas, A.P., 1988, Fractals and engineering surface roughness: Surface Topography, v. 1, no. 1, p. 143-152.

Thomson, J.W., and Cooper, A.P.R., 1992, A digital map of Antarctica: Mapping Awareness (UK), v. 6, no. 5, p. 21-25.

Tibaldi, Alessandro, 1995, Morphology of pyroclastic cones and tectonics: Journal of Geophysical Research, v. 100, No. B12, p. 24,521-24,535.

Timmins, S., Huston, M.A., and Clapp, R.B., 1989, Generation of digital elevation models from contours and comparison of topographic indices (abs.): Eos, Transactions, American Geophysical Union, v. 70, no. 43, p. 1094.

Tokunaga, Eiji, 1966, The composition of drainage network in the Toyohira-river basin and valuation of Horton's first law (in Japanese with English abstract and figure captions): Geophysical Bulletin of Hokkaido University, no 15, p. 1-19.

Tokunaga, Eiji, 1972a, Topologically random channel networks (in Japanese): Geographical Reports, Tokyo Metropolitan University, v. 6, no. 7, p. 39-49.

Tokunaga, Eiji, 1972b, Statistical laws of drainage network composition (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 45, no. 5, p. 351-363.

Tokunaga, Eiji, 1974, Statistical law of stream numbers for subnetworks in infinite topologically random channel networks (in Japanese with English summary): Geographical Review of Japan, v. 47, no. 11, p. 696-708.

Tokunaga, Eiji, 1975, Laws of drainage composition in idealized drainage basins (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 48, no. 5, p. 351-364.

Tokunaga, Eiji, 1979, On the cyclicity and allometric growth of drainage networks (in Japanese with English summary and figure captions): Geographical Review of Japan, v. 52, no. 3, p. 126-136.

Tomita, Fumiaki, and Tsuji, Saburo, 1990, Computer Analysis of Visual Textures: Boston/Dordrecht/London, Kluwer, 173 p.

Troeh, F.R., 1964, Landform parameters correlated to soil drainage: Proceedings of the Soil Science Society of America, v. 28, no. 6, p. 808-812.

Trotter, C.M., and Dymond, J.R., 1993, The acquisition and application of digital elevation data using GIS and remote sensing: International Geoscience and Remote Sensing Symposium (IGARSS) '93, Tokyo, Proceedings, v. 4, p. 1713-1716.

Tsai, V.J.D, 1993, Delaunay triangulations in TIN creation—an overview and a linear-time algorithm: International Journal of Geographic Information Systems, v. 7, no. 6, p. 501-524.

Türk, N., Greig, M.J., Dearman, W.R., and Amin, F.F., 1987, Characterization of rock joint surfaces by fractal dimension, *in* U.S. Symposium on Rock Mechanics, 28th, Tucson, AZ, June 29-July 1: Proceedings, p. 1223-1236.

Turner, A.K., D'Agnese, F.A., and Faunt, C.C., 1966, Digital Elevation Model (DEM) file of topographic elevations for the Death Valley Region of southern Nevada and southeastern California processed from U.S. Geological Survey 1-Degree (3-arc-second) Digital Elevation Model data files: U.S. GEological Survey, Open-file Report 95-287, 9 p.

U

Ulupinar, F., and Nevatia, R., 1993, Perception of 3-D surfaces from 2-D contours: IEEE Transactions on Pattern Analysis and Machine Intelligence, v. 15, no. 1, p. 3-18.

U.S. Geological Survey, 1990, DLG2DEM production user's manual (draft): Reston, VA, USGS National Mapping Program, Technical instructions, 351 (?) p.

