Verisk Founded the Catastrophe Modeling Industry and Creates Models for Perils Worldwide

- Founded the catastrophe modeling industry in 1987 as Applied Insurance Research (AIR)
- Emerged as the scientific leader of risk modeling software and consulting services
- Locations in Boston, Halifax, London, Munich, Beijing, Tokyo, Singapore, and Hyderabad
- Grown to serve more than 400 clients in a wide range of industries, including insurance, reinsurance, finance, corporate, and government

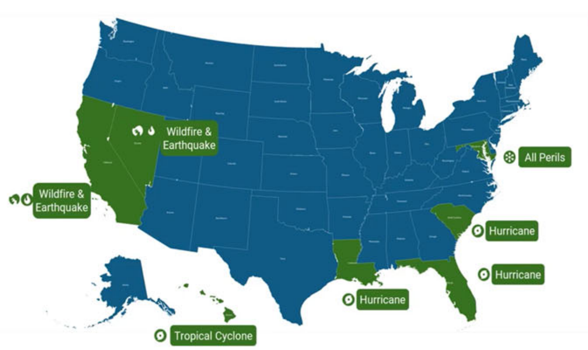
1

Verisk's long tradition of catastrophe model acceptance under all established review processes

The Verisk Wildfire Model for the United States was independently validated through a rigorous review by a state regulatory body

The Verisk Wildfire Model for the United States was **approved by Nevada's Department of Insurance** in February 2025

The Verisk Wildfire Model for the United States is the **1st model to be reviewed under California's new PRID procedure**



Verisk maintains the **longest record of model acceptance for hurricane modeling** under the 1st major model review process from the Florida Commission

2

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Verisk Extreme Events Solutions Staff Is Multidisciplinary

- Geoscientists
- Meteorologists
- Climatologists
- Physicists
- Software Specialists
- Mathematicians
- Statisticians
- Actuaries
- Operations Researchers
- Engineers
- Analysts
- Modelers
- Computer Scientists

More than 700 professionals. 90+ hold Ph.D.

3

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Verisk has dedicated significant resources to develop the Wildfire Model for the United States

- The Verisk Wildfire Model for the United States was first released in 2006
- Analyzed 59,000 historical wildfires across the domain
- Leverages Verisk's high-resolution exposure database
- Covers 13 western states spanning 45 ecoregions with distinct climates
- Model spread of fires through wildland, WUI, and urban areas
- Explicitly model smoke as a sub-peril
- More than 41,000 CPU hours of runtime
- Verisk Climate Council of independent, academic advisers

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What is a Catastrophe Model?

- Mathematically represents the physical characteristics of the peril
- Quantifies and prices risk throughout the industry
- Informs event frequency and severity
- Industry Standard Practice

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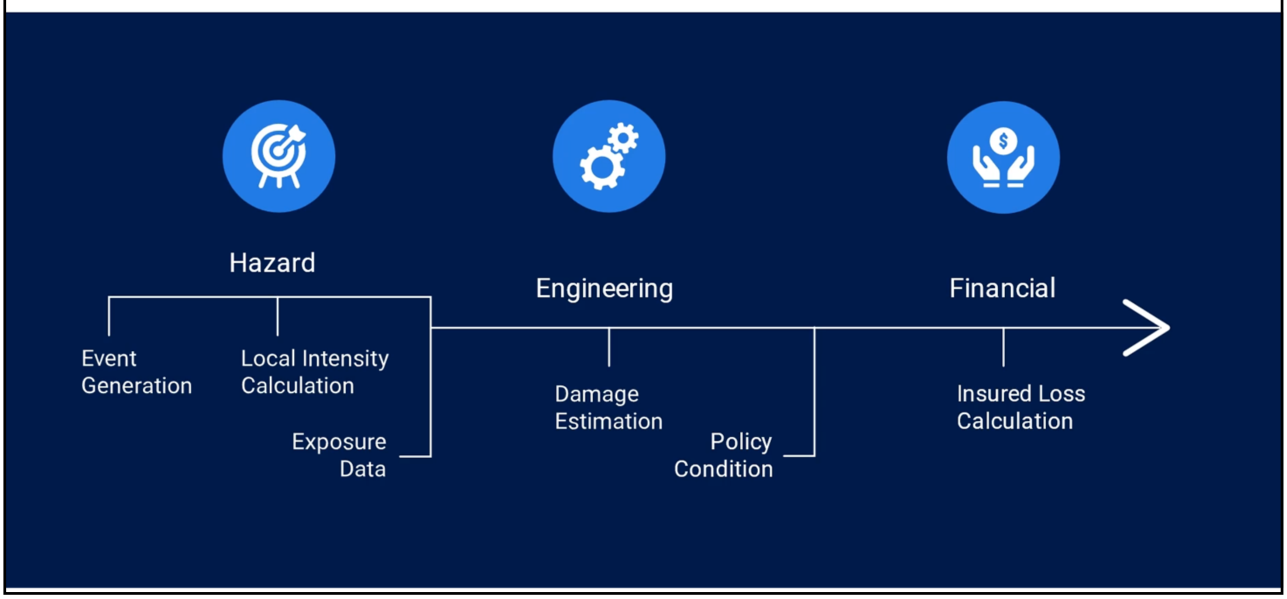
Verisk Extreme Event Modeling Framework



