Delineating Rooftops and Mapping Solar Radiation Potential: A Case Study in the Midtown Manhattan of New York City

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INTRODUCTION
Solar energy as a clean and renewable resource is becoming increasingly important in the global context of climate change and energy crisis. Utilization of solar energy in urban areas is of great importance in urban energy planning, environmental conservation, and sustainable development. However, available spaces for solar panel installation in cities are quite limited except for building roofs. The objectives of this research are:

- Estimating the solar radiation on building roofs in the Midtown Manhattan of New York city.
- Selecting suitable spaces for installing solar panels that can effectively utilize solar energy.

DATA
- Airborne LiDAR Produces High-Precision, Multipurpose Data
- High-resolution aerial imagery
- Administrative boundary of Manhattan
- Rooftop footprint shapefile

DELINEATING ROOFTOPS
- Airborne LiDAR produces a high-resolution airborne LiDAR (LiDAR) dataset that is high-resolution four-band digital imagery (Red, Green, Blue, Near Infrared) and existing building footprints.
- The semi-automated feature extraction process combines the LiDAR dataset, high-resolution four-band digital imagery and existing building footprints.

SOLAR POTENTIAL ANALYSIS
- Calculating diffuse radiation, direct radiation and duration of incoming solar radiation (Figures 7-9)
- Extract rooftop solar potential map (Figures 10 & 11)
- Zonal statistics
  - Calculating rooftop solar potential energy in kWh of each building in 2015
  - Area of each building
  - Calculate aspect of buildings
  - Calculate slope of buildings

RESULTS
- The total rooftop area in the Midtown Manhattan of New York city is 12,203,065 ft² (1133.7 m²), which is a high potential available space resource...
- Conclude from 12 months solar potential maps and average solar energy trend chart that May, June, and July had much higher radiation energy in 2015. Because the New York city is located at northern hemisphere, in these three months the incident angle of solar rays is closest to 90 degrees. The weather condition is better have less diffuse radiation...
- Further, according to various requirements of customers, suitable rooftops could be extracted by using DSM (elevation) data combine with solar maps, aspect and slope maps.

REFERENCES