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Earth Observation and Contributing Citizen for Crisis and Disaster Resilience

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Earthquakes, floods, heatwaves, droughts, among many, are all natural disasters that can substantially impact and cripple human societies. Human lives are lost, and the economic burdens associated with the destructive powers by such disasters will cause additional negative effects on societies' development and progress. It is thus critical to minimize these losses/burdens by not only responsive actions, but also by mitigation efforts and by preparing crisis responder organizations and coordinators, as well as the citizens who are finally the ones being mostly affected during such events.
To effectively achieve this, it is necessary to establish decision and policy making grounded on reliable and timely available information, which is primarily based on collecting and evaluating the data from the area of interest. Besides applying methods for collecting the data using in-situ sensors, remote sensing and official reporting channels, it is nowadays crucial to include the citizen as an important source. We present one such approach and the results of its demonstration. The approach is simple and boils down to using sensor data combined with citizen data to provide an operational picture. The solution is, however, easily adaptable to different environmental crises and disaster scenarios and can include all types of geo-referenced data sources. The demonstration of the approach was performed in the "921 International Disaster Prevention Drill" in Taiwan in 2018 with the focus on a magnitude 7.0 earthquake. It included very high-resolution (VHR) Earth Observation (EO) satellite technologies to provide the data and imagery from a high vantage point covering large areas with a spatial resolution of a submeter level. These initial results contained some errors but nevertheless provided a quick first impression of the situation on the ground (e.g., which areas contain most damages) and thus allowed crisis managers to initiate further data collecting activities. This is where the citizen as the data collector comes into the picture. These in-situ data collecting activities involved citizens as volunteers being assigned tasks using dedicated smartphone app. The type of a task in general can be very diverse, depending on the data needed to establish a full operational picture. In our earthquake situation, data such as the building height and construction material were important to bypass some EO limitations such as lacking information on buildings due to viewing angles, sparse temporal coverage due to satellite re-visit times, or limited view due to unfortunate weather conditions. The demonstration showcased that the approach of combining citizen-contributed data and satellite imagery provides possibilities for positively impacting the response times, allocation of resources, and distribution of response personnel during and after a disaster event. However, the solution is easily adaptable to other types of environment-related events. As example, in a heatwave event, indoor air temperature or a citizen's personal comfort level can be provided as data that can further be used to establish an overview of the most critical areas in a city. This way, the citizen is empowered not only to provide the data, but also to affect the decision and policy making.