U.S. Geological Survey, 1994, GCIP Reference Data Set: U.S. Geological Survey Open-file Report 94-388. [one CD-ROM, includes 500-m DEM; contents available on-line at <http://nsdi.usgs.gov/nsdi/wais/water/gcip.html>]

U.S. National Geophysical Data Center, 1995, GLOBE Elevation Data, Version 0.1 (see NOAA flier SE-1105): Boulder, CO, Department of Commerce, National Oceanic and Atmospheric Administration, two CD-ROMs. [product 1090G27000: 30" gridded elevations for 60% of Earth's land surface in 11,478 1° blocks]

U.S. National Geophysical Data Center, 1996, National Ocean Service (NOS) Hydrographic Survey Data—U.S. Coastal Waters, Version 3.2 (see NOAA Data Announcement 96-MGG-02): Boulder, CO, Department of Commerce, National Oceanic and Atmospheric Administration, two CD-ROMs. [product 125A27001: bathymetry; 44 million soundings (1.7 GB); for PCs using Windows™ and UNIX using X Windows]

Usery, E.L., and Pape, David., 1995, Extracting geographic features from raster data, *in* American Society for Photogrammetry and Remote Sensing / American Congress on Surveying and Mapping, Annual Convention, Charlotte, NC, February 27-March 2: Technical Papers, v. 3 (ASPRS), p. 733-740.

V

Van Deusen, B.D., 1967, Analytical techniques for designing riding quality into automotive vehicles: Society of Automotive Engineers, SAE Paper 670021, paging unknown.

Van Deusen, B.D., and Hoppe, C.H., 1965, A study of the vehicle ride dynamics aspect of ground mobility: Detroit, MI, Chrysler Corporation, Defense Operations Division, MERS Project, Final Report, v. 4 (Field Measurements), 97 p.

van Leusen, P.M., 1993, Cartographic modelling in a cell-based GIS, *in* Andresen, J., Madsen, T., and Scollar, I., eds., Computing the Past, CAA92, Computer Applications and Quantitative Methods in Archaeology: Aarhus, Aarhus University Press, p. 105-123.

van Oosterom, P.J.M., 1994, Reactive Data Structures for Geographic Information Systems: N.Y., Oxford Press, 216 p.

van Westen, C.J., 1994, GIS in landslide hazard zonation—A review, with examples from the Andes of Colombia, *in* Price, M.F., and Heywood, D.I., eds., Mountain Environments and Geographic Information Systems: London, Taylor and Francis, p. 135-165.

Vandaele, Karel, Poesen, Jean, Govers, Gerard, and van Wesemael, Bas, 1996, Geomorphic threshold conditions for ephemeral gully incision: Geomorphology, v. 16, no. 2, p. 161-173.

Vandaele, Karel, Vanommeslaeghe, Joost, Muylaert, Raf, and Govers, Gerard, 1996, Monitoring soil redistribution patterns using sequential aerial photographs: Earth Surface Processes and Landforms, v. 21, no. 4, p. 353-364.

Varichenko, V.S., and eight others, 1994, Scanning tunnelling microscopy of diamond irradiated with high energy ions: Diamond and Related Materials, v. 3, nos. 4-6, p. 711-714.

Velitchiko, A.A., 1959, Several morphometrical differences between rills, gullies and river valleys (in Russian): Vopr. Geogr., v. 46, paging unknown.

Verrecchia, E.P., 1996, Morphometry of microstromatolites in calcrete laminar crusts and a fractal model of their growth: Mathematical Geology, v. 28, no. 1, p. 87-109.

Verspui, M.A., van der Velden, P., de With, G., and Slikkerveer, P.J., 1996, Angularity determination of abrasive powders: Wear, v. 199, no. 1, p. 122-126.

Vieux, B.E., and Tangella, S.K., 1995, Hydrologic scaling characteristics of drainage networks (abs): Eos, Transactions American Geophysical Union (supplement), v. 76, no. 17, p. S124.

Vincent, P., and Howarth, J., 1979, Drainage density-basin area relationship: Area (UK), v. 11, no. 3, p. 225-226.

Vogt, P.R., and Smoot, N.C., 1984, The Geisha guyots—Multibeam bathymetry and morphometric interpretation: Journal of Geophysical Research, v. 89, no. B13, p. 11,085-11,107.

W

Wagner, Mary Jo, 1995, Seeing in 3-D without the glasses—new mapping system makes data acquisition faster and less costly: Earth Observation Magazine, v. 4, no. 7, p. 51-53. [the Airborne Laser Terrain Mapping (ALTM) 1020 system]

Wallace, R.E., 1977, Profiles and ages of young fault scarps, north-central Nevada: Geological Society of America Bulletin, v. 88, no. 9, p. 1267-1281.

