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Global 30m Height Above the Nearest Drainage

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Variability of the Earth surface is the primary characteristics affecting the flow of surface and subsurface water. Digital elevation models, usually represented as height maps above some well-defined vertical datum, are used a lot to compute hydrologic parameters such as local flow directions, drainage area, drainage network pattern, and many others. Usually, it requires a significant effort to derive these parameters at a global scale.

One hydrological characteristic introduced in the last decade is Height Above the Nearest Drainage (HAND): a digital elevation model normalized using nearest drainage. This parameter has been shown to be useful for many hydrological and more general purpose applications, such as landscape hazard mapping, landform classification, remote sensing and rainfall-runoff modeling. One of the essential characteristics of HAND is its ability to capture heterogeneities in local environments, difficult to measure or model otherwise. While many applications of HAND were published in the academic literature, no studies analyze its variability on a global scale, especially, using higher resolution DEMs, such as the new, one arc-second (approximately 30m) resolution version of SRTM.

In this work, we will present the first global version of HAND computed using a mosaic of two DEMS: 30m SRTM and Viewfinderpanorama DEM (90m). The lower resolution DEM was used to cover latitudes above 60 degrees north and below 56 degrees south where SRTM is not available.

We compute HAND using the unmodified version of the input DEMs to ensure consistency with the original elevation model. We have parallelized processing by generating a homogenized, equal-area version of HydroBASINS catchments. The resulting catchment boundaries were used to perform processing using 30m resolution DEM. To compute HAND, a new version of D8 local drainage directions as well as flow accumulation were calculated. The latter was used to estimate river head by incorporating fixed and variable thresholding methods. The resulting HAND dataset was analyzed regarding its spatial variability and to assess the global distribution of the main landform types: valley, ecotone, slope, and plateau.

The method used to compute HAND was implemented using PCRaster software, running on Google Compute Engine platform running under Ubuntu Linux. The Google Earth Engine was used to perform mosaicing and clipping of the original DEMs as well as to provide access to the final product. The effort took about three months of computing time on eight core CPU virtual machine.