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Interactive comment on "Mangrove Forest against Dyke-break induced Tsunami in Rapidly Subsiding Coasts" *by* H. Takagi et al.

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Review of nhess-2016-128, 2016 paper titled "Mangrove Forest against Dyke-break induced Tsunami in Rapidly Subsiding Coasts" by Hiroshi Takagi, Takahito Mikami, Daisuke Fujii, Miguel Esteban

a. General Comments and Remarks The article of Hiroshi Takagi and his collaborators approaches an important subject, namely the risk associated with subsiding coastal sites under potential flooding of a type similar to that induced by tsunamis. The authors investigated thoroughly a coastal section presently protected by thin coastal dykes and bring a potential relatively cheap solution for reducing the flooding risk to the local population via plantation of mangroves. While the proposed solution may be adequate for a temporary protection of a number of 10-20 years, we believe that it will

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not provide protection in the long run under the foreseen climate change induced global sea level rise. A number of specific remarks are presented below and in section b in Table 1 is provided a list of technical and typographical corrections sugestions to the article contents. 1. The nick-naming of the dyke-break induced flooding as tsunami for greater awareness of public is understandable, but because it is misleading due to its prolonged flooding, in this reviewer's opinion, it should not be accepted. Instead, a plain nick name such as “dyke-break extreme flooding”or at least “dyke-break induced tsunami like flooding” would be preferable. If my opinion is accepted all terms in the text should be corrected accordingly. 2. It would be advisable that the authors mentioned sea water desalination as a counter action potential solution against land subsidence induced by underground water withdrawal. 3. A fast and significant subsidence rate has been indicated for the recent past years. It is not clear on what basis the same rate is maintained for the coming 10 years as well as for further time states. The subsidence would depend on the soil type of the underground and the thickness of the pervious layers, so it is not necessary correct to extrapolate the same sinking rate for the future, unless the pervious soil and its thickness give base to this assumption, fact that is not stated. 4. It is not clear also if the plantation of mangrove forest will be able to provide the expected protection in future. The present water depth in the proposed plantation area is indicated as 50 cm and that the plants grow at approximately as the present sea level rise. However, new publications (e.g. Dutton et al., 2015; DeConto and Pollard, 2016; Hansen et al., 2015; Mengel et al., 2015;) indicate a feasible faster and larger sea level rise globally (up to 1m by 2050, 2-3 m by 2100), in which case the mangrove will not be able to grow at the same rates and provide the expected protection from dyke-break rapid flooding. Perhaps an engineering alternative could be to adopt the Dutch concept, of building wide sand dunes at the waterline, requiring resettling of population and its activities back to higher and more remote places from the lower sea/water front areas. Another theoretical option might be migration to higher places (Roberts and Andrei, 2015) or that adopted by Miami City in USA (Weiss, 2016). 5. The criteria proposed following the classification given by Pistrika et al. as well as the one proposed by Wright et al., (2010) seem very problematic as explained further below. Also the data brought by Suga et al., 1995) indicating a safe velocity limit of up to 0.8 m/s in a water depth of about 0.8 m, whereas at speed of 1 m/s was the highest safe limit walking against the current. Based on a research beach bathers survey study carried in Japan with in order to determine safe recreational conditions, that paper stated a safe limit of current speed of about 0.15m/s for knees deep water flow (about 0.5m depth), beyond which bathers could not walk normally or remain stable. Unfortunately, I was not able to find this article published in the “Coastal Engineering in Japan”, in the 1980’s. In the present article, the authors selected to use a depth velocity product criterion to determine safe passage of pedestrians in a flooded area. The present paper describes a flooding in the Philippines where people could cross a flooded street in a water depth of 0.6 m (knees depth) and while a 0.6 m/s current flow was present.

The information provided about the persons particulars is very limited and about which type of street (paved, unpaved, etc) was crossed in the flooded area. This seems already dubious as it is not clear how one was able at the time to measure the current speed, which, if it was 0.6 m/s (based on the Japanesse paper I mentioned), should have been done by a tall, heavy and strong person with perhaps even some cable support from being carried away. A velocity-depth product of 1.0 m2/s seems already unsafe, if we consider that this product can be due to various scenarios, such as: a depth of 1m and speed of 1.0 m/s (2 knots); a 1.8 water depth in a 0.55 m/s current (1 knot); or a water depth of 0.6m in a current speed of 1.67 m/s. These all lead to same velocity-depth product of 1 m2/s. A more rigorous approach is the work of Cox et al., 2010, quoted by Pistrika et al., which in this reviewer’s opinion is a very important one. We believe it would be appropriate that the authors quote the following text taken from Cox and al., 2010, or at least refer to it and give the a summarizing figure from that publication, copied further below as Figure 1. Since the Cox et al. report is more recent and of broader coverage, and since it refers in greater detail to the various types of persons and ages and floor bottom conditions, even if the Japanesse article was

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right for the wave induced current under open coast conditions with waves and sandy sea bottom, we estimate using the Cox et al. report would be more adequate for use in the present article.

