AEGIS Modeling Capabilities

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AEGIS Modeling Capabilities

Tiffany Zormelo

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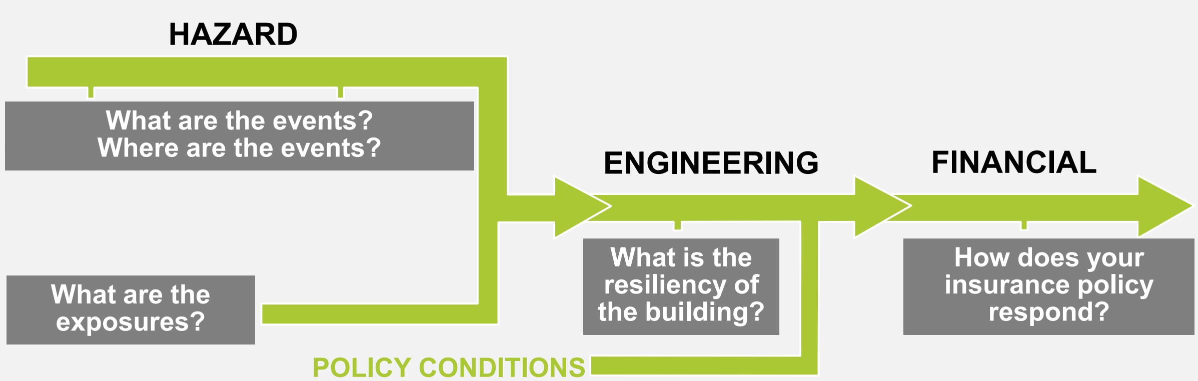
Agenda

- What is catastrophe modeling?
- Catastrophe modeling impact on insurance operations
- Changing landscape
  - Insurance
  - Catastrophe modeling industry
  - AEGIS
- Good data vs. bad data
- Model output
- Member reports

What is Catastrophe Modeling?

Three main components



Model Impact

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Transformation of insurance

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Changing Landscape for Catastrophe Modeling

Traditional catastrophe modeling companies

Changing Landscape for Catastrophe Modeling

Original catastrophe modeling companies

Current catastrophe modeling companies

Development of a New Data Aggregation Tool

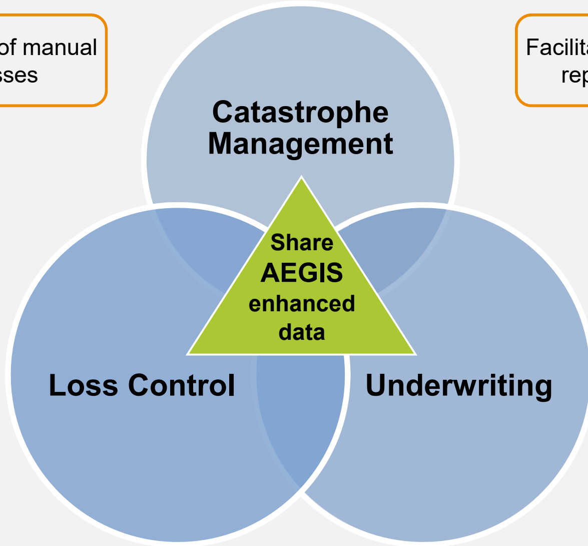
sequelimpact

Automation of manual processes

Align hazard tools across groups

Facilitate data consolidation reports and analytics

Embed catastrophe modeling in the underwriting process



KatRisk

HazardHub

PYRAMID ANALYTICS

Verisk

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Data Quality: Good Data vs. Bad Data

Key details needed to improve the accuracy of catastrophe modeling

- Coordinates or street address
- Year of construction
- Elevations
  - Flood defenses
  - % Value above grade
  - Building elevation
- Construction type & construction quality

Without this information assumptions have to be made and the uncertainty is greater.

