Nat. Hazards Earth Syst. Sci. Discuss., 3, C103–C105, 2015
www.nat-hazards-earth-syst-sci-discuss.net/3/C103/2015/
© Author(s) 2015. This work is distributed under
the Creative Commons Attribute 3.0 License.

Natural Hazards
and Earth System
Sciences
Discussions

Interactive comment on "A spatio-temporel optimization model for the evacuation of the population exposed to natural disasters" *by* H. Alaeddine et al.

H. Alaeddine et al.

houssein.alaeddine@hotmail.fr

Received and published: 2 March 2015

1. Title of paper: A spatial-temporal optimization model for the evacuation of the population exposed to flood hazard
2. Abstraction of Network :
   (a) Page 6, Line 12: urban network database (highways and arterials)
   (b) i. Page 7, Line 2: the first step is to assign each building to the nearest network node using the airline distance from the centroids of buildings to the extremities of arcs.

   ii. Page 7, Line 11. in the valley of Tours. Otherwise intermediate nodes must be created in order to minimize that distance.
   (c) Page 7, Line 25: all the remaining nodes that hold nothing.
3. Page 8, Line 17: (see Alaeddine et al., 2014c). The determination of paths is performed according to two main objectives: the minimization of total clearance time and the maximization of the acceptance degree of these paths by the evacuees. The first objective can be achieved by computing a large number of paths between each origin-destination. But as the evacuees of an origin will not accept, firstly, a large number of paths, and secondly, a long paths in terms of travel time, we determine the paths and their number by compromise between the two objectives announced (for more details, please see Alaeddine et al., 2014c).
4. Page 11, Line1: (see vehicles pursuit models, Fig.2). The congestion on evacuation network causes of course a reduction of the flow entering the network and therefore queues will be formed on several roads. In our model STOM, we avoid such situation to occur by two steps: 1) for each time slot, the capacity (fluid regime) of each road is respected (flow assigned is lower than or equal to the capacity). This capacity is computed using a polynomial traffic model of the form :

$$q = kv_f(1 - \frac{k^2}{k_j^2})$$

where q is the flow, v_f is the free-flow speed, k the density and k_j the jam-density. The maximal flow rate (or the capacity) q_m is obtained when $\frac{dq}{dk} = 0$ (please see Alaeddine et al., 2014a, section Traffic model). 2) As flow in dynamic network changes over time (increasing of flow followed by a decreasing) and as the set of buildings evacuated varies from one time slot to another, congestion on some roads may be occurred. We handle this problem by developing a pursuit vehicles model which computes for each origin the minimal evacuation departures times which avoid any traffic-jams to occur in the network (for further details, please see Alaeddine et al., 2014a). This two-stages. . .

5. Page 7, Line 21: aid, etc. The determination of shelters in our model and as we mentioned above is not performed by an optimization approach (selection of a number of shelters among a set of candidates) but directly by the decision makers. It should be noted that the location and the number of shelters may have significant impact on the evacuation time which, in its turn, depends on two elements: the capacity of network and the travel time.

6. Page 9, Line 17. From both dikes and shelters. The last paragraph of this section gives an explanation on the establishment of one of the priority lists used in STOM.

7. Page 15, Line23: in network capacity. The fall percentage of roads capacity aims to simulate the total evacuation time in case of incidents. This is performed by reducing the capacity of each road of evacuation network. The new capacity is equal to the initial capacity minus the percentage of fall multiplied by the initial capacity. This simulation aims to determine the validation level of the horizon time. For example, if after a little fall the evacuation time computed exceeds the horizon time given, then the decision makers should apply some strategies such as: authorizing the no entry, increasing speed, opening an additional safe areas, etc.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 1, 2015.