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Underwriting and Quantifying Catastrophe Risks Using GIS

by Kevin Huang

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Abstract

Underwriters in insurance and reinsurance companies have been striving to quantify the natural and man-made catastrophe risks taken by them. Even though there are a handful modeling companies that provide software and services just for the purpose of catastrophe modeling and pricing, their products are often limited in geographical coverage and lack of modeling capability for certain perils. GIS, with its unique advantage in spatial analysis and visualization, has proven to be a powerful tool for underwriters to better understand and quantify catastrophe risks. This paper demonstrates a number of examples where GIS can be used to provide assistance in underwriting non-traditional risks, such as terrorism exposure accumulation, volcano and lava flow analysis, brushfire risk quantification, and hurricane risk visualization. GIS should always be kept as one of the tools available to underwriters.

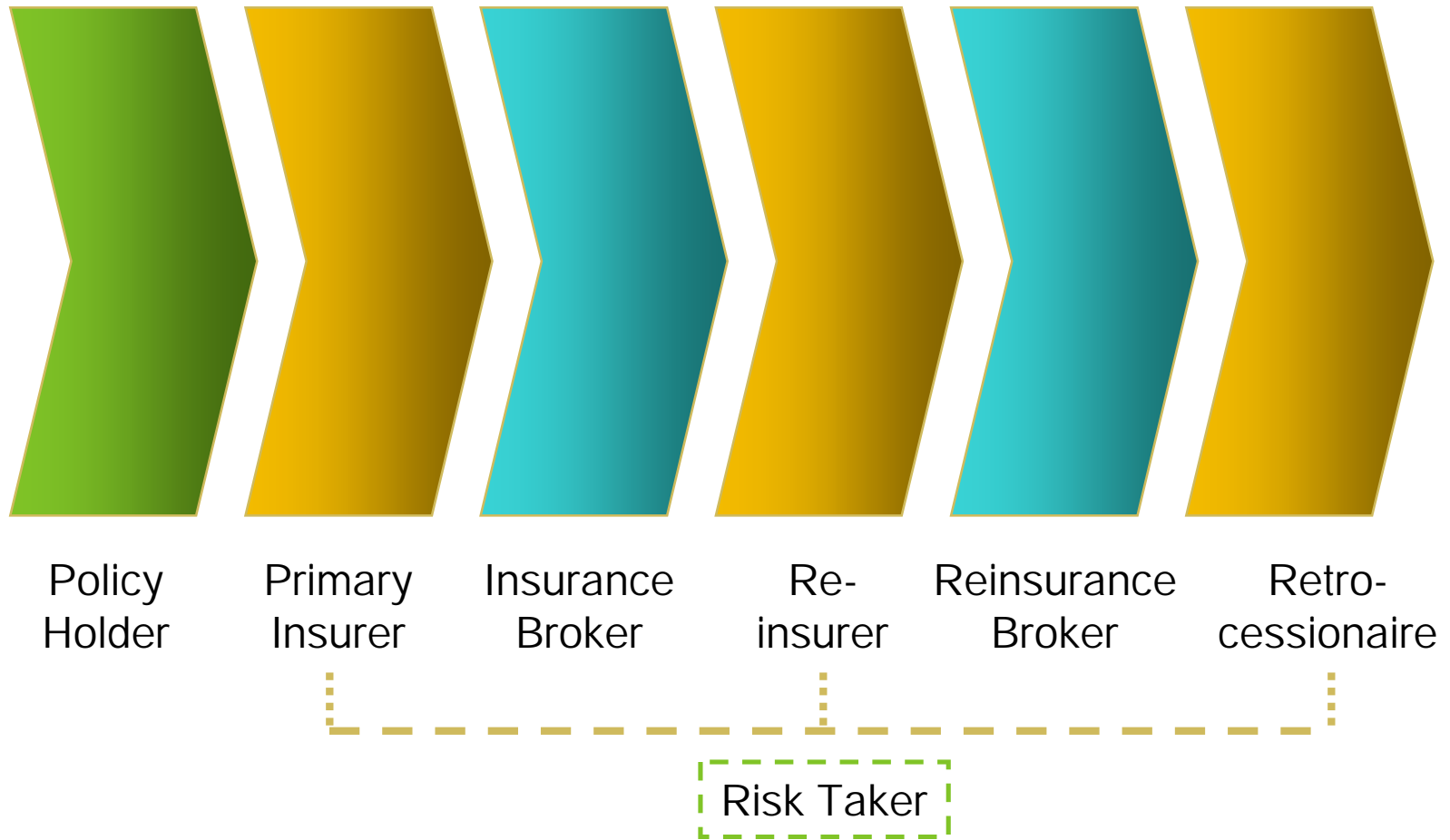


Introduction

- About insurance and reinsurance
- Underwriting catastrophes
- Challenges facing catastrophe modeling
- Examples of GIS technologies being used in catastrophe modeling and pricing
- Conclusions