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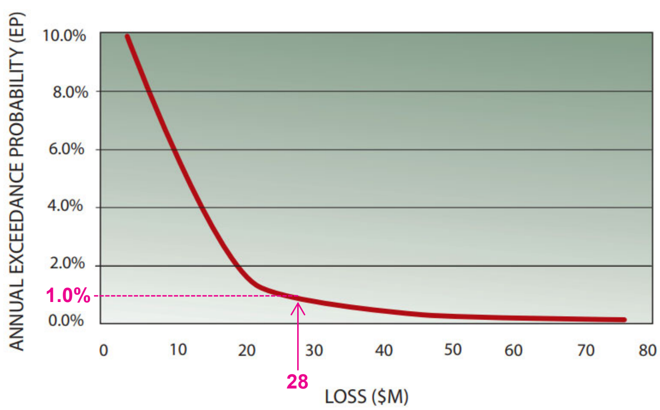
Model Output

Sample Annual Exceedance Probability Curve

SUMMARY RESULTS OF AN EP ANALYSIS



After running an EP analysis, the summary results are as follows:

EP	RETURN PERIOD	LOSS AMOUNT ($M)
0.02%	5,000	76
0.10%	1,000	57
0.20%	500	48
0.40%	250	40
1.00%	100	28
2.00%	50	20
10.00%	10	4

Member Reports

What is the exposure to critical equipment?

- Perils
  - Hurricane including storm surge
  - Earthquake and fire following
  - Inland flood
  - Wildfire
  - Straight line wind, tornado, and hail
- Return period losses and average annual loss by peril
- Maps showing estimated losses and location values by peril
- Key locations driving loss by peril
- Estimated losses for key historical events

Member Reports

Return period losses and average annual loss by peril

Technical Pricing / Occurrence Exceedance Probability, $'s								
Primary Regions								
NAME	**Description**	**AAL**	**SD**	**COV**	**10**	**100**	**250**	**500**
	US + Caribbean - Wind + Surge	738,730	7,950,127	10.8	0	19,161,023	47,154,955	77,460,401
	US + Canada - Quake	39,542	2,301,434	58.2	0	0	0	0
Regional Analysis								
	US + Caribbean - Wind Only	580,856	7,117,828	12.3	0	13,404,615	38,385,949	66,518,347
	US + Caribbean - Surge Only	161,420	2,210,807	13.7	0	3,187,787	12,276,256	21,409,021
	Southeast - Quake	32,012	2,102,516	65.7	0	0	0	0
	Northeast - Quake	9,703	965,825	99.5	0	0	0	0
Expiring Slip								
	US + Caribbean - Wind + Surge	709,434	7,803,471	11.0	258	17,318,212	46,084,709	78,254,053
	US + Canada - Quake	35,968	2,186,832	60.8	0	0	0	0

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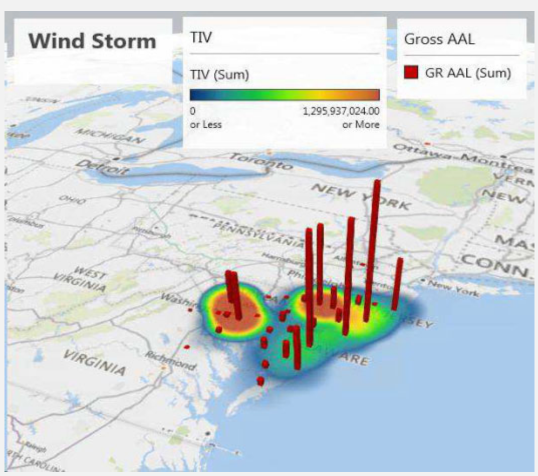
Member Reports