Walsh, R.P.D., 1996, Drainage density and network evolution in the humid tropics—evidence from the Seychelles and the Windward Islands: Zeitschrift für Geomorphologie, Supplementband 103, p. 1-23.

Walton, D.J., and Xu, R., 1991, Representing of contour lines by turning point preserving quadratic splines: The Cartographic Journal, v. 28, no. 2, p. 208-212.

Wang, Jianjun, Robinson, G.J., and White, Kevin, 1996, A fast solution to local viewshed computations using grid-based digital elevation models: Photogrammetric Engineering and Remote Sensing, v. 62, no. 10, p. 1157-1164.

Wang, Li, 1994, Un nouvel espace de texture (in French): International Journal of Remote Sensing, v. 15, no. 8, p. 1713-1723.

Wang, Li, 1995, Automatic identification of rocks in thin sections using texture analysis: Mathematical Geology, v. 27, no. 7, p. 847-865.

Watson, D.F., and Philip, G.M., 1984, Systematic triangulations: Computer Vision, Graphics, and Image Processing, v. 26, no. 2, p. 217-223.

Watson, F.G.R., Vertessy, R.A., and Band, L.E., 1996, Distributed parameterization of a large scale water balance model for an Australian forested region, *in* Kovar, K. and Nachtnebel, H.P., eds., Application of Geographic Information Systems in Hydrology and Water Resources Management (Proceedings of the HydroGIS'96 Conference, Vienna, April 16-19), International Association of Hydrological Sciences, Publ. no. 235, p. 157-166.

Webb, E.K., 1995, Simulation of braided channel topology and topography: Water Resources Research, v. 31, no. 10, p. 2603-2611.

Webster, R.W., and Beckett, P.H.T., 1965, Records of relief in study area, (appendix 12): Minor Statistical Studies on Terrain Evaluation: Christchurch, UK, Military Engineering Experimental Establishment, MEXE Report 877, p. 54-59.

Weeks, R.J., Smith, Milton, Pak, Kyung, Li, W.-H., Gillespie, Alan, and Gustafson, Bill, 1996, Surface roughness, radar backscatter, and visible and near-infrared reflectance in Death Valley, California: Journal of Geophysical Research, v. 101. no. E10, p. 23,077-23,090.

Weibel, Robert, 1991, Amplified intelligence and rule-based systems, *in* Buttenfield, B.P., and McMaster, R.B., eds., Map Generalization—making rules for knowledge representation: New York, Wiley/ Harlow (Essex, UK), Longman Scientific and Technical, p. 172-186.

Weibel, Robert, and Brändli, Martin, 1995, Adaptive methods for the refinement of digital terrain models for geomorphometric applications, *in* Pike, R.J., and Dikau, Richard, eds., Advances in Geomorphometry: Zeitschrift für Geomorphologie, Supplementband 101, p. 13-30.

Weibel, Robert, and Heller, Martin, 1990, A framework for digital terrain modeling, *in* International Symposium on Spatial Data Handling, 4th, Zürich, Switzerland, July 23-27: 1990, Proceedings, v. 1, p. 219-229.

Weidner, U., and Förstner, W., 1995, Towards automatic building extraction (sic?) from high-resolution digital elevation model: ISPRS Journal of Photogrammetry and Remote Sensing, v. 50, no. 4, p. 38-48.

Weih, R.C., and Smith, J.L., 1990, Characteristics and limitations of USGS digital elevation models, *in* Conference on Applications of GIS, Simulation Models, and Knowldege-based Systems for Landuse Management, Blacksburg (?), VA, Department of Agricultural Engineering, Virginia Polytechnic: Proceedings, p. 139-148.

Weissel, J.K., and Stark, C.P., 1996, Estimating topographic slope and curvature as a function of DEM resolution using wavelet transforms (abs.): Fall Meeting Supplement to Eos, Transactions of the American Geophysical Union, v. 77, no. 46, p. F233-F234.

Wendeborn, J.O., 1965, Die Unebenheiten landwirtschaftlicher Fahrbahnen ("The roughness of field roads", in German): Grundl. der Landtechn., v. 15, no. 2, paging unknown.