The Chain of Risk Transfer



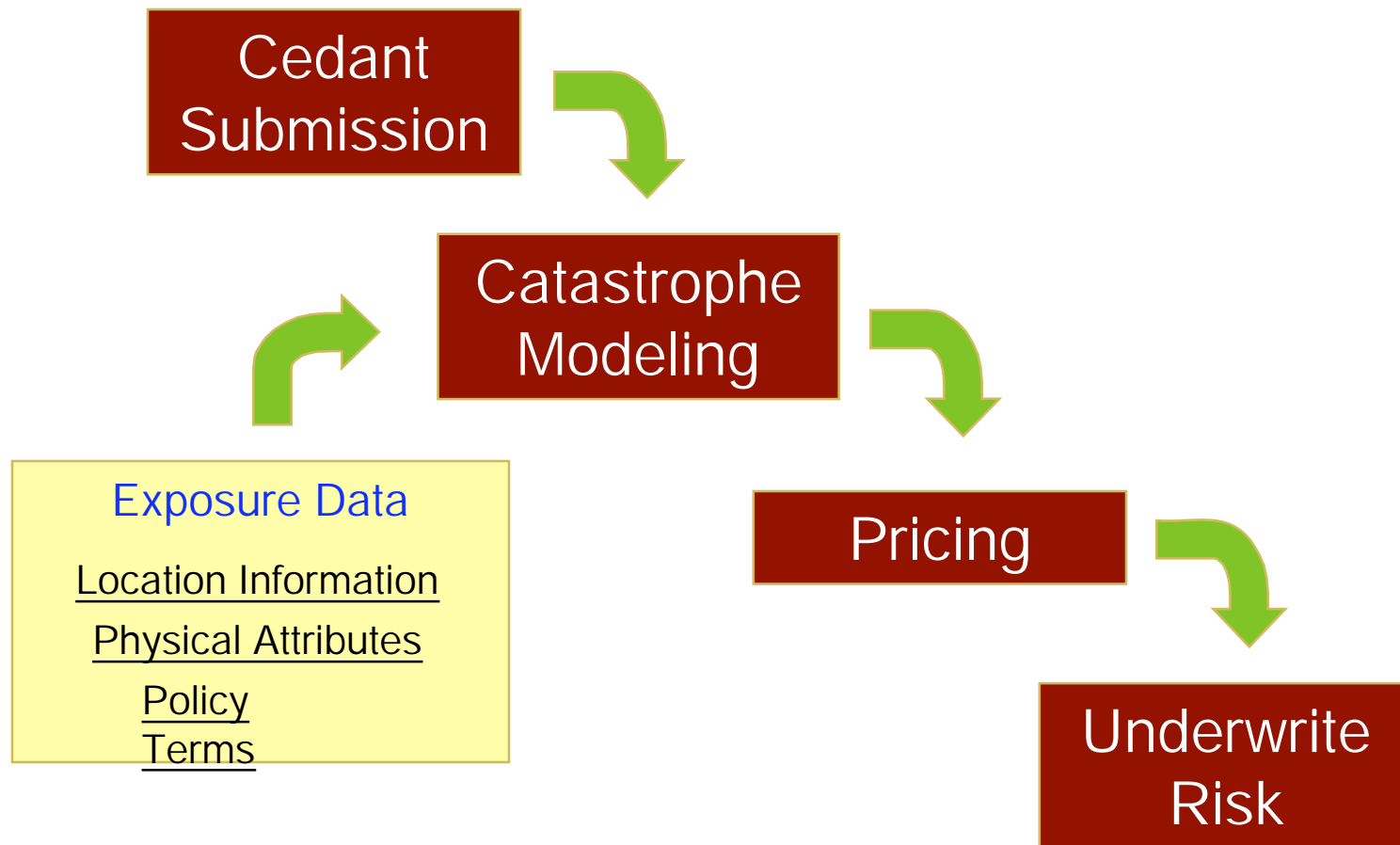


Catastrophes

- Natural Catastrophes
 - unlikely to cause surprise by cause
 - uncertainty around return period and severity
 - earthquake, hurricane, flood, tornado
 - meteors, tsunami, volcano
- Man-made Catastrophes
 - potential to cause surprise by source
 - uncertainty around most parameters
 - fire / explosion, aviation, terrorism
 - asbestos, asset-bubbles, cyber-risk, global warming



