Optimal depot locations for humanitarian logistics service providers using robust optimization

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When determining the optimal number of depots, larger networks typically have less uncertainty in the expected cost of transportation. Even if at some point increasing the number of depots allowed to be opened may not decrease the expected cost of transportation significantly, it likely reduces the uncertainty in this expected transportation cost.

We incorporate uncertainty in the location and scale of future disasters by developing a robust optimization framework.

Relief items are partly supplied via aircraft (in the immediate response phase) and partly via sea (in the recovery phase).

We create groups of disasters that share their nearest airport and harbor. We exploit the fact that these disaster areas receive relief items through the same depot.

Locations that are close to a large airport and a large harbor are considered as potential depot locations.

An optimal network aligns with two main objectives: cost of transportation and maximum response time.

When determining the optimal locations of depots, we conclude that solutions based on nominal and robust optimization may perform similar on individual years that are not included in the optimization, but robust solutions guarantee a smaller cost of transportation for worst case scenarios. This uncertainty reduction is especially valuable when the solution has to be robust against extreme scenarios.