Werner, C., Hensley, S., Rosen, P., and Rodriguez, E., 1995, Radar interferometric estimation of surface slopes (abs.): Eos, Transactions of the American Geophysical Union, v. 76, no. 46, Supplement, p. F63.

Werner, Christian, 1972, Patterns of drainage areas with random topology: Geographical Analysis, v. 4, no. 2, p. 119-133.

Wessel, Paul, and Smith, W.H.F., 1991, Free software helps map and display data: Eos, Transactions of the American Geophysical Union, v. 72, no. 41, p. 441, 445-446. [public domain collection of UNIX tools]

Wessel, Paul, and Smith, W.H.F., 1995, New version of the Generic Mapping Tools (GMT) released: Eos, Transactions of the American Geophysical Union, v. 76, no. 33, p. 329. [updated public domain collection of UNIX software]

Wester, Kjell, and Lundén, Bengt, 1996, Digital elevation data, Landsat TM and magnetic data for visualization of geomorphological and geological features, *in* Singhroy, V.H., Nebert, D.D., and Johnson, A.I., eds., Remote Sensing and GIS for Site Characterization—Applications and Standards: West Conshohocken, PA, American Society for Testing and Materials, Special Technical Publication 1279, p. 29-37.

Wheatley, D., 1995, Cumulative viewshed analysis—a GIS-based method for investigating intervisibility, and its archaeological application, *in* Lock, Gary, and Stancic, Zoran, eds., Archaeology and Geographical Information Systems—A European Perspective: London, Taylor and Francis, p. 171-185.

Wheeler, D.A., 1984, Using parabolas to describe the cross-sections of glaciated valleys: Earth Surface Processes and Landforms, v. 9, no. 4, p. 391-394.

Whitehouse, D.J., 1978, The digital measurement of peak parameters on surface profiles: Journal of Mechanical Engineering Science, v. 20, no. 4, p. 221-227.

Whitehouse, D.J., 1982, The parameter rash—Is there a cure?: Wear, v. 83, no. 1, p. 75-78.

Whitehouse, D.J., and Phillips, M.J., 1978, Discrete properties of random surfaces: Philosophical Transactions of the Royal Society, v. 290, Series A, no. 1369, p. 267-298.

Whitehouse, D.J., and Phillips, M.J., 1982, Two-dimensional discrete properties of random surfaces: Philosophical Transactions of the Royal Society, Series A, v. 305, no. 1490, p. 441-468.

Wickramasinghe, H.K., 1989, Scanned-probe microscopes: Scientific American, v. 261, no. 4, p. 98-105.

Wilcox, David, and Moellering, Harold, 1995, Pass location to facilitate the direct extraction of Warntz networks from grid digital elevation models, *in* American Society for Photogrammetry and Remote Sensing / American Congress on Surveying and Mapping, Annual Convention, Charlotte, NC, February 27-March 2: Technical Papers, v. 4 (AutoCarto 12), p. 22-31.

Wildey, R.L., 1966, On terrain figures of merit for spacecraft landers: Journal of Spacecraft and Rockets, v. 3, p. 1551-1552.

Wildflower Productions, 1995, TOPO! San Francisco Bay Area (plus other areas in-work): 4104 24th Street, Suite 530, San Francisco, CA 94114. [CD-ROM for Macintosh or Windows, containing 45 USGS 7.5' DEM's plus interactive terrain mapping software]

Wilhelms, D.E., 1964, A photometric technique for measurement of lunar slopes: U.S. Geological Survey Astrogeologic Studies Annual Progress Report, August 1962 to July 1963, Part D, p. 1-12.

Williams, G.P., 1986, River meanders and channel size: Journal of Hydrology, v. 88, no. 1/2, p. 147-164.

Wilson, J.P., and Gallant, J. C., 1996, EROS, a grid-based program for estimating spatially-distributed erosion indices: Computers and Geosciences, v. 22, no. 7, p. 707-712.

Wolfram Research, Inc., 1996, Wavelet Explorer: software for signal and image analysis (Macintosh, Windows, Sun SPARC, and other platforms); based on Mathematica; 1-800-441-6284; http://www.wolfram.com/wpt; info@wolfram.com.