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What Kind of Data Are Used to Build A Wildfire Catastrophe Model?

Some of the data we use include

- Historical Wildfire Footprints and Ignitions
- Weather Data
- Ecoregion Definitions
- Topographical Information
- Fuel Classifications
- Land Cover
- Building Count and Location
- Road Datasets
- Engineering Field Research
- Verisk Damage Surveys
- Historical Loss Data

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Users Access the Model Via Verisk's Touchstone Platform

Company Detailed Exposures

Catastrophe Loss Estimates

Touchstone

8

How do you model a wildfire?

9

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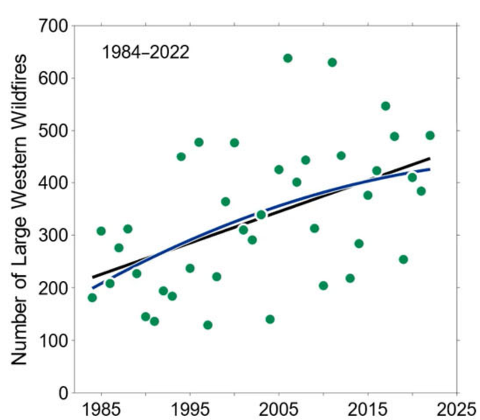
The frequency of large western wildfires is increasing

Number of Large Fires has Nearly Doubled in the Last 40 Years



1. Number of annual burn scars exceeding 800 acres is clearly trending upward:
   On average, 800-acre burn scars in the Western US have 1,000-acre fire perimeters
2. Frequency of all-sized fires is **not** increasing
3. **Big fires are more frequent – and bigger**

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The relationship among Climate, Weather, and Fire Potential varies across the model domain

We have divided the domain into 45 "Ecoregions" to capture local relationships

Ecoregions represent areas with largely similar ecosystems as defined by the EPA

Derive relationships between ***near-present seasonal weather variables*** (temperature, precipitation, aridity, etc.) and burning potential in each ecoregion

Weather variables interact with regional vegetation layers to model rapid growth and drying resulting in ***availability of fuels***

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Devastating fires are often associated with extreme wind

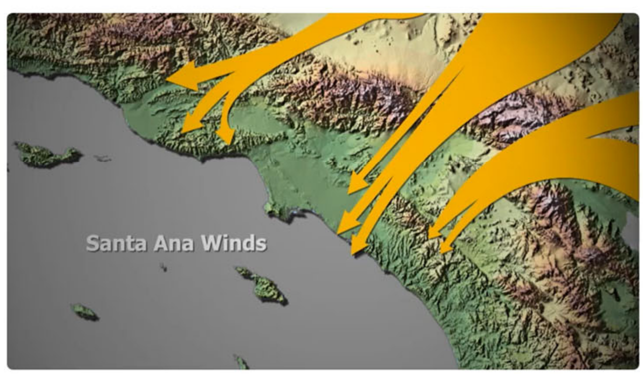
Verisk Wildfire Model for the United States explicitly includes events with downslope wind effects

