Answer to Referee Comment #2

Thank you for your review and your interest in this paper. Answering your comments helped me to refine further the message I want to share in this paper and how to deliver them appropriately. Please find below a point-by-point answer to the comments you raised. Moreover, as suggested by Referee #3 and yourself, the structure of the paper will be rearranged. The suggested structure is presented p2 of this document.

1. **Either to change the title or, preferably, to widen the subject of the paper to the risk management of natural hazards. This latter would include besides the traditional mitigation strategies, also risk transfer and financing solutions.**

For more clarity the title will be changed, replacing "natural hazard risk management" by "natural hazard risk modelling". While it would be of interest to analyse current risk management solutions, I prefer to focus in this paper on the challenges ahead for the modelling of natural hazard that supports risk assessment and risk management.

2. **The paper has now the structure and the tone of a newspaper article. To be a scientific paper should: a) refer to data, b) be structured in a more rigorous and readable manner. For instance all the challenges mentioned could be structured referring to the different component, phases, of the risk modelling chain. I think the classification of knowns and unknowns is misleading given that in all the components, procedures, techniques and data used for risk modelling there's something already well consolidated and something not yet consolidated.**

I acknowledge that, by rearranging some parts, the message I want to convey will be clearer and the readability of the paper will be facilitated. Following your comment and the one from Referee #3, I suggest a new structure that is available in the supplement document.

Models' validation and quantification of uncertainties are key elements to reinforce and delineate the extent of what we know. However, regarding the terminology, I think that the terms "known" / "unknown" are more appropriate as the concept associated to these terms goes beyond the concept associated to "consolidated / not consolidated". Indeed, "known/unknowns" terminology encourages a mindset associated to becoming aware that a part of unknown will always be present, even though extensive validation and consolidation analyses are performed, and we need to deal with it. All the more in an ever-evolving environment (e.g. climate change, population migration, new data available, new techniques…) and given the complexity of the risk modelling, some results that have been consolidated in the past may become obsolete in the future.

3. **One of the most interesting feature of the paper is the perspective from an insurer. However there's very little presented from that perspective. Nonetheless the (re-)Insurance world has been completed reinvented in the last 20 years from many aspects: financially, regulatory, commercially and technically. The essence of the paper should be to tell to the scientific community the story of how the insurance sector has been changed by the possibility to quantify risk on each of those aspects and to write a list of open questions, a program for the next years to come for the scientific community on those aspects which can be of common interest with the insurance industry.**

The purpose of the paper is to present the current issues we face as insurers, opening up paths for researchers to define what they see as relevant and make sense within their research projects.

Regarding the lack of details on (re)insurance history, this will be tackled in the version of the paper, as part of the historical section as shown in the supplementary material.

Suggested structure following RC2 and RC3 comments:

(i)   Loss / risk model development from a historic perspective
   - Example of Hurricane Andrew
   - Detailed discussion on
       • the three components (hazard, exposure, vulnerability)
       • the loss simulation process (i.e. how the transmission and the intersection of information from one component to the other is performed)
   - Details related to the (re)insurance market and its evolution regarding natural hazard risk modelling

(ii)   Uncertainty in each of the components (current state) and its quantification / how we improve and measure what we know
   - Uncertainty driven by data quality and availability by component (exposure, hazard and vulnerability), some are inherent, some can be improved (e.g., uncertainty in hazard modelling due to a lack of appropriate observations and/over observation data over longer time periods is not mentioned). Include examples such as:
       • Improvement of exposure data to get precise information on buildings' coordinates and physical characteristics
       • The access to various type of hazard measurements, the availability of reanalysis datasets for atmospheric hazards
   - Uncertainty caused by modelling assumptions and approaches. Include examples such as:
       • Improvement of the modelling of serial clustering of European Windstorms
       • The impact of parameters setting in hydrologic tools (Kaczmarska et al. 2018)
   - Uncertainty caused by the implementation in the loss modelling framework

(iii)   Perspectives: Challenges, further needs, and expected developments to address these needs
   - Need for systematic analysis and quantification of uncertainties, component by component and on the overall loss simulation process
   - Identified challenges (e.g. how to model interrelated hazards and their impacts, how to model the impact of natural hazards on supply chain, the role of machine learning…)
   - Management of unknown unknowns in natural hazard modelling