Maps showing estimated losses and location values by peril



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Member Reports

Key locations driving loss by peril

Top 10 Earthquake Locations by Gross AAL																		
Location Name	Occupancy	Construction	Year Built	State	County	City	Zip	Address	Latitude	Longitude	Resolution	Landslide	Liquefaction	Soil Type	TIV	GU AAL	GR AAL
	Professional, Technical and Business Services	Unknown	Unknown	DE	NEW CASTLE	NEWARK	19702	401 EAGLE RUN ROAD	39.669965	-75.66827	Lat / long	Very Low	Very Low	Soft Rock to Stiff Soil	188,812,605	4,039	2,656
	Professional, Technical and Business Services	Unknown	Unknown	DC	DISTRICT OF COLUMBIA	WASHINGTON	20001	701 9TH STREET NW	38.899007	-77.023648	Lat / long	Very Low	Low	Stiff Soil	201,921,682	3,772	1,976
	Wholesale Trade	Unknown	Unknown	DC	DISTRICT OF COLUMBIA	WASHINGTON	20019	3400 BENNING ROAD NE	38.898416	-76.955251	Lat / long	Very Low	Very Low	Stiff Soil	160,466,282	3,464	1,845
	Electric Power - Substations (Large)	Steel Frame	Unknown	DC	DISTRICT OF COLUMBIA	WASHINGTON	20002	99 V STREET SW	38.866717	-77.011523	Lat / long	Very Low	Low	Stiff Soil	269,975,311	2,697	1,097
	Electric Power - Substations (Large)	Steel Frame	Unknown	DC	DISTRICT OF COLUMBIA	WASHINGTON	20019	3300 BENNING ROAD NE	38.899394	-76.955673	Lat / long	Very Low	High	Stiff Soil	238,038,457	2,801	1,070
	Electric Power - Substations (Large)	Steel Frame	Unknown	DE	NEW CASTLE	WILMINGTON	19809	200 HAY ROAD	39.740454	-75.509887	Lat / long	Very Low	Moderate	Stiff Soil	86,010,542	1,669	1,046
	Electric Power - Substations (Large)	Steel Frame	Unknown	MD	PRINCE GEORGE'S	AQUASCO	20608	18051 EAGLE HARBOR ROAD	38.560397	-76.688744	Lat / long	Very Low	Low	Stiff Soil	204,123,017	1,609	1,028
	Electric Power - Substations (Large)	Steel Frame	Unknown	DE	NEW CASTLE	NEW CASTLE	19720	1593 RIVER ROAD	39.608	-75.627	Lat / long	Very Low	Moderate	Stiff Soil	74,878,169	1,325	805
	Professional, Technical and Business Services	Unknown	Unknown	DE	NEW CASTLE	NEWARK	19702	500 N WAKEFIELD DRIVE	39.662999	-75.674171	Lat / long	Very Low	Very Low	Soft Rock to Stiff Soil	51,930,041	1,098	719
	Electric Power - Substations (Large)	Steel Frame	Unknown	DE	NEW CASTLE	NEWARK	19702	2101 SUNSET LAKE ROAD	39.633325	-75.731115	Lat / long	Very Low	Very Low	Soft Rock to Stiff Soil	99,060,490	1,196	710