Wolock, D.M., 1995, Effects of subbasin size on topographic characteristics and simulated flow paths in Sleepers River watershed, Vermont: Water Resources Research, v. 31, no. 8, p. 1989-1997.

Wolock, D.M., and McCabe, G.J., Jr., 1995, Comparison of single and multiple flow direction algorithms for computing topographic parameters in TOPMODEL: Water Resources Research, v. 31, no. 5, p. 1315-1324.

Wood, J.D., and Fisher, P.F., 1993, Assessing interpolation accuracy in elevation models: IEEE Journal of Computer Graphics and Applications, v. 13, no. 2, p. 48-56.

Wooldridge, S.W., and Morgan, R.S., 1937, The geometrical nature of relief forms (Chapter 17) *in* The Physical Basis of Geography, an Outline of Geomorphology: London, Longmans Green & Co., p. 257-266.

Wright, K., and Karlsson, B., 1983, Topographic quantification of non-planar localized surfaces: Journal of Microscopy, v. 130, pt. 1, p. 37-51.

Wu, J., and Lin, S.-G., 1995, Height accuracy of one and a half centimetres by GPS rapid static surveying: International Journal of Remote Sensing, v. 16, no. 15, p. 2863-2874.

Wu, Weimin, and Sidle, R.C., 1995, A distributed slope stability model for steep forested basins: Water Resources Research, v. 31, no. 8, p. 2097-2110.

Y

Yatsu, Elihu, 1950, On relief energy of the Chichibu Mountains, Japan (in Japanese): Transactions of the Otsuka Geographical Association, v. 6, p. 323-330.

Yoeli, Pinhas, 1977, Computer executed interpolation of contours into arrays of randomly distributed height-points: The Cartographic Journal, v. 14, no. 2, p. 103-108.

Yokoi, Yoshihiro, Carr, J.R., and Watters, R.J., 1995, Fractal character of landslides: Environmental and Engineering Geoscience, v. 1, no. 1, p. 75-81.

Yonekawa, Satoshi, Sakai, Naoki, and Kitani, Osamu, 1996, Identification of idealized leaf types using simple dimensionless shape factors by image analysis: Transactions of the American Society of Agricultural Engineers, v. 39, no. 4, p. 1525-1533. [cf. drainage basin outlines]

Yoshida, Junko, and Akojima, Isao, 1986, Morphometric parameters for medium scale landform classification map in mountainous region (in Japanese with English summary and figure captions): Annals of the Tohoku Geographical Association, v. 38, no. 4, p. 317-326.

Yoshiyama, A., 1994, Relationship between channel slope and topographic parameters of drainage basins (in Japanese with English abstract): Geographical Review of Japan, v. 67, p. 794-802.

Z

Zarn, Benno, and Davies, T.R.H., 1994, The significance of processes on alluvial fans to hazard assessment: Zietschrift für Geomorphologie, v. 38, no. 4, p. 487-500.

Zdenkovic, M., 1976, Kartografska kommunikacija i odredivanje sadrzaja informacije 1 cm^2 topografske karte u mjerilu 1:1,000,000 (in Croatian): Geod. Fak., University of Zagreb, 83 p.

Zdenkovic, M., 1977, Entropija topografskih karata (in Croatian): Informatologia Jugoslavica, v. 9, no. 1-4, p. 19-38.

Zdenkovic, M., 1982, Odredivanje entropije prikaza reljefa na topografskim kartama (in Croatian): Geod. Fak., University of Zagreb, Reihe A 33, p. 26-44.

Zdenkovic, M., 1985, Entropija prikaza reljefa izohipsama na nizu nasih topografskih karata (in Croatian): Iniversity of Zagreb, Dissertation, 226 p.

Zdenkovic, M.L., and Scheidegger, A.E., 1989, Entropy of landscapes: Zietschrift für Geomorphologie, v. 33, no. 3, p. 361-371.

Zebker, H.A., Farr, T.G., Salazar, R.P., and Dixon, T.H., 1994, Mapping the world's topography using radar interferometry—the TOPSAT mission: Proceedings of the IEEE, v. 82, no. 12, p. 1774-1786.

