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RiskScape - an innovative tool for multi-hazard risk modelling

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New Zealand - located at the interface between the Pacific and Australian crustal plates in a maritime SW Pacific situation - is affected by various environmental hazards including earthquakes, volcanic eruptions, tsunamis, floods, wind storms, and landslides. Emergency managers and planers are requiring more quantitative information on the risks and consequences associated with the impacts of those environmental hazards on various risk elements. Of particular relevance is the relative risk of different natural hazards on humans and the built environment. Comparison of the risks from different hazards is necessary to make effective decisions on risk reduction for a particular element at risk and region. Integration of natural hazards with vastly different recurrence intervals and mechanisms with assets and demographics of different nature leads to challenges in terms of data and model integration, and common and useful ways of displaying calculated losses and risks. These challenges are being met in New Zealand by development of a Regional RiskScape Model through a joint-venture between GNS Science and NIWA.

GNS Science and NIWA have developed over the last two years a new software prototype called 'Regional RiskScape Model'. This innovative software determines regional risks from multiple natural hazards in a single package. We have compiled various hazard modules for earthquakes, volcanic eruption, tsunami, flood inundation, and wind-storm scenarios and events into the model. The prototype is being trialled with three New Zealand local authority partners for Westport, Napier/Hastings, Christchurch, spanning two orders of magnitude in population size (from 3,000 to 300,000). But RiskScape is designed to go beyond that - the modular software design is based on the most fundamental principles of risk calculation. Hence, any new haz-

ard or risk element can be ‘plugged’ into the system as a new module with relatively little effort - and is immediately available for risk calculation. Therefore, RiskScape can serve as a generic framework for multi-risk assessment and be used to compare consequences of various hazard events on multiple assets. This tool will enable end-users to analyse their particular risk profile to underpin decision-making processes e.g. prioritising investment in risk reduction, developing realistic emergency training scenarios and informing emergency-management response & recovery.

At this stage only direct losses are being considered covering building damage, damage to engineering lifeline networks (e.g. railways or roads), and the direct impacts on people in exposed communities at different times of day and week (casualties, evacuation and disruption). Several issues have been identified in development of the software prototype. Access and availability of adequate inventory data including relevant parameters for the calculation of asset or personal vulnerabilities are critical. For example for flood risk modelling it is crucial to get good quality data of building location and floor height which is often not available. Accurate modelling of hazard exposure requires good information about local topography, soils, and vegetation (for example LIDAR data for flooding). Different hazard sectors have different ways to communicate risk, probability, and uncertainty - so we are faced with the ongoing need to work with our partners to ensure they obtain results that are appropriate for the intended use.

This paper discusses the fundamental principles of multi-hazard risk modelling the tool is based on, shows some example applications for risk assessment in New Zealand, and evaluates current problems and future needs for calculating consequences of environmental hazards including future climate-change impacts.