Rapid communication during extreme events is one of the critical aspects of successful disaster management strategies. Due to their ubiquitous nature, social media platforms offer a unique opportunity for crisis communication. Moreover, social media usage on GPS enabled devices such as smartphones allow us to collect human movement data which can help understanding mobility during a disaster. This study leverages social media (Twitter) data to understand the effectiveness of social media-based communication and the resilience of human mobility during a disaster. This thesis has two major contributions. First, about 52.5 million tweets related to hurricane Sandy are analyzed to assess the effectiveness of social media communication during disasters and identify the contributing factors leading to effective crisis communication strategies. Effectiveness of a social media user is defined as the ratio of attention gained over the number of tweets posted. A model is developed to explain more effective users based on several relevant features. Results indicate that during a disaster event, only few social media users become highly effective in gaining attention. In addition, effectiveness does not depend on the frequency of tweeting activity only; instead it depends on the number of followers and friends, user category, bot score (controlled by a human or a machine), and activity patterns (predictability of activity frequency). Second, to quantify the impacts of an extreme event to human movements, we introduce the concept of mobility resilience which is defined as the ability of a mobility infrastructure system to manage shocks and return to a steady state in response to an extreme event. We present a method to detect extreme events from geo-located movement data and to measure mobility resilience and loss of resilience due to those events. Applying this method, we measure resilience metrics from geo-located social media data for multiple types of disasters occurred all over the world. Quantifying mobility resilience may help us to assess the higher-order socio-economic impacts of extreme events and guide policies towards developing resilient infrastructures as well as a nation's overall disaster resilience.

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The public is welcome to attend.