Property Catastrophe Underwriting Process





Challenges in Catastrophe Modeling

- Only a handful of commercially-available modeling firms (AIR, EQE, and RMS in US)
- Limited geographical coverage (North America, UK/Europe, Australia/New Zealand, Japan, and Caribbean are the major regions covered)
- Limited peril types (e.g., earthquake & fire-following, hurricane, tornado & hail, UK flood) that can be modeled with meaningful confidence
- Significant parameter risk
- New regulatory environment and competitive market
- GIS has been proven to be a useful tool for underwriters to better understand and quantify catastrophe risks

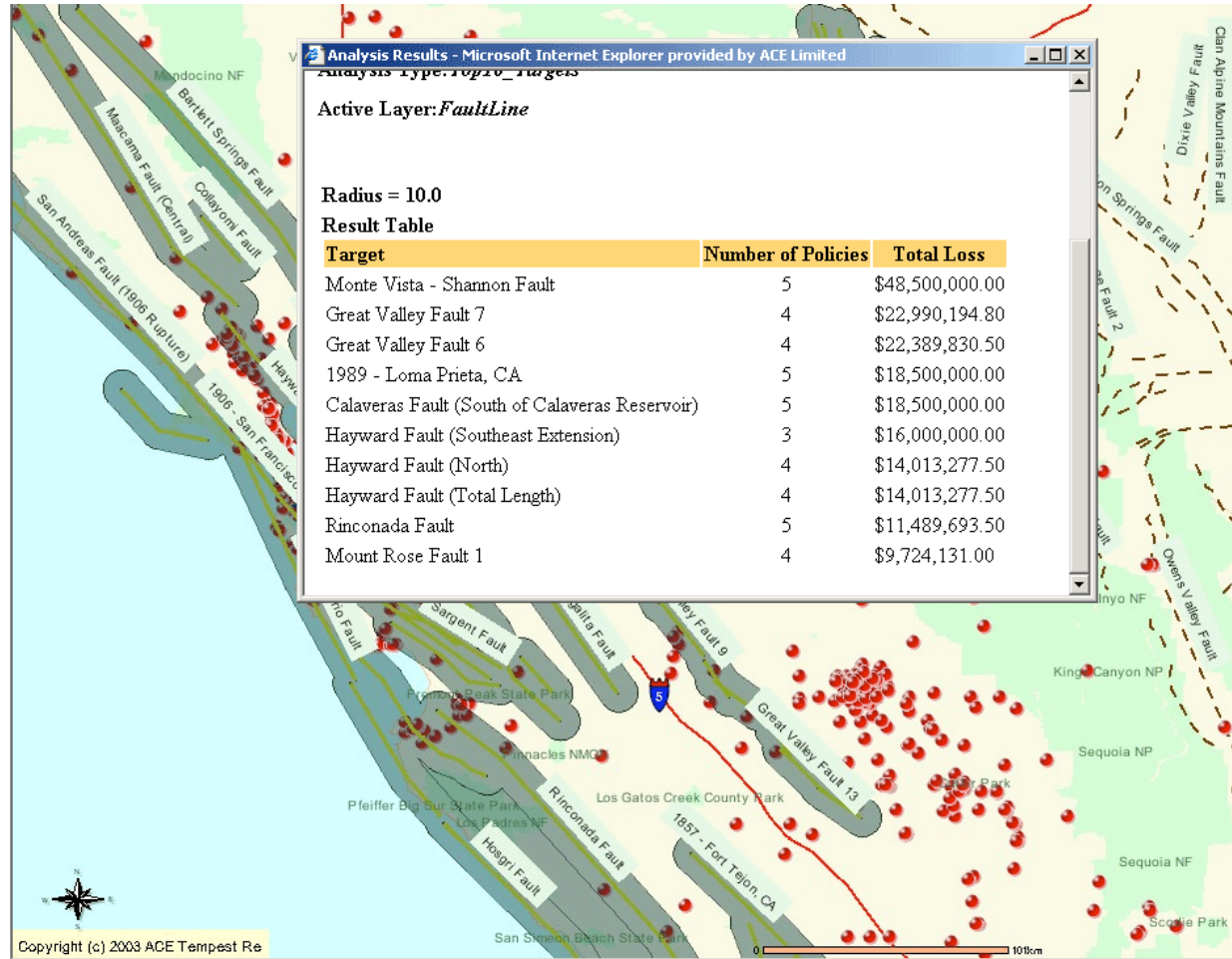


Geocoding

- The first step in catastrophe modeling and exposure accumulation control
- Lack of high quality address information
- Out-of-date underlying street/zip database
- Street level geocoding may not be sufficient for certain perils
- Lack of comprehensive international geocoding coverage
- 3 dimensional geocoding
- Pre-geocoding policies before feeding into the catastrophe models
- Onsite inspection with handheld GPS devices (for high value risks)

