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Interactive comment on "Topography- and nightlight-based national flood risk assessment in Canada" *by* Amin Elshorbagy et al.

Anonymous Referee #2

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The study aims to develop a national flood risk assessment in Canada by producing a flood hazard map, a flood exposure map, and an economic flood risk map based on global and national spatially distributed data, such as a national DEM, land-use map, nightlight data, and population density information. The flood hazard map is tested against a local inundation map produced by hydraulic modeling for the city of Calgary. The authors also test the influence of flood protection measures on the flood hazard map for the city of Wyoming. The article is well written and easy to follow. It has some interesting aspects, but there are several concerns that will be discussed below.

I miss a clear statement of the research problem and what is novel with the purposed study. The structure of section one and two could be improved by avoiding jumping back and forth between topics.

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Discussion paper

[Page 8-9] To create the EAND and DFND classes, a drainage network was created using ArcGIS hydrology tool on a coarse resolution DEM. This can produce many errors - why not use an already existing drainage network, or at least verify against one?

[Page 9, Lines 12-13] The classification process for the different maps produced is not clear. For example, the hazard class intervals were selected somewhat arbitrarily. I would like to see more thought behind this, e.g., do they represent floodplains, and why five classes?

[Page 12, Lines 6-8] The exposure map based on nightlight data indicate that 98% of Canada's area has absent or low human activity. This leads to the following question – is a national flood risk assessment useful?

[Page 12, Table 2 and 3; Page 31, Figure 7; Page 32, Figure 8] The land-use classes and the nightlight classification used for the exposure map give northern communities very low or low exposure level by default, resulting in very low or low flood exposure, and very low flood risk in areas above 60° N. Is this national flood risk map useful for residents above 60° N? I am missing a discussion around how the classification process affects the end product.

[Page 14-15, Lines 14-21, 1-5] A coarser DEM is chosen for the study to keep computational costs low, but results show that a finer resolution DEM (20 m in this case) gives better results and a more reliable flood hazard assessment. Floods are usually analyzed and managed at the provincial level in Canada where local information is important, why is a national flood risk assessment needed?

[Page 15, Lines 16-20] It is suggested that hazard levels can be reclassified locally to match floods with different return periods in areas where flood inundation using hydraulic modeling is available. But, how useful are local topography-based flood hazard maps where flood inundation maps based on hydraulic modeling already exist? Also, topography-based flood hazard maps does not account for backwater and other hydraulic effects on areas upstream of flood protection. One related question is also how

useful flood hazard maps with different return periods are if many floods are caused by ice-jams [Page 7, Lines 7-8; Page 18, Lines 11-14]?

[Page 16-17, Lines 23-24, 1-3] The authors bring up the issue with overglow effect when analyzing nightlight data. Have potential overglow effects been analyzed for the 2013 nightlight data used in this study, e.g., in comparison with previous years?

[Page 17, Lines 10-19] There is a discussion that population data should be used together with nightlight data to separate social and economic impact, as airports and industrial areas show high luminous values but low population density. I will argue that although these built-up areas have low population density, they have high social impact, e.g., airports.

[Page 19, Lines 12-16] There are many uncertainty aspects with the classes identified and some of the methods used – is the final product really useful and practical [Page 20, Lines 6-7] - also when considering the shortcomings the authors have presented?

The article has 10 figures, are all of them needed? For example, Figure 1 – a and b should be combined if to be included at all. Also, is both a and b in Figure 2 needed, they show the same information. Figure 5 – exclude enlarged figures, and visually improve the main figure.

Minor issues: [Page 1, Line 13] The authors state that the study uses datasets at reasonably fine resolutions to create flood risk maps – what is considered reasonable?

[Page 9, Line 4] What do you mean by horizontal distance?

[Page 9, Line7] EAND instead of EFND

[Page 11, Lines 19-22] It is stated that the average values of all nightlight satellites were used in this study, but there is only one available for 2013.

[Page 17, Line 17] What is the “average” effect?

[Page 21, Line 31] De Moel should be de Moel

[Page 23, Line 25] The reference Schanze is not found in the text

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