LOCATION NAME	TIV	STATE - COUNTY - CITY	LATITUDE	LONGITUDE	MATCH	FEMA ZONE	KATRISK STORM SURGE SCORE	KATRISK INLAND FLOOD SCORE	KATRISK INLAND 100YR DEPTH	KATRISK INLAND 200YR DEPTH	KATRISK INLAND 500YR DEPTH	KATRISK INLAND FLOOD 100YR LOSS	KATRISK INLAND FLOOD 250YR LOSS	KATRISK INLAND FLOOD 500YR LOSS	KATRISK INLAND FLOOD GU AAL
	10,425,344	DE - NEW CASTLE - WILMINGTON	39.7303	-75.6693	Lat/Long	AE	9	0	7.96	8.74	11.71	3,682,982	6,059,675	8,973,788	85,073
	12,582,408	NJ - GLOUCESTER - PAULSBORO	39.8292	-75.2556	Lat/Long	AE	9	6	6.38	9.40	9.53	3,355,957	6,588,680	8,748,914	77,880
	34,381,457	MD - MONTGOMERY - BROOKEVILL	39.1894	-77.1019	Address	X	7	0	3.43	3.49	3.49	471,337	7,317,634	10,990,613	69,392
	28,933,676	MD - PRINCE GEORGE'S - HYATTSVI	38.9176	-76.9110	Address	AE	8	0	2.82	3.82	6.32	0	7,111,461	11,351,543	64,411
	7,742,100	NJ - GLOUCESTER - GIBBSTOWN	39.8382	-75.2932	Lat/Long	AE	10	8	8.55	10.40	10.56	2,747,912	4,711,051	7,540,691	60,935
	10,246,320	NJ - GLOUCESTER - PITMAN	39.7372	-75.1136	Lat/Long	X	8	0	5.13	5.72	5.99	2,365,985	4,360,654	5,470,109	53,222
	65,347,445	DE - NEW CASTLE - WILMINGTON	39.7260	-75.5648	Lat/Long	X	6	4	1.28	2.33	2.69	0	2,164,941	8,148,208	44,620
	238,038,457	DC - DISTRICT OF COLUMBIA - WAS	38.8994	-76.9557	Lat/Long	X	4	0	0.29	0.33	0.46	0	250,677	2,216,639	34,653
	46,333,144	DC - DISTRICT OF COLUMBIA - WAS	38.8835	-77.0146	Address	X	6	0	0.00	0.49	4.22	0	0	4,708,303	29,082
	19,571,257	MD - MONTGOMERY - GAITHERSBU	39.1398	-77.1958	Address	X	7	0	2.36	2.89	3.36	0	2,615,929	4,775,649	26,367
	51,569,733	DC - DISTRICT OF COLUMBIA - WAS	38.9427	-77.0790	Lat/Long	X	4	0	1.61	1.64	1.64	0	1,013,188	4,353,471	24,444
	18,312,846	DE - NEW CASTLE - WILMINGTON	39.7811	-75.5085	Lat/Long	X	7	0	2.16	2.36	3.12	0	1,513,742	3,632,916	18,365
	120,725,226	DE - NEW CASTLE - WILMINGTON	39.7318	-75.5385	Lat/Long	X	4	3	0.00	0.29	0.56	0	0	0	14,474
	31,016,416	DE - NEW CASTLE - NEW CASTLE	39.6764	-75.5589	Lat/Long	X	6	4	1.08	1.61	2.20	0	185,860	2,035,317	13,055
	21,033,099	DE - NEW CASTLE - NEW CASTLE	39.6966	-75.6034	Lat/Long	X	5	2	0.03	2.03	3.43	0	18,084	2,541,985	12,946
	18,452,398	DE - SUSSEX - MILTON	38.7353	-75.2618	Lat/Long	X	7	0	1.84	2.00	2.16	0	451,259	2,617,729	12,823
	5,809,927	NJ - GLOUCESTER - SWEDESBORO	39.7864	-75.4015	Lat/Long	AE	7	5	2.82	4.09	4.15	184,701	1,271,170	1,891,998	12,473
	11,474,792	NJ - SALEM - SALEM	39.5489	-75.4105	Lat/Long	X	7	4	1.84	2.26	3.95	0	1,035,862	2,409,676	12,394
	101,905,506	MD - MONTGOMERY - GERMANTOV	39.1364	-77.2938	Lat/Long	X	4	0	0.00	0.00	0.00	0	0	0	11,481
	4,226,424	NJ - CAMDEN - CLEMENTON	39.8214	-74.9777	Lat/Long	X	7	0	4.09	4.09	4.09	280,549	1,135,767	1,569,522	11,253

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Member Reports

Estimated losses for key historical events

Wind Storm	Mean
Charley	0
Jeanne	1,525
Frances	0
Ivan	2,161
Total 2004 Events	**3,686**
Katrina	5,347
Rita	0
Wilma	0
Total 2005 Events	**5,347**
Ike	0
Gustav	256
Total 2008 Events	**256**
Sandy 2012	279,629

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Conclusion

Summary

- The cat modeling capabilities are transforming
- Better quality data will improve our understanding of risk
- Member-specific reporting can be provided

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Value.

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Vice President, Property Underwriting

AEGIS Insurance Services, Inc.

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Underwriting and Natural Catastrophe Modelling

TRUE or FALSE

- Does modeling affect premium and/or pricing?

- Both true and false are correct

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Underwriting and Natural Catastrophe Modelling

TRUE or FALSE

- Do modeled results ***PROVE*** exposure?

- Both true and false are correct

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Underwriting and Natural Catastrophe Modelling

Submission data quality – what does right look like?

- Location address
  - Number and street name, city, state, ZIP code
- Latitude and longitude: single best item of information
- Occupancy: co-gen, simple cycle, pipeline, terminal, etc.
- Construction: year built, number of stories, elevation, brick, steel, metal, etc.