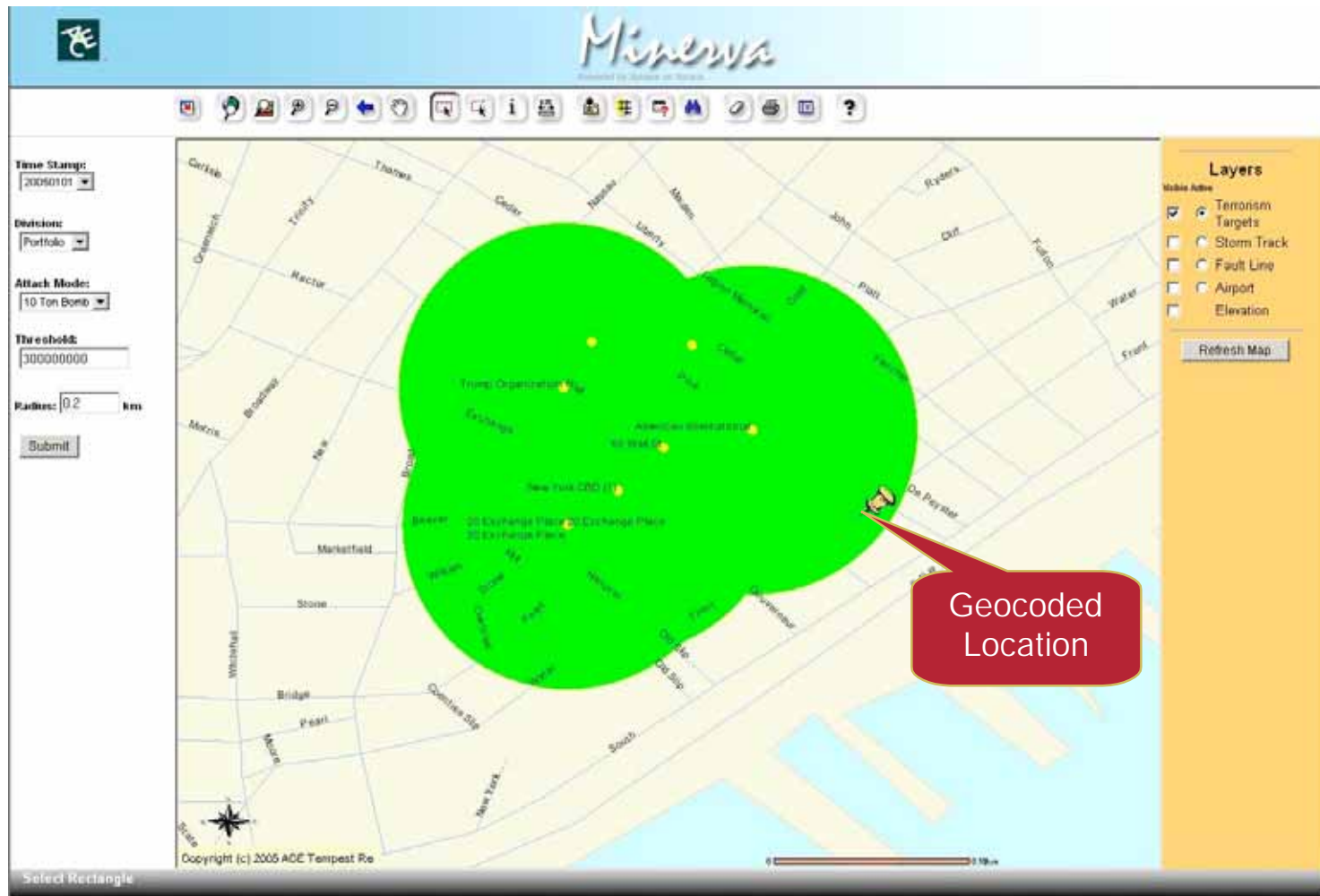


Exposure Accumulation





Underwriting Terrorism Coverage

