Minimizing the response time of support units in earthquakes: prediction and assignment

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When an earthquake occurs, the response time of rescue units is crucial and, in some cases, even decisive for saving the lives of those affected. For this reason, it is crucial that help arrives as quickly as possible and with an adequate number of units. In this paper, we investigate how to minimize the maximum response time in order to optimize rescue, using real earthquake data from Seismo. In our model, we identify areas frequently affected by earthquakes based on their magnitude and depth. Since, in the event of an earthquake, detailed information on the type of damage suffered, the type of help needed and the number of units required to intervene are not initially available, our goal is to use this information to predict where to send relief support units to these areas. As units, we consider a mixed fleet of vehicles, such as ambulances, helicopters, drones, military SUVs, and so on. The project is divided into three main phases: data processing, assignment, and implementation. In particular, we first model the problem of assigning support units to the affected areas, subject to feasibility constraints (e.g. an ambulance may not be able to reach highly affected area, but a helicopter may be able to do that) and capacity constraints (e.g. we may have to send 20 units to a highly affected area but only 5 to a slightly affected area). Then, within this constrained model, we minimize the response time of units to affected areas in an assignment. We propose two algorithms for this task. Finally, we evaluate the performance of these algorithms. The results suggest that minimizing the response times after earthquakes can be significantly improved by assigning appropriate support before the earthquakes to areas predicted to be affected, using data from Seismo.