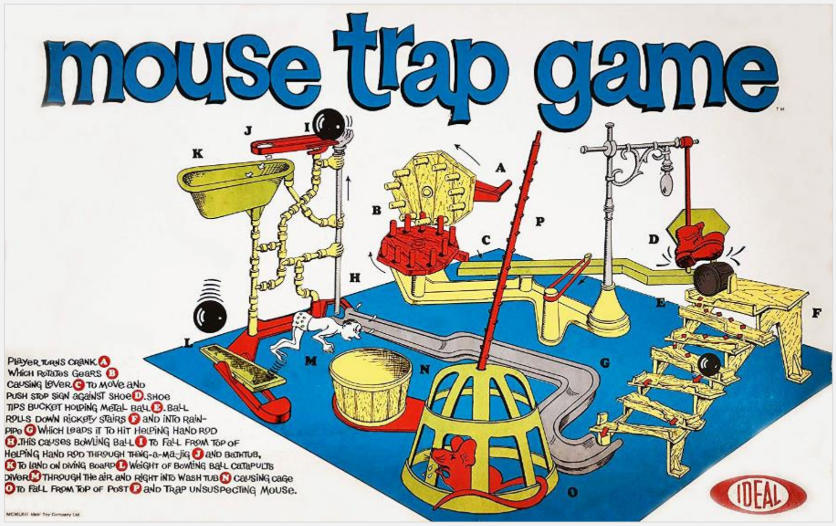
Underwriting and Natural Catastrophe Modelling

Example

Address	City	County / Province	State / Country	Zip	Latitude	Longitude	Elevation	Flood Defense	Occupancy	Year Built	Total Insured Value
Island of Haida Gwaii of the North coast of BC	Haida Gwaii	British Columbia	Canada	V8B 0C2	52° 56'04"N	132° 07'50"W	5'	5' burm	Power Plant (Hydroelectric)	1990	$$$$$$$$$$
North Side of Highway 11 on lots 26, 27 and 28, Concession 4 (30km west of Hearst, ON)	Hearst	Ontario	Canada	P0L1N0	49.470013	-84.085990	10'	6' concrete dike	Power Plant (Wood Biomass)	2000	$$$$$$$$$$
Highway 11 North Potter Road	Iroquois Falls	Ontario	Canada	P0N1J0	48.521637	-80.533550	7'	none	Power Plant (Natural Gas)	1995	$$$$$$$$$$

Underwriting and Natural Catastrophe Modelling

Timing – From ***Submission*** to ***Modelled*** results



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Underwriting and Natural Catastrophe Modelling

Capacity and Pricing

- Good, accurate and timely data allow underwriting to collect and analyze natural catastrophe results
- Results are paired with regional historical data, engineering review and insight, and underwriting judgement relative to line size setting, sublimit and deductible application

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Underwriting and Natural Catastrophe Modelling

AEGIS and Our Members

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Catastrophe Modeling

Jacqueline Noto

Senior Catastrophe Modeler

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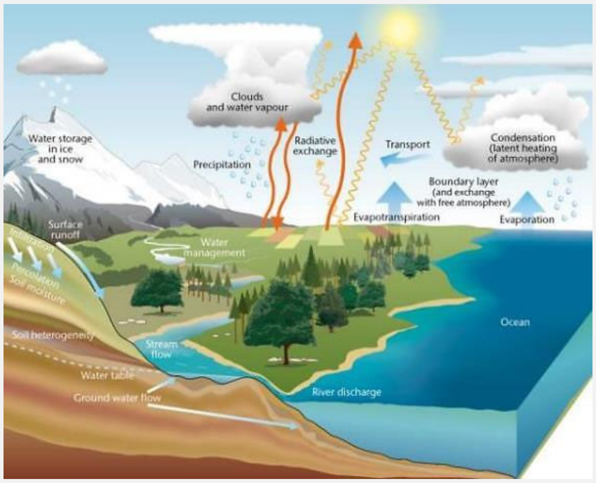
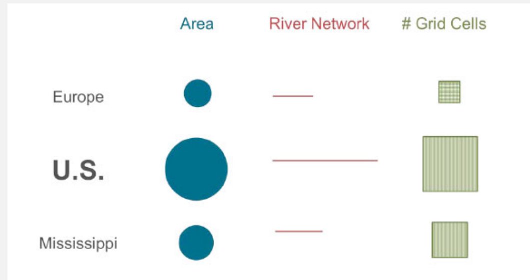
Complexities of US Flood Modeling





$$\frac{\partial h}{\partial t}+\frac{\partial hu}{\partial x}+\frac{\partial hv}{\partial y}=0$$

$$\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}+g\frac{\partial (h+z)}{\partial x}+\frac{gn^2u\sqrt{u^2+v^2}}{h^{4/3}}-\frac{v}{h}\left(2\frac{\partial^2 hu}{\partial x^2}+\frac{\partial^2 hu}{\partial x^2}+\frac{\partial^2 hv}{\partial x\partial y}\right)=0$$

$$\frac{\partial v}{\partial t}+u\frac{\partial v}{\partial x}+v\frac{\partial v}{\partial y}+g\frac{\partial (h+z)}{\partial y}+\frac{gn^2v\sqrt{u^2+v^2}}{h^{4/3}}-\frac{v}{h}\left(\frac{\partial^2 hv}{\partial x^2}+2\frac{\partial^2 hv}{\partial y^2}+\frac{\partial^2 hu}{\partial x\partial y}\right)=0$$

