

An innovative micro-scale approach for vulnerability and flood risk assessment with the application to property-level protection adoptions

ABSTRACT

Economic damage assessment for food risk estimation is established in many countries, but attentions have been focused on macro- or meso-scale approaches and less on micro-scale approaches. Whilst the macro- or meso-scale approaches of food damage assessment are suitable for regional- or national-oriented studies, micro-scale approaches are more suitable for cost–benefit analysis of engineered protection measures. Furthermore, there remains lack of systematic and automated approaches to estimate economic food damage for multiple food scenarios for the purpose of food risk assessment. Studies on food risk have also been driven by the assumption of stationary characteristic of food hazard, hence the stationary-oriented vulnerability assessment. This study proposes a novel approach to assess vulnerability and food risk and accounts for adaptability of the approach to nonstationary conditions of food hazard. The approach is innovative in which an automated concurrent estimation of economic food damage for a range of food events on the basis of a micro-scale food risk assessment is made possible. It accounts for the heterogeneous distribution of residential buildings of a community exposed to food hazard. The feasibility of the methodology was tested using real historical food records and spatial information of Teddington, London. Vulnerability curves and residual risk associated with a number of alternative extents of property-level protection adoptions are estimated by the application of the proposed methodology. It is found that the methodology has the capacity to provide valuable information on vulnerability and food risk that can be integrated in a practical decision-making process for a reliable cost–benefit analysis of food risk reduction options.

Keyword: Flood risk management; Micro-scale food damage assessment; Property level protection; Flood risk assessment; Vulnerability curve; Decision-making