

TopoVar90m: Global high-resolution topographic variables for environmental modeling

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Abstract—Topographical relief involves the vertical and horizontal variation of the Earth's terrain and it drives processes in hydrology, climatology, geography and ecology. Its assessment and characterization is fundamental for various types of modeling and simulation analysis. In this regard, the Multi-Error-Removed Improved Terrain (MERIT) Digital Elevation Model (DEM) currently provides the best high-resolution DEM globally available, at a 3 arc-second resolution (90m), due to the removal of multiple error components from the underlying SRTM3 and AW3D30 DEMs. To depict topographical variations worldwide, we developed a new dataset comprising different terrain features derived from the MERIT-DEM. The fully standardized topographical variables consist of slope, aspect, eastness, northness, roughness, terrain roughness index, vector ruggedness measure, topographic position index, stream power index, convergence, profile/tangential curvature, first/second order partial derivative and 10 geomorphological landform classes with their parameters features (intensity, exposition, range, variance, elongation, azimuth, extend and width). To assess how potential errors in the MERIT-DEM affect the derived topographic variables, we compared our results with the same variables derived from the National Elevation Dataset (NED), which is the best-available gridded elevation dataset for the United States. We compared the two data sources by calculating the first order derivative (i.e., rate of change through space measured in degrees) of the difference between a MERIT-derived vs. a NED-derived topographic variable. All newly-created topographic variables are readily available at a 3 arc-second resolution, for use as input data in various environmental models and analyses in the field of geography, geology, hydrology, ecology and biogeography.