Santa Ana wind events in Southern California

Diablo wind events in Northern California

Chinook wind events on eastern side of the Rockies

These wind events drive larger, more intense fires



U.S. Geological Survey

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Model Explicitly Accounts for Spread Mechanisms

Surface Spread

Transition to Canopy and Canopy Spread

Branding/Spotting (Embers)

13

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Embers Are Drivers of Wildfire Spread and Key to Ignitions of Structures

U.S. Fire Administration, FEMA

- Embers can be thrown ahead of the main fire front
- Embers can cross rivers, bare soil, roads, and other firebreaks
- Embers are responsible for most **structure ignitions** (not contact with burning vegetation)

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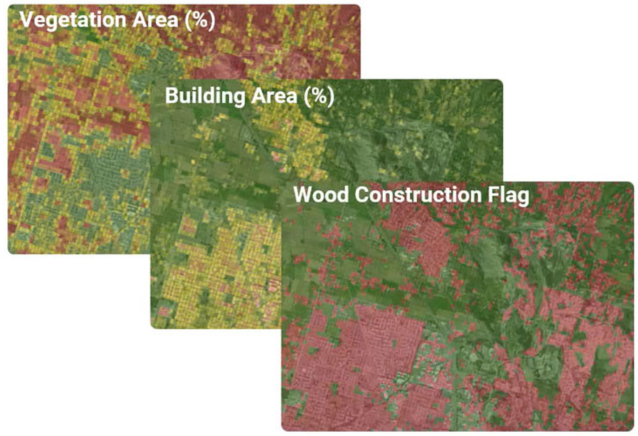
Explicit modeling of urban conflagration is enhanced by a detailed view of available fuels

Structure fire leads to embers resulting in spread and spotting



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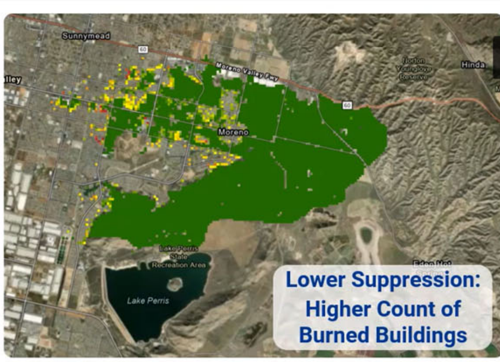
Fire suppression ability is dynamic and contingent on many factors

Primary drivers of modeled suppression

- Population Density
- Winds
- Fuel Moisture
- Fire Penetration
- Construction Type
- Fire Size