“Significant scatter is observed within individual experimental data sets and, to a more significant degree, when all data sets are combined. Additionally, markedly differing tolerable D.V values are observed for identical subjects. Discussion with investigators has indicated that “training” of the subject (Abt, pers. com, 2009) may enable higher flow values to be resisted as the subject learns how to position the body so to best resist the flow. The lowest stability values (D.V) for each subject is, in most cases, the first exposure test and more applicable to the general population whom have not had the benefit of such training prior to encountering flood water. While distinct relationships exist between a subjects height and mass (H.M; mkg) and the tolerable flow value (D.V; m2s-1), definition of general flood flow safety guidelines according to this relation is not considered practical given the wide range in such characteristics within the population. In order to define safety limits which are applicable for all persons, hazard regimes are defined for adults (H.M > 50 mkg) and children (H.M = 25 to 50 mkg). Infants and very young children (H.M < 25 mkg) are considered unsafe in any flow without adult support. For children with a height and mass product (H.M) of between 25 and 50, low hazard exists for flow values of D.V < 0.4 m2s-1, with a maximum flow depth of 0.5 m regardless of velocity and a maximum velocity of 3.0 ms-1 at shallow depths. Under these flow regimes, the children tested retained their footing and felt “safe” in the flow. For adults (H.M > 50), low hazard exists for flow values of D.V < 0.6 m2s-1 with a maximum depth limit of 1.2 m and a maximum velocity of 3.0 ms-1 at shallow depths. Moderate hazard for adults exists between D.V = 0.6 to 0.8 m2s-1, with an upper working flow value of D.V < 0.8 m2s-1 recommended for trained safety workers or experienced and well equipped persons. Significant hazard for adults exists between D.V = 0.8 to 1.2 m2s-1. For flow values D.V > 1.2 m2s-1 the majority of tests for adults indicated instability - the hazard is extreme and should not be considered safe for standing or wading.

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Figure 1 – Appropriate safety criteria for pedestrians walking in a flooded area Fig. 1

It should however be noted that loss of stability could occur in milder flow regimes when adverse conditions are encountered including: âĂć Bottom conditions: uneven, slippery, obstacles; âĂć Flow conditions: floating debris, low temperature, poor visibility, unsteady flow and flow aeration; âĂć Human subject: standing or moving, experience and training, clothing and footwear, physical attributes additional to height and mass including muscular development and/or other disability, psychological factors; âĂć Others: strong wind, poor lighting, definition of stability limit (i.e. feeling unsafe or complete loss of footing)."

b. Table 1 List of technical and typographical corrections sugestions to the article content Fig. 2

c. References listed by Rosen, excluding those in the referred article:

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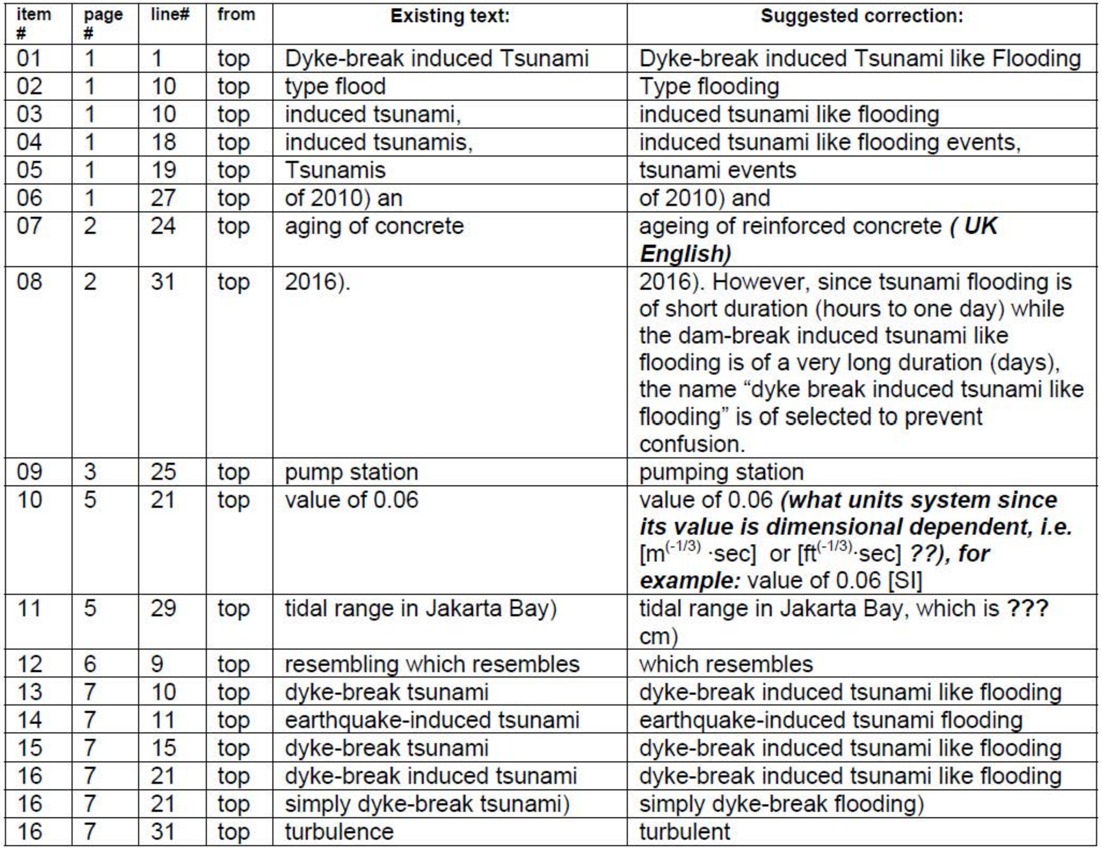
DV (m^2s^{-1})	Infants, small children ($H.M \leq 25$) and frail/older persons	Children ($H.M = 25$ to 50)	Adults ($H.M > 50$)
0	Safe	Safe	Safe
0 – 0.4	Extreme Hazard; Dangerous to all	Low Hazard[1]	Low Hazard[1]
0.4 – 0.6		Significant Hazard; Dangerous to most	
0.6 – 0.8		Extreme Hazard; Dangerous to all	Moderate Hazard; Dangerous to some[2]
0.8 – 1.2			Significant Hazard; Dangerous to most[3]
> 1.2			Extreme Hazard; Dangerous to all

[1] Stability uncompromised for persons within laboratory testing program at these flows (to maximum flow depth of 0.5 m for children and 1.2 m for adults and a maximum velocity of 3.0 ms^{-1} at shallow depths).

[2] Working limit for trained safety workers or experienced and well equipped persons ($D.V < 0.8\ m^2s^{-1}$)

[3] Upper limit of stability observed during most investigations ($D.V > 1.2\ m^2s^{-1}$)

Fig. 1.



item #	page #	line#	from	Existing text:	Suggested correction:
01	1	1	top	Dyke-break induced Tsunami	Dyke-break induced Tsunami like Flooding
02	1	10	top	type flood	Type flooding
03	1	10	top	induced tsunami,	induced tsunami like flooding
04	1	18	top	induced tsunamis,	induced tsunami like flooding events,
05	1	19	top	Tsunamis	tsunami events
06	1	27	top	of 2010) an	of 2010) and
07	2	24	top	aging of concrete	ageing of reinforced concrete ***(UK English)***
08	2	31	top	2016).	2016). However, since tsunami flooding is of short duration (hours to one day) while the dam-break induced tsunami like flooding is of a very long duration (days), the name “dyke break induced tsunami like flooding” is of selected to prevent confusion.
09	3	25	top	pump station	pumping station
10	5	21	top	value of 0.06	value of 0.06 ***(what units system since its value is dimensional dependent, i.e.*** [$m^{(-1/3)}$ ·sec] or [$ft^{(-1/3)}$·sec] ***??), for example:*** value of 0.06 [SI]
11	5	29	top	tidal range in Jakarta Bay)	tidal range in Jakarta Bay, which is **???** cm)
12	6	9	top	resembling which resembles	which resembles
13	7	10	top	dyke-break tsunami	dyke-break induced tsunami like flooding
14	7	11	top	earthquake-induced tsunami	earthquake-induced tsunami flooding
15	7	15	top	dyke-break tsunami	dyke-break induced tsunami like flooding
16	7	21	top	dyke-break induced tsunami	dyke-break induced tsunami like flooding
16	7	21	top	simply dyke-break tsunami)	simply dyke-break flooding)
16	7	31	top	turbulence	turbulent

Fig. 2.