

HAZUS-MH Flood Loss Estimation Methodology. I: Overview and Flood Hazard Characterization

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Abstract: Part I of this two-part paper provides an overview of the HAZUS-MH Flood Model and a discussion of its capabilities for characterizing riverine and coastal flooding hazard. Included is a discussion of the Flood Information Tool, which permits rapid analysis of a wide variety of stream discharge data and topographic mapping to determine flood-frequencies over entire floodplains. Part II reports on the damage and loss estimation capability of the Flood Model, which includes a library of more than 900 damage curves for use in estimating damage to various types of buildings and infrastructure. Based on estimated property damage, the model estimates shelter needs and direct and indirect economic losses arising from floods. Analyses for the benefits of flood warning, levees, structural elevation, and flood mapping remedies are examples of analyses that can be performed with the Flood Model.

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Introduction

HAZUS-MH is the most recent evolution of a family of natural hazards loss estimation software whose development began in the early 1990s. The purpose of HAZUS and natural hazards loss estimation software in general is to quantify the human, property, financial, and social impacts of natural hazards such as earthquake, wind, and flood, under existing conditions and given any of numerous possible mitigation measures. Quantification of losses under existing conditions is valuable for understanding and communicating the relative importance of natural hazards risks and the various factors (such as location, land use zoning, construction quality, etc.) contributing to that risk. Similarly, analysis of the beneficial impacts of mitigation measures (such as relocation, improved land use and planning, structural modifications, warning, etc.) permits informed decision making and efficient allocation of scarce resources. The first release of HAZUS, in 1997, was for analysis of earthquake effects. This paper discusses, in two parts, the development and technical details of the HAZUS Flood Model.

Flood Model Development

Development of the HAZUS Flood Model took place in two phases that began in 1997 with the appointment of an advisory committee to provide technical oversight and guidance. Phase I consisted of a comprehensive review of existing flood loss estimation studies, models, and data (EQE 1998). Based on that review, a concept for a methodology was developed as represented in Fig. 1 (EQE 1999a). The concept was evaluated through proof-of-concept testing performed in six communities in regions representing various flooding conditions (EQE 1999b). The findings from the proof-of-concept testing were that:

- Discharge frequencies can be determined for all river reaches in the United States where digital elevation models (DEM) and regional regression relations are available;
- Flood depths can be determined for all river reaches in the United States where DEM and Q3 data is available. Fig. 2 is an example of the accuracy achievable using the recommended methodology and available DEM and Q3 data;
- Base flood elevations (BFEs) along coastal shore-perpendicular transects can be estimated and provide reasonable results;
- Applying U.S. Census and Dunn & Bradstreet data at the census block level provides a resolution suitable for flood loss estimation;
- Depth-damage functions for buildings developed by the Federal Insurance Administration (termed "credibility-weighted" functions) are suitable for flood loss estimation, since they are based on the best available damage data and represent more than 20 years of losses. Additionally, depth-damage functions developed by the U.S. Army Corps of Engineers (USACE) are also suitable in selected instances, for a wide variety of building types in various regions;
- Depth-damage functions for lifelines such as water, electric power, roads, and railroads can be developed using a combination of historical data, component based modeling, and expert opinion; and

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Chao Zhang



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