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What about mitigation efforts? Are they reflected in the model?
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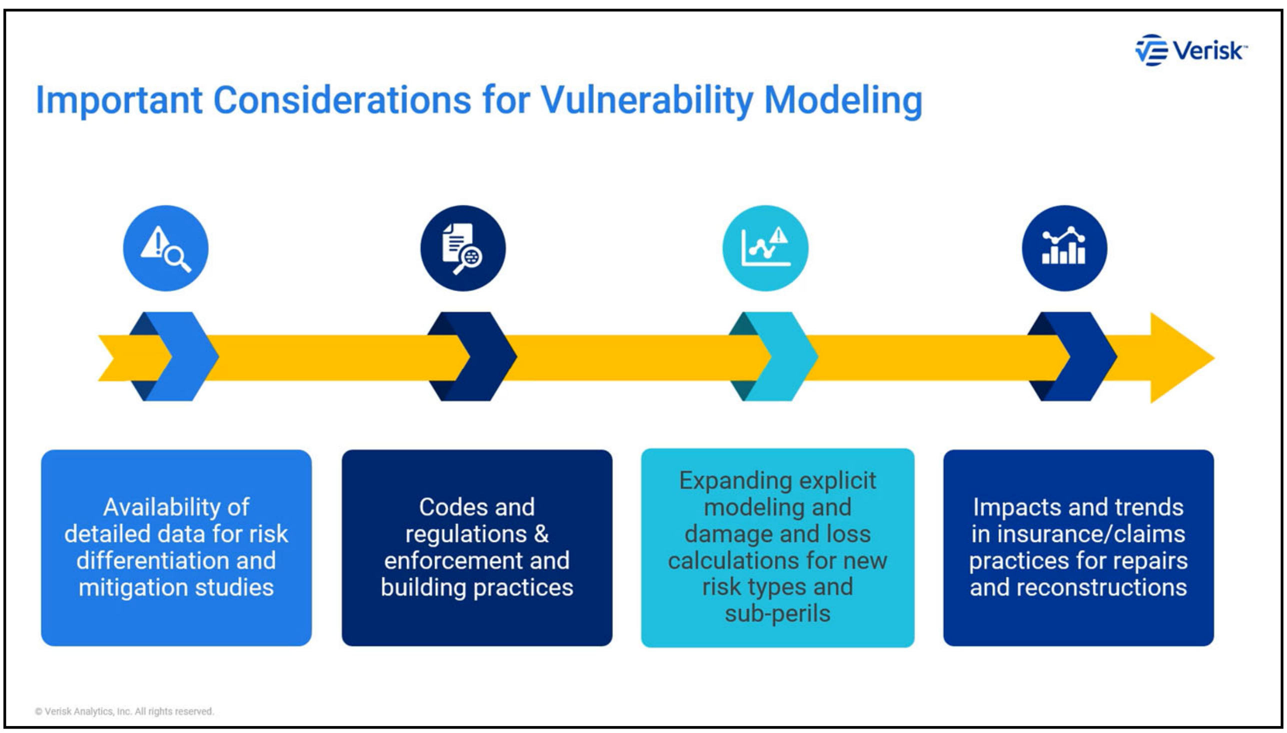
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Important Considerations for Vulnerability Modeling
Availability of detailed data for risk differentiation and mitigation studies
Codes and regulations & enforcement and building practices
Expanding explicit modeling and damage and loss calculations for new risk types and sub-perils
Impacts and trends in insurance/claims practices for repairs and reconstructions
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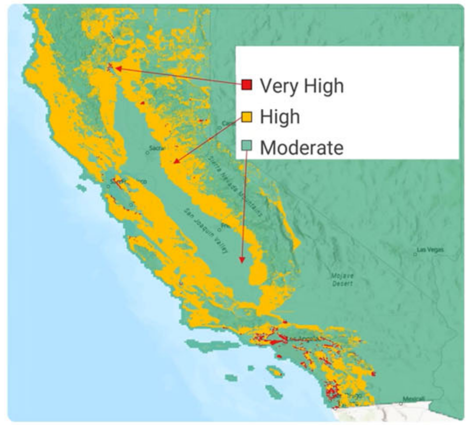
Hazard Zone-Based Requirements in California

- Local, state and federal responsibility area zones are mapped to moderate, high and very high hazard levels
- California Building Code (CBC) construction class A, B, & C requirements mapped to the hazard levels
- Buildings in very high hazard zone built after 2008 are less vulnerable than similar buildings in high or moderate zones at same flame intensity due to the required mitigations
- Mitigations are represented through **secondary risk characteristics**



