CATASTROPHIC DISASTER EVENTS

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EXECUTIVE SUMMARY

Insurers and reinsurers face challenges from highly variable, geographically concentrated catastrophe risks.

Traditional frameworks often miss low-frequency, high-severity events, causing mispriced premiums, inefficient reinsurance, capital strain and disclosure risks.

Project Purpose and Relevance: Using disaster analytics and a Random Forest model, global hazard data is transformed into actionable insurance insights. Integrating severity, frequency and geographic concentration metrics improves underwriting precision, reinsurance structuring and supports climate-exposed markets, insurance brokers and ensures regulatory compliance. ***Data source: data***

INTRODUCTION

Under-pricing of catastrophic risk arises from high variability, tail-heavy severity, and geographic concentration.

Project objective includes leveraging predictive analytics for underwriting, premium setting, retention, reinsurance management and product design for flood, drought, and earthquake risks.

Performance metrics include improved predictive accuracy, optimised limits, resilient portfolios and strengthened compliance.

METHODOLOGY

- Global disaster analytics link heavy-tailed, concentrated hazards to underwriting, pricing, retention, and reinsurance decisions.

- Skewed earthquake depth and large impact footprints justify higher loadings, depth-aware pricing, stricter limits, and elevated retentions. Flood and drought patterns guide product design, deductibles, and diversification.

- Random Forest models captured non-linear relationships, improving Mean Absolute Error from 2.311 to 2.02, with interpretable feature importance for targeted underwriting, reinsurance, broker advice, and regulatory compliance.

RESULTS

- **Risk Profiles:** Disaster risks are heavy-tailed; upper-quartile impacts exceed medians. This implies that there is a significant chance of extremely severe events far beyond the average and that the top 25% of disaster events have losses much higher than the middle loss, showing that extreme events dominate the risk profile.
- **Spatial Correlation:** Droughts show multi-country accumulation in Europe, Middle East, and Africa. This implies that drought events are not isolated to a single country but tend to occur across multiple neighbouring or connected countries at the same time or within the same period.
- **Model Performance:** Random Forest reduced Mean Absolute Error from 2.311 to 2.02, identifying high-severity flood zones as China, Italy, Colombia and Burundi.
- **Regional Intensity:** High disaster intensity in East/Southeast and South Asia; Africa and Central Asia have data gaps requiring conservative assumptions.

WAY FORWARD

- (a) Institutionalize hazard-conditional, data-driven frameworks translating analytics into pricing, retention, and reinsurance strategies, recalibrating quota share, surplus, and catastrophe programs using validated model outputs.
- (b) Strengthen model governance via regular validation, regional calibration, stress testing of low-frequency, high-severity events, and close data gaps using satellite, geospatial, and exposure data to improve capital efficiency, portfolio resilience and sustainable underwriting.
- (c) Gather historical disaster data with details on **severity, frequency, location while incorporating** external sources, i.e. satellite imagery, geospatial data, climate projections and exposure databases.