

# **Aggregation of catastrophe losses with multi-tiered financial terms**

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Loss aggregation from catastrophic events requires accounting for presence of multiple-tiers of re/insurance financial terms. Portfolio single risks are subject to both insurance coverage and geo-spatial correlation. In this paper three examples of three tiered structure used primarily in commercial and industrial facilities re/insurance will be presented: (1) per risk, by geo-spatial region, with top level cover on all geo-regions, (2) per risk, with second tier geo-spatial sub-limit and top level cover on all geo-regions and (3) per risk and per insurance coverage, by geo spatial and by insurance coverage , with top level cover on all geo-regions and all insurance coverages.

In order to perform loss aggregation for the above complex structure both coverage and spatial correlations need to be incorporated into the loss aggregation algorithm. Two algorithms will be discussed: mixed convolution and copula-based latin hypercube sampling. The former is a weighted sum of convolution and comonotonic joint pdfs with weight estimated using assumed correlation model. The latter is a combination of latin hypercube sampling, copula sampling and Iman-Conover reordering to induce desired correlation structure. Simulation results for an example of an industrial facility with sixteen risks located in four campuses will be discussed.