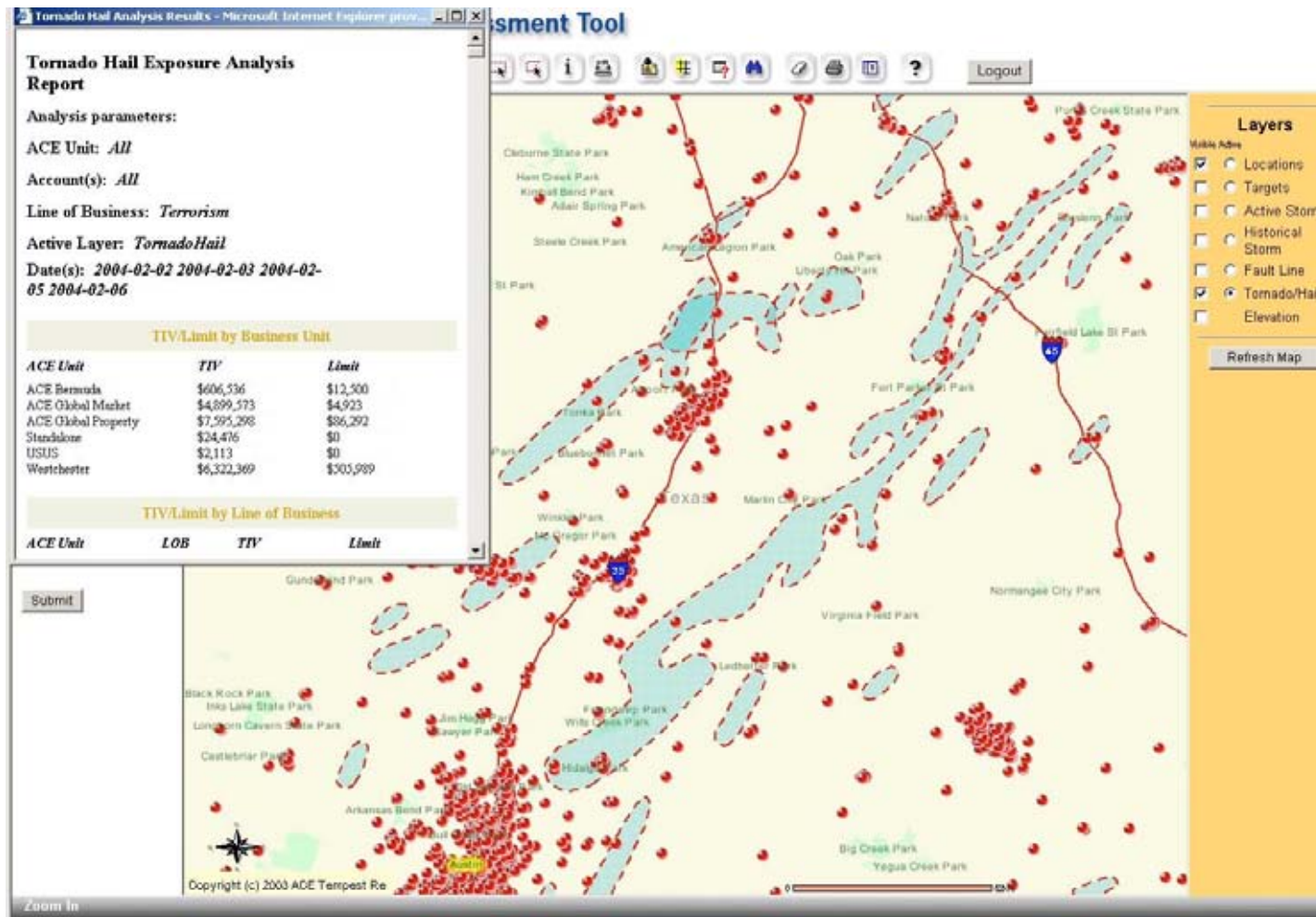


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Real-time Tornado/Hail Loss Estimation



