Geophysical Research Abstracts
Vol. 20, EGU2018-6637, 2018
EGU General Assembly 2018

Evaluating the resilience of Greater London's Fire & Rescue Service during a surface water flood event

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A wide-spread surface water flood event occurred in Greater London on 23rd June 2016 (EU Referendum day), causing significant disruptions to the city and increasing pressures on the operations of emergency services. London Fire & Rescue Service attended over 400 flood-related incidents from early hours throughout the day. This research: (i) undertook high-resolution (5m) surface water flood modelling for the entire city (1,600 km2); (ii) modelled the spatial accessibility of Fire & Rescue stations in London during the flooding, and (iii) cross-compared the predicted flood footprints and modelled station spatial accessibility, with the Fire & Rescue Service's recorded incident and mobilisation data (including incident location, travel durations and delay mode). Surface water flood modelling was undertaken using distributed rainfall estimates based on Radar observation and a high-resolution LiDAR dataset. The spatial accessibility of each Fire & Rescue Station within certain regulatory time frames (5-minute and 8-minute) under normal and the predicted flood condition was derived using network analysis. The locations of flood-related incidents and photos collated from social media sources were used to calibrate and validate the predicted flood footprint. Fire & Rescue Service mobilisation data were compared with the modelled spatial accessibility for each station. Results suggest that the general pattern of surface water flooding occurred in London was well predicted. Over 70% recorded incidents fall within locations where significant surface water flooding was predicted. However, due to the coarse resolution of the Radar rainfall estimates and the uncertain spatiotemporal distribution, some incidents attended by emergency services are not predicted in locations that were modelled to be flooded. Direct road flooding and associated traffic disruption reduced the spatial accessibility of the city by the London Fire & Rescue Service. Under the normal condition, only 2% of all the incidents attended on that day should be outside of the Fire & Rescue Service's 5-minute service areas. However, during the 2016 event, over 28% of the incidents were modelled to be outside of the 5-minute service areas. The modelled accessibility for the affected stations agree well with the reported accessibility as indicated by travel time and delay modes (e.g. weather condition and traffic) recorded in the mobilisation data.