Pirogov, A., Zografos, K. G., Sutanto, J., Kheiri, A. (2021) “Modelling and solving the assisted evacuation problem with risk, efficiency, and fairness considerations”. *Presented at 3rd IMA and OR Society Conference on Mathematics of Operational Research*, 20/04/2021, online event.

Abstract: We consider an evacuation planning problem which consists of several decision aspects related to the shelters selection, allocation of the population to selected shelters, determination of evacuation fleet capacity according to the allocation, and routing from affected zones to shelters. In our work, the population is presented by people and their livestock which cannot be allocated independently from the people. Two homogeneous transportation means are used to form evacuation fleet. A corresponding network is provided with the information on the distance and risk level for every link on it. The proposed problem has two incorporations. The first one represents the case of fleet size constrained evacuation, while the second – time constrained. Each sub-problem is formulated as a Mixed-Integer Linear Programming model with four objectives minimizing the total evacuation time, number of shelters to be use, number of vehicles to be use and transportation risks. The resolution of models is preceded by a procedure which effectively solve bi-objective shortest path problem to fulfil the routing component of the solution and to simplify the inputs. Then, every objective is provided with a priority which shows its order in the lexicographic optimization of models. Finally, a computational experiment based on a real case of disaster is given to demonstrate the trade-off between objectives for every sub-model.