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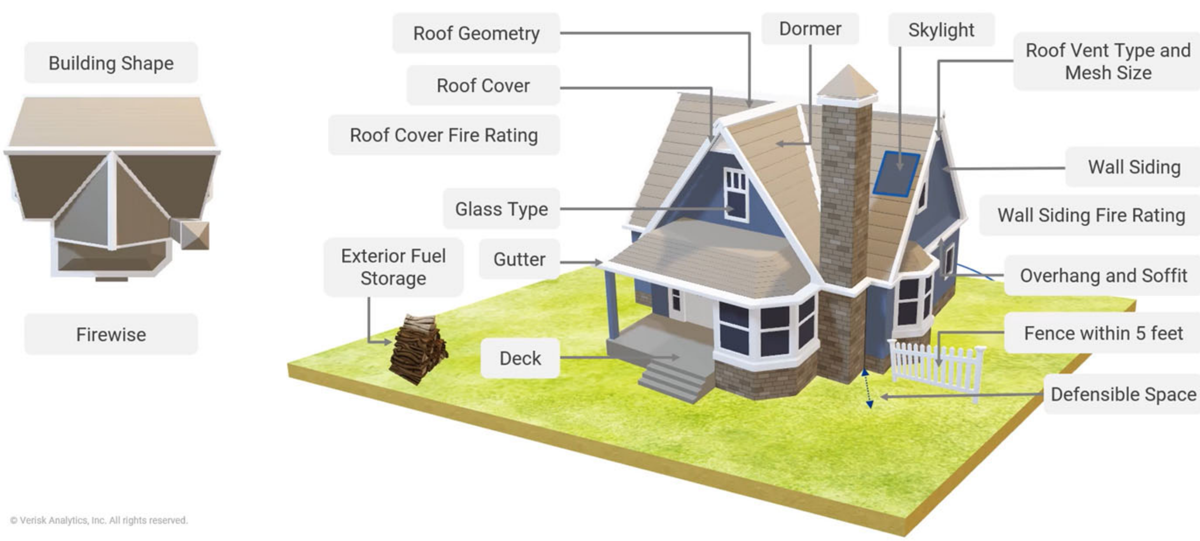
Damage Estimation Considers The Building's Mitigation Efforts

Model Mitigations from Safer from Wildfires and IBHS "Wildfire Prepared Home" Designations



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Why Do We Need Catastrophe Models?

Traditional methods may not be a good predictor of possible loss

Constantly changing landscape of exposure data limits the usefulness of past loss experience

Models should capture potential losses ***before*** they occur

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Recognized Value of Catastrophe Models in Ratemaking

Hurricane Andrew in 1992 and the Northridge Earthquake in 1994 led actuaries involved in evaluating hurricane and earthquake exposures to recognize the severe inadequacy of the traditional, empirical actuarial methods used for ratemaking for these exposures. Recognizing the need to replace these methods, many actuaries began using stochastic computer simulation models for their actuarial analysis of hurricane and earthquake exposure. – *ASOP 38*

A historical approach is only considered successful when there is sufficient data and when previous events reliably predict future claims payments. These traditional methods may not be suitable for low-frequency and high-severity catastrophic events.

Historical loss experience is difficult to adjust to reflect current conditions, such as portfolio changes or societal changes. For example, building codes, construction practices, and materials change over time, so the damage from a previous catastrophic event that occurred many years ago may not provide accurate details for a current loss. – *NAIC Catastrophe Modeling Primer*

Since ratemaking needs to be prospective by nature, and not a recoupment exercise, it is crucial to ask whether the past experience is a good surrogate for what might happen in the future.

[…]

For catastrophe perils with a very long return period, it is likely that current catastrophe rates based on the insurer's own much shorter term loss experience may have a large element of instability. – *Walters, Michael A., "Catastrophe Ratemaking" (CAS Study Note)*

Prior to the adoption of catastrophe models, (re)insurers used rough rules of thumb based on premiums to estimate potential losses. Andrew caused losses many times higher than what these formulas had projected. The catastrophe models got it right because of their unique structure and architecture. – *Insurance Journal, "The Evolution of Catastrophe Modeling Since Hurricane Andrew"*

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How Catastrophe Models Aid in The Actuarial Process

Improving quantification of risk by	Historical Data	Catastrophe Model
Increasing sample sizes	Less than 100 years of reliable data (only a few catastrophe years)	100,000 years of data
Assessing all events on current exposure	Exposure is different across experience years	Exposure is the same for all years and events

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Key Model Outputs for Risk Assessment

Average Annual Loss (AAL)
- The loss that can be expected to occur per year, on average, over a period of many years

Exceedance Probability (EP)
- The likelihood that a loss of any given size (or greater) will occur in the coming year

Occurrence Loss
- The largest loss in each simulated year

Aggregate Loss
- The sum of all loss-causing events in each simulated year

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