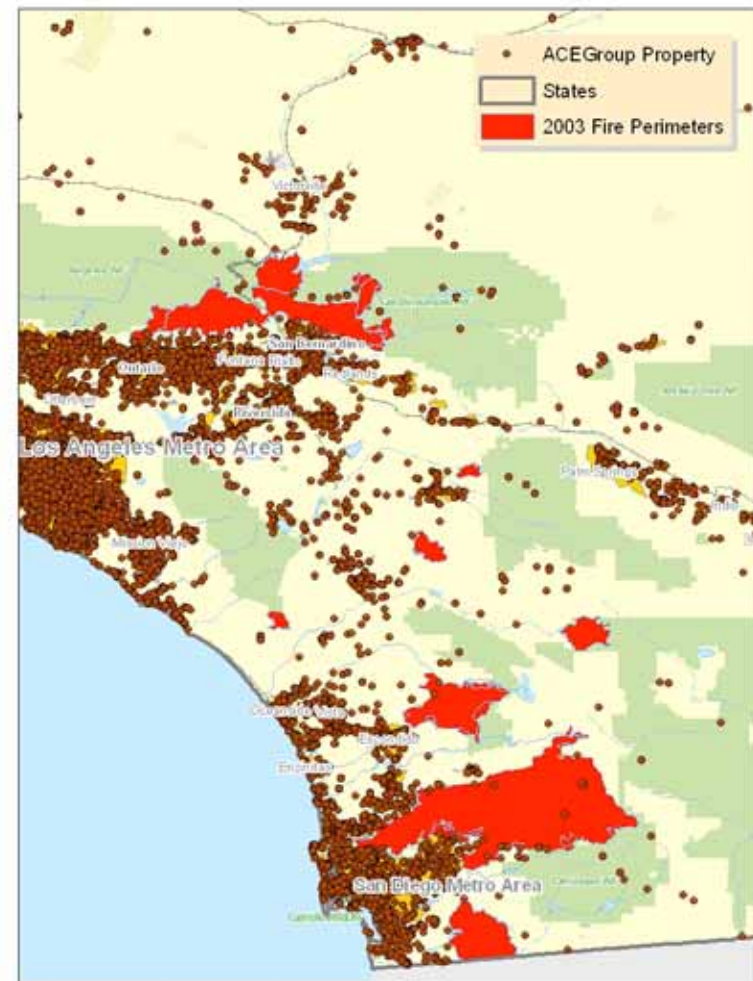
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Brushfire Risk Modeling

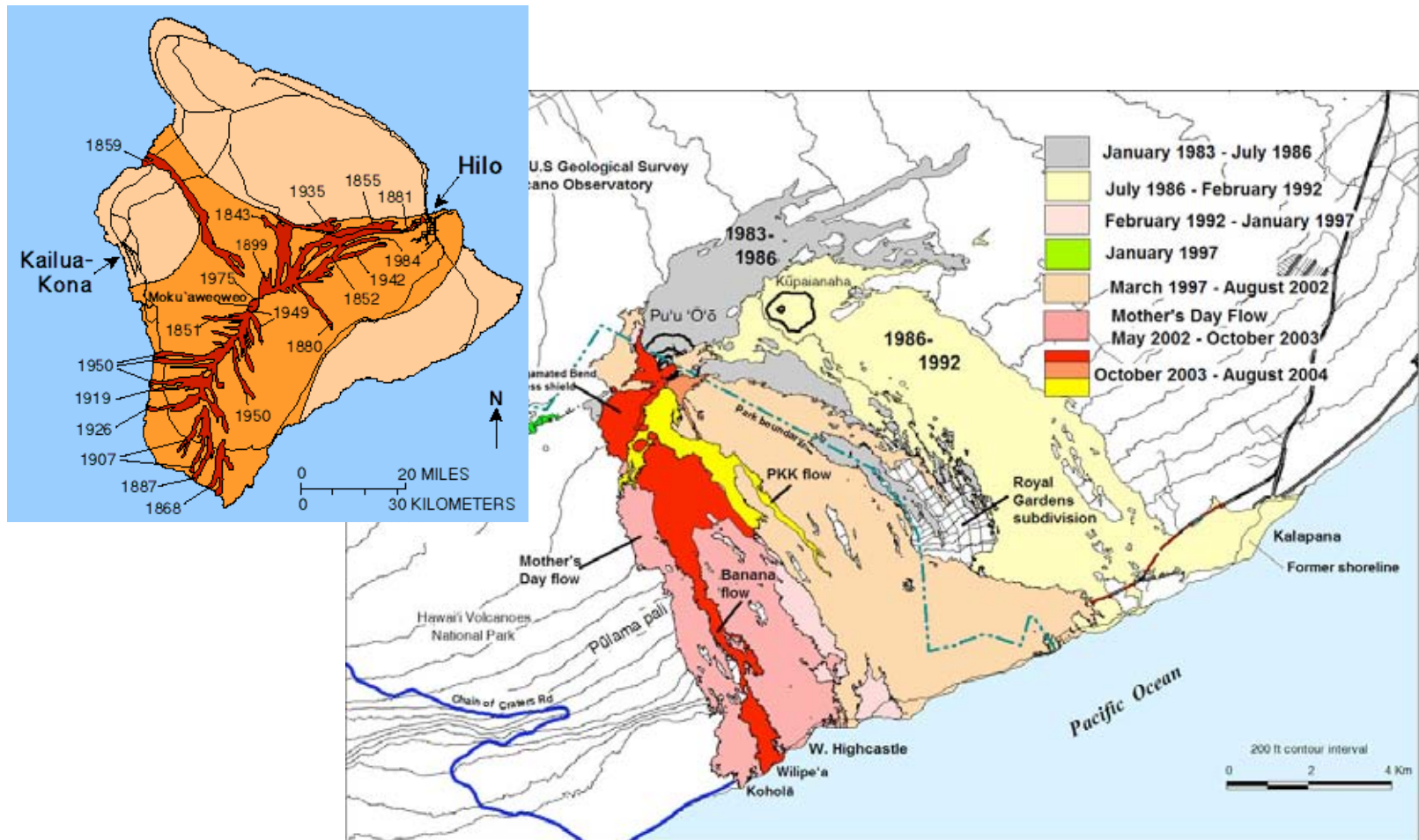
- Increased frequency and severity of brushfire due to population growth and commercial/residential development
- Defining key parameters of an event, such as slope, aspect ratio, land use / land cover, prevailing wind direction and speed, and spatial distribution of fuel, requires utilization of GIS technology
- Simple bimodal damage function