Zehana, M., Desachy, J., and Zahzah, E.-H., 1991, DEM features for remote sensing image analysis by an expert system—Stream networks and real distances compilation: International Geoscience and Remote Sensing Symposium (IGARSS) '91, Proceedings, p. 1861-1864.

Zuchiewicz, Witold, 1995, Time-series analysis of river bed gradients in the Polish Carpathians—A statistical approach to the studies on young tectonic activity: Zeitschrift für Geomorphologie, v. 39, no. 4, p. 461-477.

CORRECTIONS

Andrle, Robert, and Abrahams, A.D., 1989, Fractal techniques and the surface roughness of talus slopes: Earth Surface Processes and Landforms, v. 14, no. 2, p. 197-209. [see also, 1990, Reply, ESPL, v. 15, no. 3, p. 287-290]

Burke, K., and Dixon, T .H., 1988, Topographic Science Working Group Report to the Land Processes Branch, Earth Science and Applications Division, NASA Headquarters: Houston, TX, Lunar and Planetary Laboratory, 64 p.

Christofoletti, Antonio, 1979, A análise da densidade de drenagem e suas implicações geomorfológicas: Geografia, v. 4, no. 8, p. 23-42.

Hoffman, R.R., and Pike, R.J., 1995, On the specification of the information available for the perception and description of the natural terrain, *in* Hancock, Peter, Flach, John, Caird, Jeff, and Vicente, Kim, eds., Local Applications of the Ecological Approach to Human-Machine Systems: Hillsdale, N.J., L. Erlbaum Assoc., v. 2, p. 285-323.

Humboldt, Alexander von, 18??, Kamm- und Gipfelhöhen der wichtigsten Gebirge (in German): Annalen der Physik und Chemie, v. 13, p. 521. **[not correct; reference not located]**

Imamura, Gakuro, 1937, Past glaciers and the present topography of the Japanese Alps: Geographical Institute, Bunrika University, Tokyo, Science Reports, Section C, No. 7, 61 p.

Kiuchi, S., 1935, Hypsographic curves of Japanese volcanoes: Geographical Review of Japan (Tokyo), v. 11, p. 688-702.

Kobashi, Sumiji, Masashige, Hirano, and Toshio, Imoo, 1985, Database construction and application for measures against debris(-flow) hazards in city suburbs (in Japanese; on the Rokko Mt. area): Research Report of the Grant-in-Aid for Scientific Research from the Ministry of Education, Science and Culture, Japan, No. 59020025, 68 p., 12 color plates.

Kobashi, Sumiji, 1987, The database "MOUDIS" for measures against mountain hazards and for preservation of the environment (in Japanese, with color illustrations): Newsletter of the Computer Center of Kyoto University, v. 20, no. 3, p. 138-145.

Musgrave, F.K., Kolb, C.E., and Mace, R.S., 1989, The synthesis and rendering of eroded fractal terrains, *in* SIGGRAPH '89, Proceedings: Computer Graphics, v. 23, no. 3, p. 41-50.

Oswald, H., and Raetzsch, H., 1984, A system for generation and display of digital elevation models: Geo-Processing, v. 2, no. 2, p. 197-218.

Phillips, J.D., 1993, Interpreting the fractal dimension of river networks, *in* Lam, Nina Siu-Ngan, and De Cola, Lee, eds., Fractals in Geography: Englewood Cliffs, NJ, PTR Prentice-Hall, p. 142-157.

Slaymaker, H.O., ed., 1968, Morphometric analysis of maps: British Geomorphological Research Group Occasional Paper 4, paging unknown.

Speight, J.G., 1965, Meander spectra of the Angabunga River: Journal of Hydrology, v. 3, no. 1, p. 1-15.

Woodruff, J.F., 1965, Frequency distribution of elevations as an index to terrain classification (abs.): Annals of the Association of American Geographers, v. 55, no. 4, p. 658.

Yefremov, Yu.K., 1949, Experiment in morphological classification of relief elements and simple landforms (in Russian), *in* Geographical Questions—Cartography (Voprosy geografii): Moscow, GIGL, no. 11, p. 190-236 (or 109-136?). [alt. spelling Efremov]