Statistical modeling of fire brigade operations with respect to extreme precipitation events over Berlin

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Large cities and urban regions are highly sensitive to impacts caused by extreme events (e.g. heavy rainfall). As problems caused by hazardous atmospheric events are expected to intensify due to the Anthropogenic Climate Change, adequate adaptation planning of urban infrastructure is needed. Planning adaptations not only requires further research on potential impacts under changing climate conditions as a basis, but also a check of the practical feasibility for stakeholders.

Under the BMBF research program “Urban Climate Under Change” ([UC²]), we relate heavy precipitation events over Berlin to the respective fire brigade operations. Here, the precipitation data are based on temporally high resolved radar data. The fire brigade operation data are available on time and location, but the number of recorded events is small, and their distribution is highly overdispersive compared to a Poisson model. To account for this problem we apply a two part hurdle model with one part modeling the probability of the occurrence of fire brigade operations and one part modeling the actual number of operations given that at least one operation occurs. In the corresponding statistical models the parameters of the distributions are described by additive predictors, which are based on precipitation duration and intensity as well as building density. Based on 10 years of data with a cross validation setup, both the occurrence model and the model for the number of operations significantly outperform the reference climatology for certain areas over Berlin.