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Space Technology for Climate Adaptation and Mitigation [1] (6A)

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CLIMATE ADAPTATION FOR RESILIENT CRITICAL INFRASTRUCTURE IN LOW MEDIUM INCOME COUNTRIES FACILITATED BY SPACE TECHNOLOGY

Abstract

Critical infrastructure is essential for the society and economy, providing vital services such as transportation of people and goods, power and water supply. Infrastructure is exposed and malfunctions during and after multiple and combined human induced and natural stressors. Some of these stressors are exacerbated by climate change, including sea-level rise, extreme temperatures, floods, wildfires and other geohazards. The financial and societal impacts of natural and human-induced disasters are becoming worse, in particular in low-medium income countries (LMIC), while increasing demands, ageing and infrastructure interdependencies pose additional challenges. Hence, there is an urgent need to make existing and new infrastructure more resilient, sustainable, and smarter. This can be achieved by design and/or by intervention and by employing emerging and space technology for providing accurate assessments of asset condition and early warnings. However, there is an acknowledged lack of mainstream and system-wide approaches, in support of efficient decision-making and climate change mitigation in LMIC. In this paper we investigate the potential of key emerging technologies and data from satellites, airborne missions, and ground-based observations generated by space or weather agencies around the world, toward climate-resilient infrastructure. This also includes AI and ML techniques to calibrate risk assessment models and improve the accuracy of resilience quantifications, in support of decision-makers to prioritise the interventions and target their limited resources for climate adaptation. Advantages and limitations of earth observations data for infrastructure resilience and adaptation to climate and human-induced stressors are discussed. The paper focuses on transport infrastructure adaptation considering climate projections and sets a benchmark case study for the bridge stock in Ukraine, including highway and railway assets. Open Big data are used to assess the exposure and vulnerability of the assets to climate induced stressors, and quantify their resilience for plausible climate scenarios. High-resolution data from e.g. satellite imagery, will then be employed for understanding localised risks and improving the assessment of individual assets, considering their properties e.g., material, dimensions and year of construction. Evaluation of the precision and comparison of accuracy is performed for the different sets of data, in terms of resilience metrics. AI models will be used to calibrate the resilience assessment model, and facilitate its application at national scale, to inform decision-making and facilitate efficient investments for adaptation.