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Integrating Climate and Socioeconomic Pathways to Calculate the Future Cost of Catastrophes

Alastair Clarke¹, Alexander Koch², Eric Robinson³, Michelle Cipullo³, Shane Latchman¹, and Peter Sousounis³

¹AIR Worldwide Ltd, Research and Modelling, London, United Kingdom of Great Britain and Northern Ireland (aclark@air-worldwide.com)

²University of Hong Kong, Earth Sciences, Hong Kong, Hong Kong (akoch@hku.hk)

³AIR Worldwide Corporation, Boston, Massachusetts, USA

The cost of future catastrophes will depend on changes to the hazard, exposure and vulnerability. Previous work has shown how climate change could affect the financial losses from damaged buildings by altering the frequency, severity and other characteristics of the hazard, but has not shown how socioeconomic trends could affect losses by altering the total number, spatial distribution and vulnerability of buildings.

We extend and apply urban scaling theory to model the spatiotemporal evolution of exposure using population projections that are consistent with Shared Socioeconomic Pathways (SSPs). The exposure sets are integrated with hazard catalogues that are consistent with Representative Concentration Pathways to give five views of UK windstorm risk for the year 2100.

SSPs describe five plausible futures where socioeconomic trends have made mitigation of, or adaptation to, climate change harder or easier. For example, one SSP describes a global panacea of co-operative, sustainable development while another describes a fragmented, under-developed world heavily-reliant on fossil fuels. AIR's present-day exposure set, representative of all insurable properties in the UK, is perturbed by the SSPs to create an ensemble of plausible exposure sets for the year 2100. This ensemble is run through the AIR Extratropical Cyclone model for Europe with four stochastic event-based catalogues that represent the present hazard and three plausible future hazards posed by 1.5°C, 3°C and 4.5°C increases in global temperature.

Previous work found that global warming of 1.5°C to 4.5°C would increase the Average Annual Loss (AAL) from UK windstorms by 11% to 25%. We find that changes in exposure alone, dictated by the SSPs, lead to a wider range of changes in AAL. Urbanisation occurs under all SSPs resulting in exposure concentrating in cities and regional-level variation in AAL. Changes in AAL will further widen when integrated with the future hazard catalogues.

The results can help governments and public bodies to decide on a strategy for future urban and rural development, and how much to invest in protective measures against catastrophes. The framework can be extended to other perils in other countries adapting to climate change.

