Disaster risk assessment using LIDAR

Challenge: Unknown climate risks **Adaptation response:** Hazard and risk assessment

Description

LIDAR stands for the Light Detection and Ranging (LIDAR), a remote sensing method that can be used to generate detailed maps of topography and retrieve digital elevation data necessary for flood modelling and vulnerability and risks analysis. The LIDAR method uses a pulsed laser to measure and record three-dimensional information on the surface of the earth (topographic LIDAR), the seafloor or riverbed (bathymetric LIDAR). The equipment is usually installed on an airplane, helicopter, or other airborne device, and includes a laser, scanner and GPS device. The laser projects millions of ultraviolet, visible or near infrared light pulses (or green light for bathymetric measurements), onto the land, which are reflected by the surface. The sensors then measure the range, and combined with GPS data, provide high-resolution topographical readings.

The use of LIDAR technology helps acquire data on elevation and depth that is critical for assessing flood risks. The data is then fed into various models. For example, low-lying areas (particularly highly populated areas) at risk of flooding can be identified and mapped and integrated into the region's flood early warning systems to improve overall disaster preparedness. LIDAR technology can also be used to identify areas at risk of earthquakes by revealing faults on the ground surface.

Implementation

LIDAR lasers are mounted to an airplane (helicopter, drone), which is flown over the region of interest (e.g. a river basin). Laser pulses are projected onto land. The distance to the ground can be measured using the reflected light (return signals) that are processed in the LIDAR system to create precise elevation and surface models. These models can be combined with other software (e.g. ArcGIS or Hydrologic Engineering Center-River Analysis System (HEC-RAS)) and integrated with other data sources to visualize certain movements or events, e.g. the extent of water flows during (modelled) flooding events.

Environmental Benefits

- Provides information that can also be used for improved environmental management and planning purposes (e.g. forest management, pollution modelling).

Socioeconomic Benefits

- Improves accuracy of flood modelling and flood risk, and thus reduced risks and damages.
- Improves the quality and precision of planning and management, amongst a variety of other uses.

Opportunities and Barriers

Opportunities:

- Relatively quick and high accuracy source of data collection (can collect data in hours or days in emergency situations)

- Method to provide data for remote areas, and areas of limited accessibility
- High accuracy readings of large scale surveys, also in areas of dense vegetation
- LIDAR is a flexible technology, which can be used for many purposes

Barriers:

- Collects vast amounts of data, thus data processing can be time and resource consuming (and expensive)
- Data often provided on commercial basis (flown by commercial drones, airplanes)
- Data normally requires corrections and some manual processing

Implementation considerations*

Technological maturity:	4-5
Initial investment:	3-4
Operational costs:	2-3
Implementation timeframe:	2-3

* This adaptation technology brief includes a general assessment of four dimensions relating to implementation of the technology. It represents an indicative assessment scale of 1-5 as follows:
Technological maturity: 1 - in early stages of research and development, to 5 – fully mature and widely used
Initial investment: 1 – very low cost, to 5 – very high cost investment needed to implement technology
Operational costs: 1 – very low/no cost, to 5 – very high costs of operation and maintenance
Implementation timeframe: 1 – very quick to implement and reach desired capacity, to 5 – significant time investments needed to establish and/or reach full capacity
This assessment is to be used as an indication only and is to be seen as relative to the other technologies included in this guide. More specific costs and timelines are to be identified as relevant for the specific technology and geography.

Sources and further information

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