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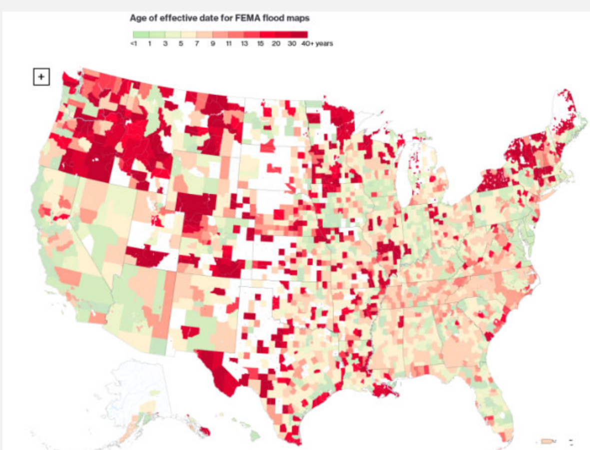
FEMA Flood Map Considerations

Out-of-date, Incomplete, Subject to Appeal



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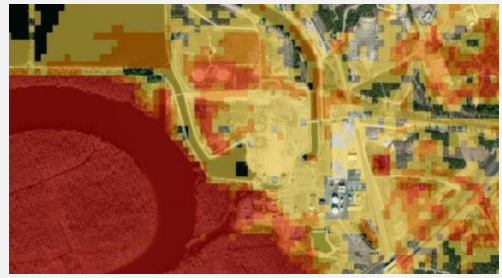
Modern Flood Modeling Powered by Grid Computing

KatRisk High-Resolution Flood Mapping Using the Titan Supercomputer

See NPR Podcast:
Supercomputing Flood Maps Using the Titan Supercomputer



Katrisk 100 return period flood map
10 meter resolution, US & Canada

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Value

Key Benefit: Fill In the Gaps, Retrieve a Second Opinion

Example: Flood Hazard Comparison Matrix For a Single Account

KATRISK FLOOD DEPTH BAND	FEMA FLOOD ZONE			
	Not Mapped	X	A & V	Total
No Flooding	49	4301	130	**4480**
Less Than 1 ft	22	1089	347	**1458**
1 to 3 ft	6	128	73	**207**
3 to 6 ft	7	155	59	**221**
6 to 10 ft		24	57	**81**
10 to 20 ft	2	5	26	**33**
More than 20 ft		1	3	**4**
Total (#Locs)	**86**	**5703**	**695**	**6484**

FEMA Overestimates Flood

FEMA and KatRisk Agree

FEMA Underestimates Flood

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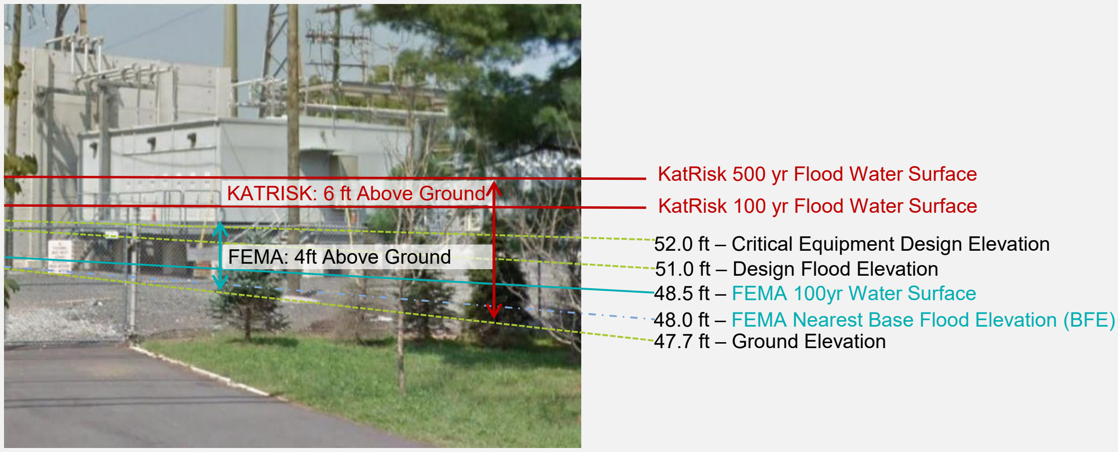
Value

