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Improving the forecasting of agricultural impacts from tephra fall

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Agricultural land is often highly exposed to volcanic hazards (such as tephra fall) due to its concentration in areas where weathered volcanic material has formed highly fertile soil. In order to better provide better management strategies, an ability to forecast this risk is needed. The development of predictive tools and models requires an understanding of the relationship between hazard intensity metrics, vulnerability characteristics, and the resultant impacts. This has been progressed by creating fragility functions for different farm types that show the relationship between a given hazard intensity metric (in this case tephra thickness) and the probability of certain impacts occurring. Impacts are represented through the use of damage/disruption states, which categorise impacts into a numeric scale. These can then be modified through the use of a set of coefficients to include the influence of seasonal vulnerability and the fluoride levels within the tephra deposit. Three notable events used to inform the functions were the 1991 Hudson, 2008 Chaitén, and 2011 Cordón Caulle eruptions. These were ideal case studies as they were large silicic eruptions that deposited varying thicknesses of tephra on thousands of farms in Patagonia distributed across a variety of climates and production styles. In-field impact assessment studies in these areas were used along with a review of previous global impact assessments and expert input to form the basis of fragility function development. The fragility functions thus developed were then used to create a probabilistic risk model for New Zealand eruptive centres. This allows for the calculation of estimated agricultural loss per sector with the annual probability of an event, leading to the creation of probabilistic loss curves. These curves have important applications in the insurance industry and emergency management sectors.