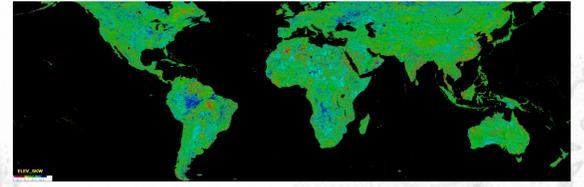
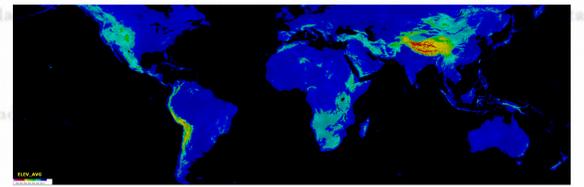
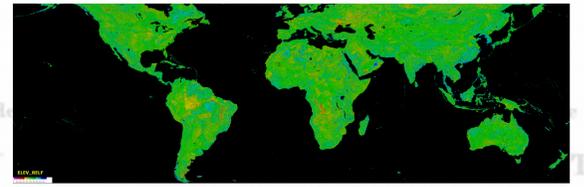
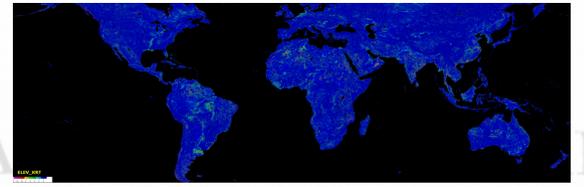
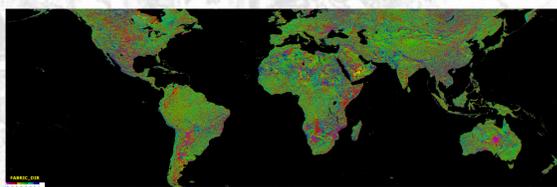
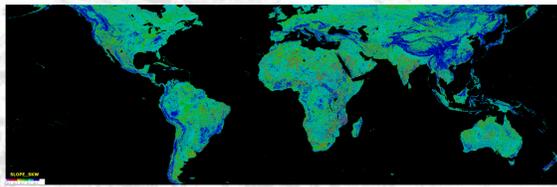
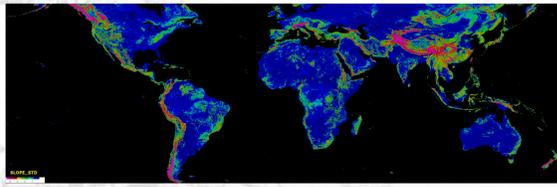
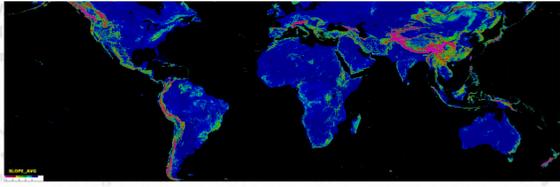
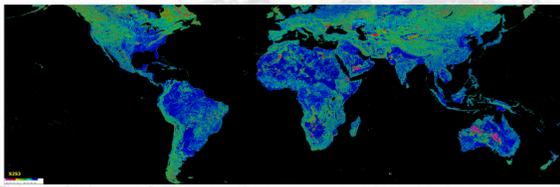
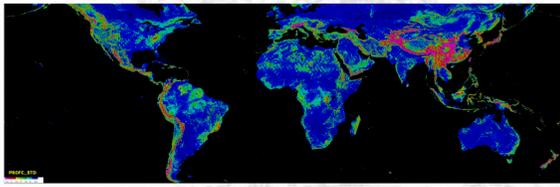
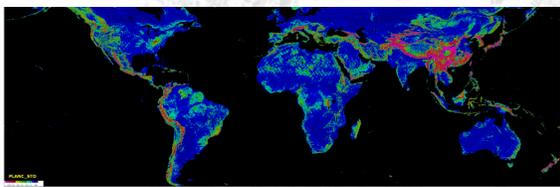




Global SRTM Geomorphometric Atlas

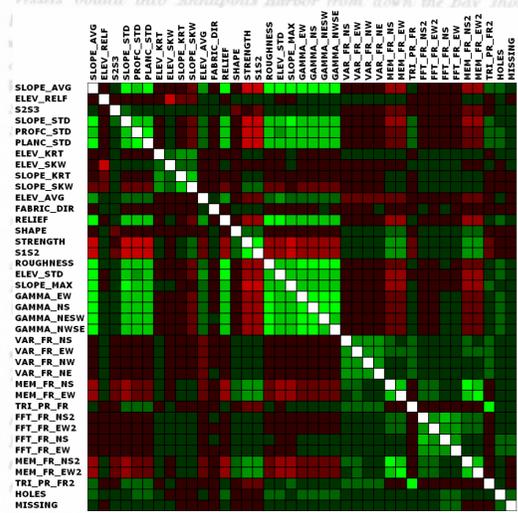
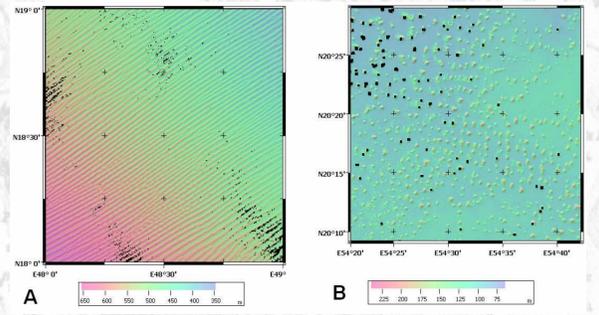
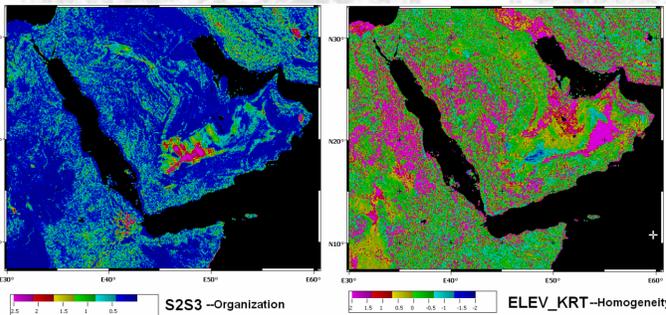
Peter L. Guth