Key Benefit: Learn the Estimated Depth of Flooding and Use It

Example: Using KatRisk vs. FEMA to Measure or Plan Mitigation



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Advancing AEGIS Modeling Capabilities

1. Strengthen the Core

- Flood: Use KatRisk flood maps to measure mitigation
- Hurricane & Earthquake: Improve the quantity and quality of secondary modifier characteristics to accurately represent the exposure

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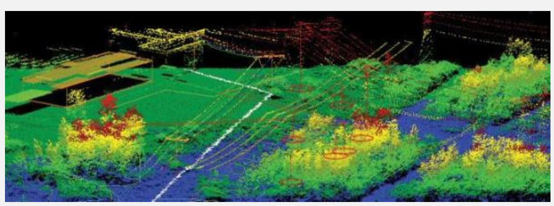
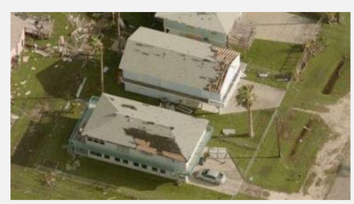
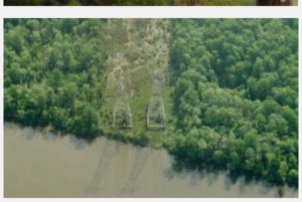
Using Imagery – *Highlights* Magazine

Check… **and Double Check**

By Martin Filchock







+1000
Insurtech Innovations

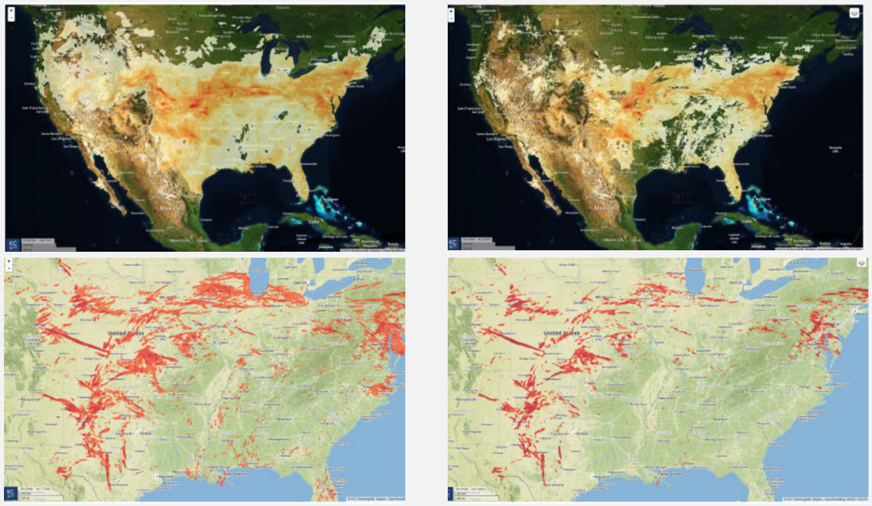
eagleview CAPE NOAA AWARE

New Generation of Tornado, Hail, Straight-Line Wind Modeling

Old | New

Tornado / Wind

Hail



Karen Clarke & Company

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2. Grow the Core

- Tornado / Hail: Adopt new peril model
- Claims-Based View: Develop proprietary view of unique damage relationships, i.e. renewable energy

