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Thailand riverine flood risk modeling and loss quantification from re/insurance perspectives

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Thailand is prone to regular flooding because of its tropical location, the influence of seasonal monsoon, and its local topographic features. The most noticeable and devastating flood in the recent history of Thailand is the 2011 riverine flooding event. The event caused an estimated economic (insurance) loss of US$ 30 ($12) Billion. The event underscored the needs for the global insurance industry to adequately quantify the riverine flood risk in Thailand. In this paper, the development of a stochastic riverine flood risk and loss quantification model is discussed. The modeling process started with collecting and analyzing the historical river flow data from Thailand. Data quality assurance programs and outlier detection algorithms were enforced to review and detect possible human intervention with river flows and any inadvertent human errors in entering the river flow data. Generalized Extreme Value (GEV) distribution was then selected to fit the peak annual river flow data for each gauge station with sufficiently long and reliable data. To compensate the resolution of gauge station network, Thailand was divided into five hydrologic regions and regional flood frequency regression equations were established using the gauge station data in each region for ten selected river flow return periods. The regional flood frequency equations provided reasonable river flow estimates for the rivers where no or little historical data ever existed. Correlation of peak annual river flows between gauge stations was also quantified using the gauge station river flow data. Using the regional flood frequency and river flow correlation information, 10,000-year worth of stochastic flooding events were simulated to reflect realistic riverine flooding scenarios in Thailand. Flooding water depth and elevation were estimated at the property location level following essentially a 1-D hydraulic routing model for each stochastic flooding scenario. A practical yet effective approach was developed to adjust the river channel bottom elevation to alleviate flood water elevation overestimation due to digital elevation model (DEM) data resolution. Flood water depths were then calculated for each property location and were used as the hazard measure to establish the flood vulnerability functions for re/insurance loss calculation by coverage for buildings, contents, and business interruptions. Thailand flood risk model and loss quantification model developed in the endeavor considered 1 in 100 years flood defense in Bangkok and South East coastal area, but it did not include flood diversion, flood retention and other flood control measures.