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Method

We divided the earth's surface between 60°N and 56°S into blocks 2.5' (arc minutes) on a side, which provides about 7.4 million regions for analysis. We computed 39 grids, each with 8640x2784 postings. The data only fills about 31% of the grid nodes because water covers 70% of earth's surface, but the files compress very well, from a total of 5.3 GB to about 400 MB for all 39 grids. If there were no holes or water, each block would have 2601 points, sufficient for robust statistics describing terrain.

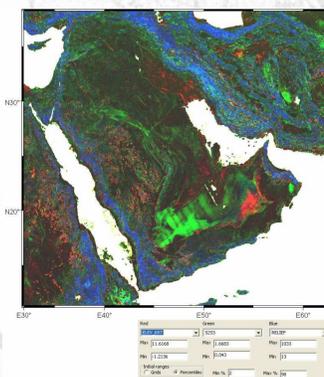
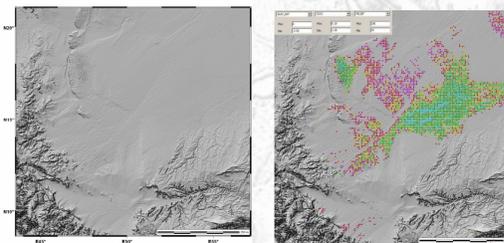


Correlation matrix for the 39 grids. The 12 parameters in the upper left correspond to the variables suggested for terrain description by Guth (PE&RS, 2006). Note the large number of parameters that correlate with slope.

Full resolution view of the Arabian peninsula, showing terrain organization and homogeneity. High organization occurs in linear dunes, folded mountains (parts of the Zagros), and fault block mountains (Afar triangle). High homogeneity indicates plains and plateaus.

SRTM 3" data with (A) linear dunes, with very high values of organization and very low values of homogeneity; and (B) star dunes, with low values of organization and very high values of homogeneity.

SRTM-30 map of a portion of the Arabian peninsula. Colored points meet the specified criteria for ELEV_KRT, S2S3, and RELIEF. This set of criteria does a good job of picking out the dunes, with very few false positives. Colors based on the value of ELEV_KRT.



Three color RGB map. Red corresponds to regions with high elevation kurtosis, which occur mostly in plains. Blue corresponds to high relief, and green to high organization such as linear dunes.

Unsupervised classification using the same parameters as the map on the left after normalizing each parameter.

Geomorphometric parameters in the SRTM Atlas

- ELEV_AVG, ELEV_STD, ELEV_SKW, ELEV_KRT: the first four moments of the elevation distribution. ELEV_STD correlates strongly with slope.
- SLOPE_AVG, SLOPE_STD, SLOPE_SKW, SLOPE_KRT: moments of the slope distribution in percent (100°rise/run).
- SLOPE_MAX: steepest slope. While this is largely of value for detecting blunders during DEM creation, it also has geomorphic significance.
- PLANC_AVG, PLANC_STD, PLANC_SKW, PLANC_KRT: moments of the plan curvature distribution.
- PROFC_AVG, PROFC_STD, PROFC_SKW, PROFC_KRT: moments of the profile curvature distribution.
- S1S2, S2S3, FABRIC_DIR, SHAPE, STRENGTH: Computed using logs of the three eigenvectors (S1 >> S2 > S3) of the surface normal vector distribution. S1S2 (ln(S1/S2)) measures flatness (logarithmic inverse of slope), S2S3 (ln(S2/S3)) measures terrain organization, and FABRIC_DIR gives the dominant direction of ridges and valley. Strength and S1S2 generally correlate closely, while S2S3 and shape correlate moderately.
- ELEV_RELF: the elevation relief ratio ((AveZ-MinZ) / (MaxZ - MinZ)) is computed for a region and is equivalent to the coefficient of dissection.
- SLOPE_MAX: the largest slope (percent) in the sampling region. While this is largely of value for detecting blunders during DEM creation, it also has geomorphic significance.
- GAMMA_NS, GAMMA_EW, GAMMA_NESW, GAMMA_NWSE: Nugget variance, Co, from the variogram.
- ROUGHNESS: Measure correlating strongly with slope. RELIEF: difference between the highest and lowest elevations within the sampling region.
- TRI_PR_FR, TRI_PR_FR2: triangular prism fractal measures using the fractal box counting method, with a second method to lessen the effects of holes.
- MISSING: the percentage of holes and points removed after applying the water body mask.
- HOLES: the percentage of holes in the SRTM data. This can be used to filter the results, and only look at statistics where missing data might bias the results.

Conclusion

Geomorphometric parameters computed from the 3 second SRTM data set capture a wealth of information about earth's landscapes. The restricted, nominal 1 second SRTM data set really provided information at no better than 2 second resolution, so the freely available 3 second data likely represents the best elevation data that will be available for some time. We are actively working on ways to better manipulate and visualize this data, for instance using clustering for terrain classification. The size of the data set makes this a challenging proposition, but the rewards will be significant.