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Lava Flow Risk Analysis

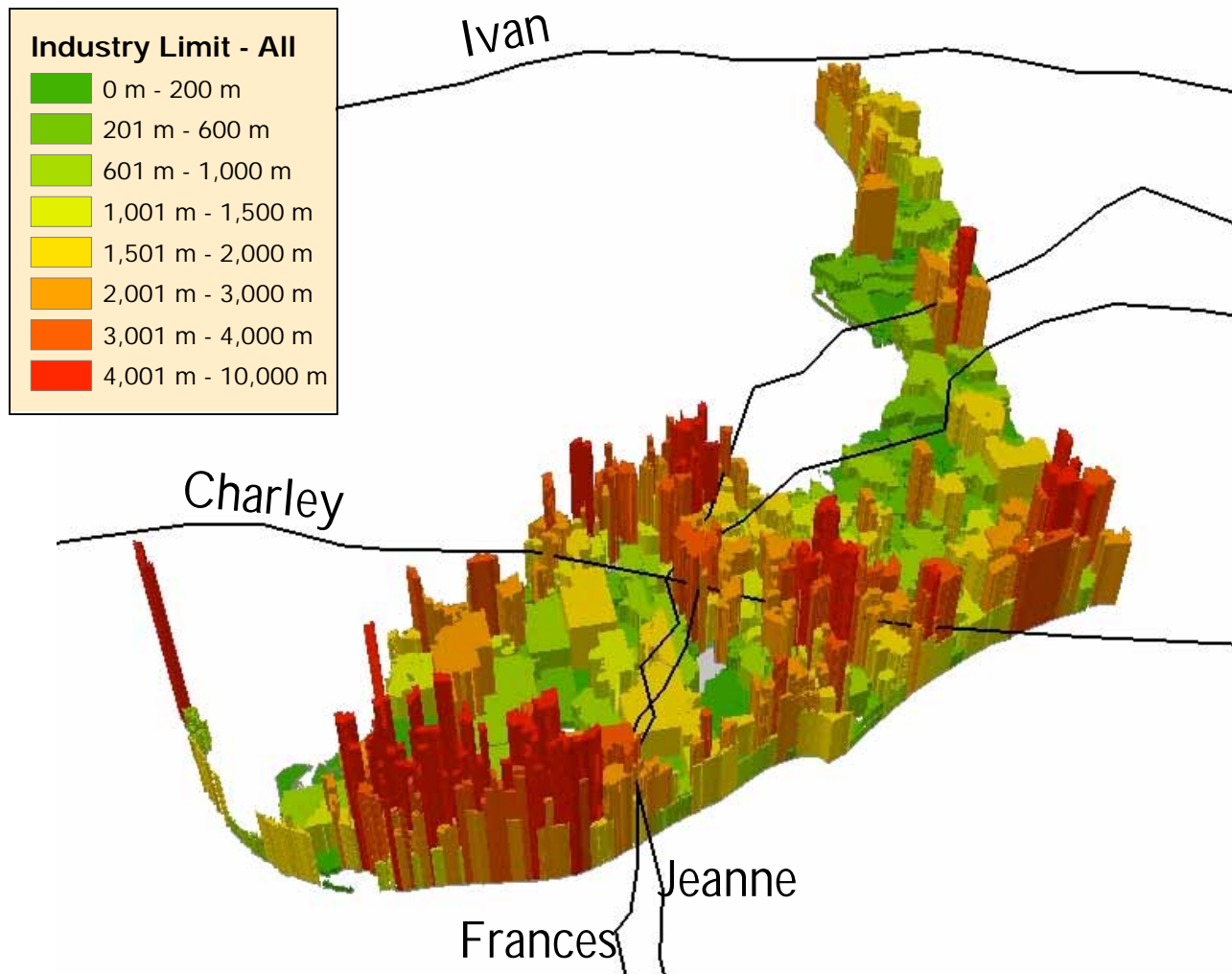


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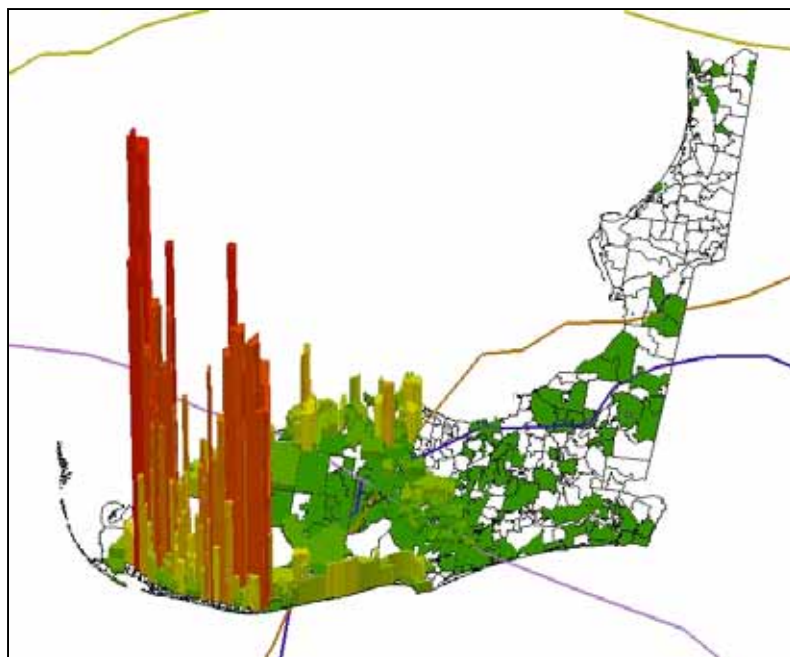


Risk Visualization (1)

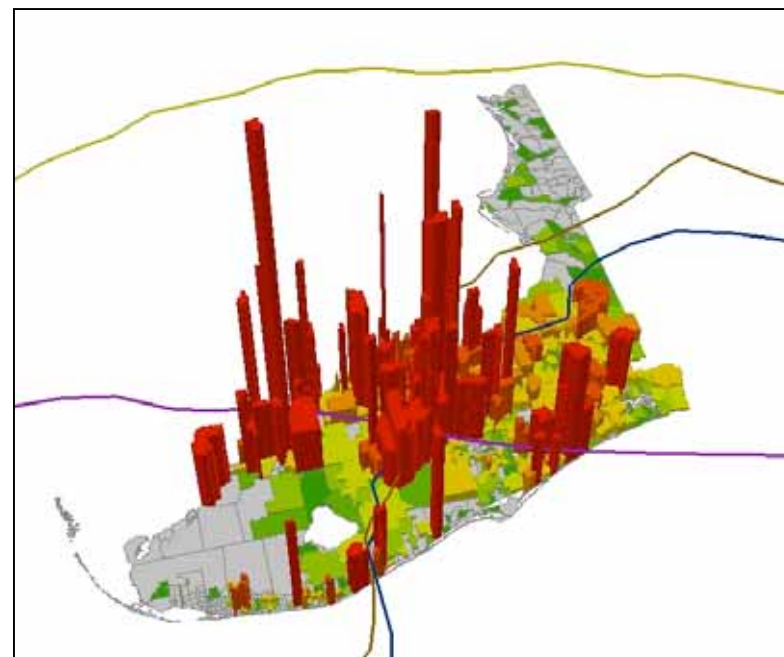




Risk Visualization (2)



Cedant 1



Cedant 2



Conclusions

- Underwriters are facing daily challenges of properly quantifying natural and man-made risks.
- New regulatory environment has called for thorough understanding and controlling of the risks being written.
- GIS has been proven useful in exposure accumulation control, terrorism policy underwriting, brushfire and lava risk modeling, real-time loss estimation, and risk visualization.
- The adoption of GIS technology in the insurance industry has been profound and comprehensive. However, its benefits haven't been fully explored by every underwriter due to either lack of training or difficult/expensive to implement such technology into existing underwriting systems.



Author Information

Dr. Kevin Huang is AVP and Director of R&D with ACE Tempest Reinsurance Limited, who has more than 8 years of experience in using GIS to quantify natural and man-made risks for the insurance industry.

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