River Network Delineation from Sentinel 1 Synthetic Aperture Radar Data

Authors : Christopher B. Obida, George A. Blackburn, James D. Whyatt, Kirk T. Semple

Abstract : In many regions of the world, especially in developing countries, river network data are outdated or completely absent, yet such information is critical for supporting important functions such as flood mitigation efforts, land use and transportation planning, and the management of water resources. In this study, a method was developed for delineating river networks using Sentinel 1 imagery. Unsupervised classification was applied to multi-temporal Sentinel 1 data to discriminate water bodies from other land covers then the outputs were combined to generate a single persistent water bodies product. A thinning algorithm was then used to delineate river centre lines, which were converted into vector features and built into a topologically structured geometric network. The complex river system of the Niger Delta was used to compare the performance of the Sentinel-based method against alternative freely available water body products from United States Geological Survey, European Space Agency and OpenStreetMap and a river network derived from a Shuttle Rader Topography Mission Digital Elevation Model. From both raster-based and vector-based accuracy assessments, it was found that the Sentinel-based river network products were superior to the comparator data sets by a substantial margin. The geometric river network that was constructed permitted a flow routing analysis which is important for a variety of environmental management and planning applications. The extracted network will potentially be applied for modelling dispersion of hydrocarbon pollutants in Ogoniland, a part of the Niger Delta. The approach developed in this study holds considerable potential for generating up to date, detailed river network data for the many countries where such data are deficient.

Keywords : Sentinel 1, image processing, river delineation, large scale mapping, data comparison, geometric network
Conference Title : ICRSG 2019 : International Conference on Remote Sensing and Geomorphology
Conference Location : New York, United States
Conference Dates : January 30-31, 2019