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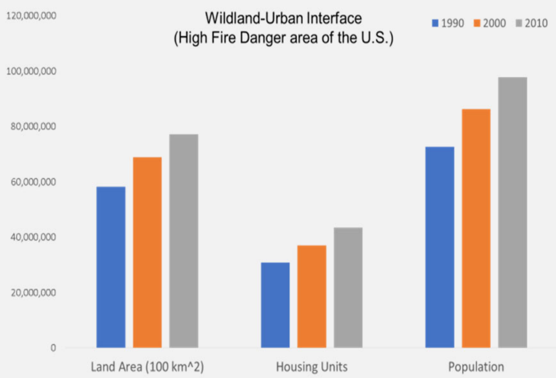
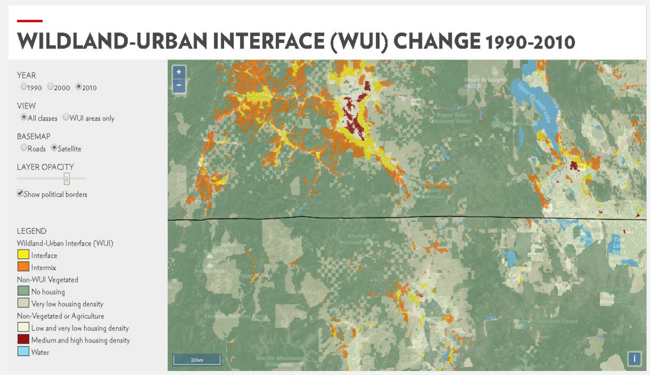
Value

Wildfire Modeling #1 Driver of Risk: Exposure

Changes in Wildland-Urban Interface (WUI)





Source: Radeloff, et. Al. Rapid growth of the US wildland-urban interface raises wildfire risk, 2018

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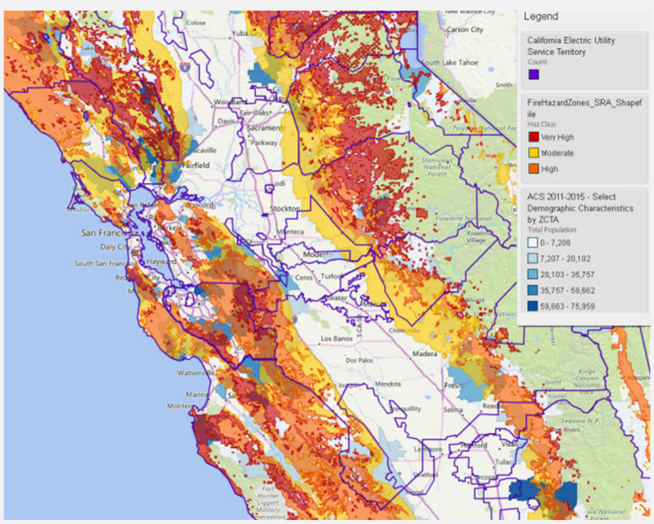
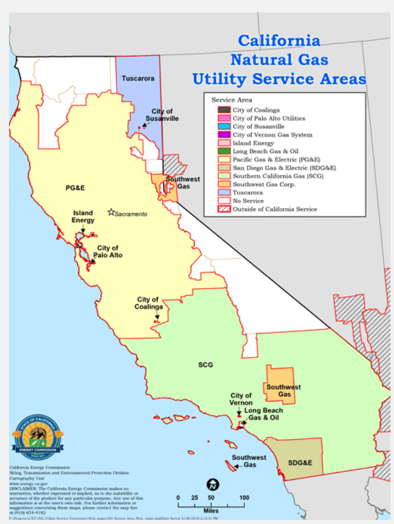
Mapping Wildfire Risk

Population Exposed Within High Hazard Wildfire Zones by Service Territory





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Advancing AEGIS Modeling Capabilities

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- Flood: Use KatRisk flood maps to measure mitigation
- Hurricane & Earthquake: Improve the quantity and quality of secondary modifier characteristics to accurately represent the exposure

2. Grow the Core

- Tornado / Hail: Adopt new peril model
- Claims-Based View: Develop proprietary view of unique damage relationships, i.e. renewable energy

3. Leverage the Core

- Liability Wildfire: Use models for more than property risk modeling
- Support the Members: Discover and fulfill external needs using models

Advancing AEGIS Modeling Capabilities

1. Strengthen the Core

- Flood: Use KatRisk flood maps to measure mitigation
- Hurricane & Earthquake: Improve the quantity and quality of secondary modifier characteristics to accurately represent the exposure

Loss Control

2. Grow the Core

- Tornado / Hail: Adopt new peril model
- Claims-Based View: Develop proprietary view of unique damage relationships, i.e. renewable energy

Claims

3. Leverage the Core

- Liability Wildfire: Use models for more than property risk modeling
- Support the Members: Discover and fulfill external needs using models

Members

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