



A New Perspective on the World of Catastrophe Modelling

Ways towards analytically-driven company

Prepared by Dr. Petr Punčochář of Impact Forecasting

Presentation for Catastrophe Insight 2018, 10th August, 2018

Agenda

Section 1 Challenges

Protection Gap | Climate Facts | Technology

Section 2 Solutions

World of Catastrophe Models

Primary Underwriting

Portfolio Accumulation

Catastrophe Modelling

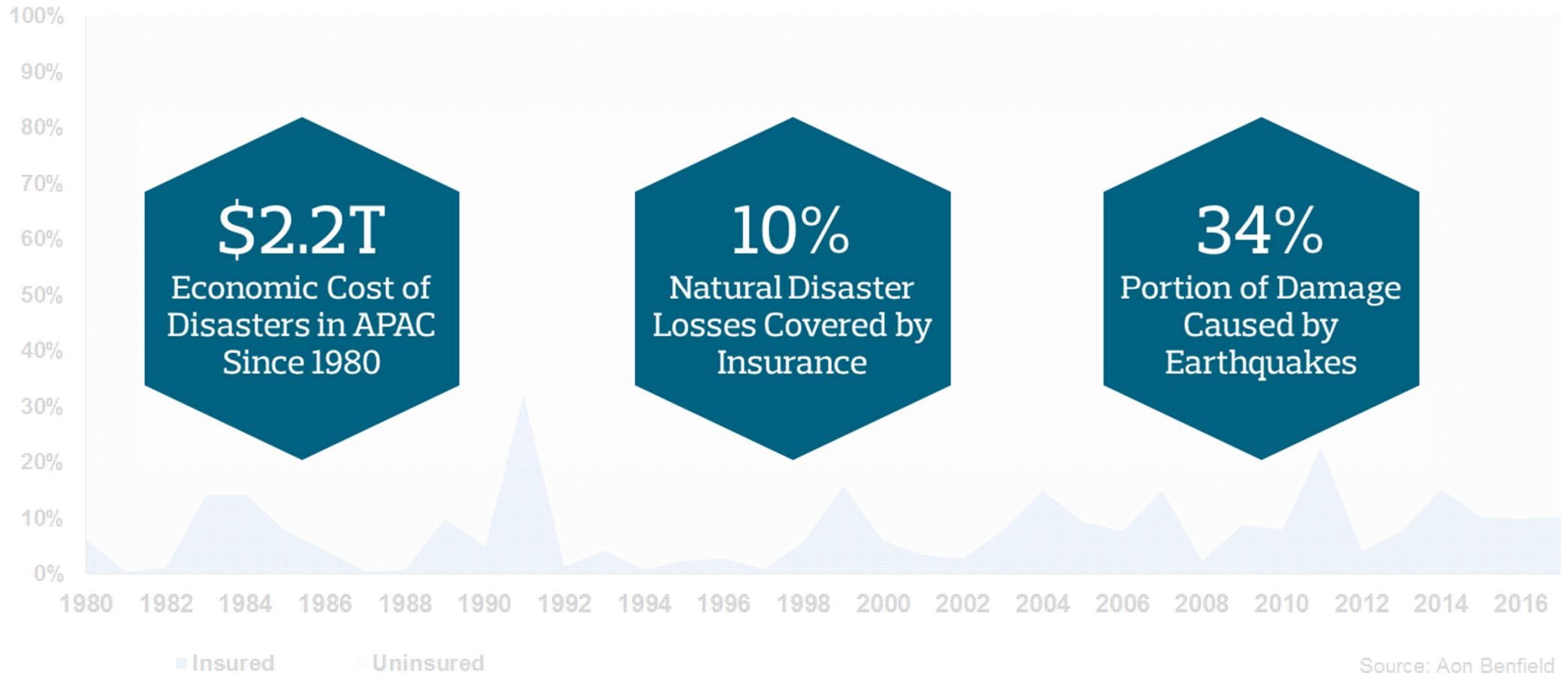
A Little Gift

Section 3 Benefits



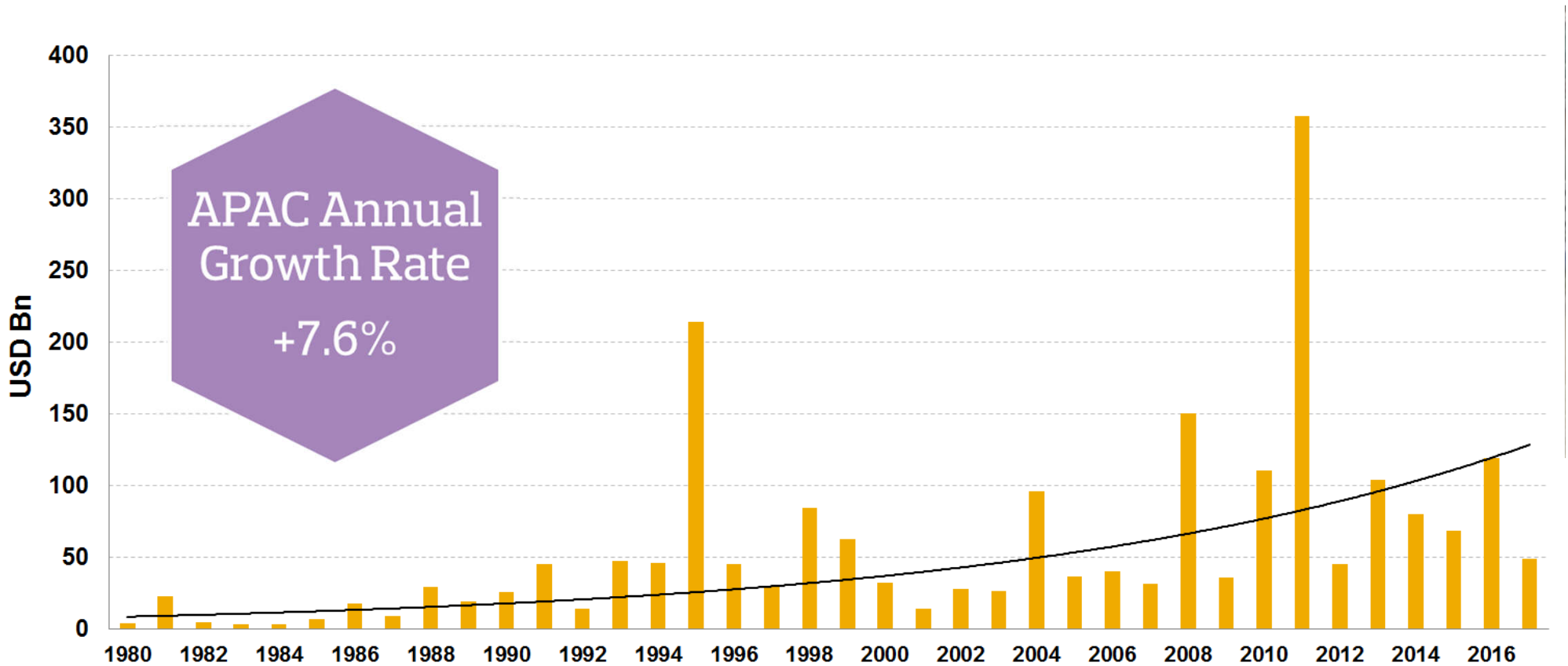
Section 1: Challenges

Challenges: Significant Protection Gap in APAC



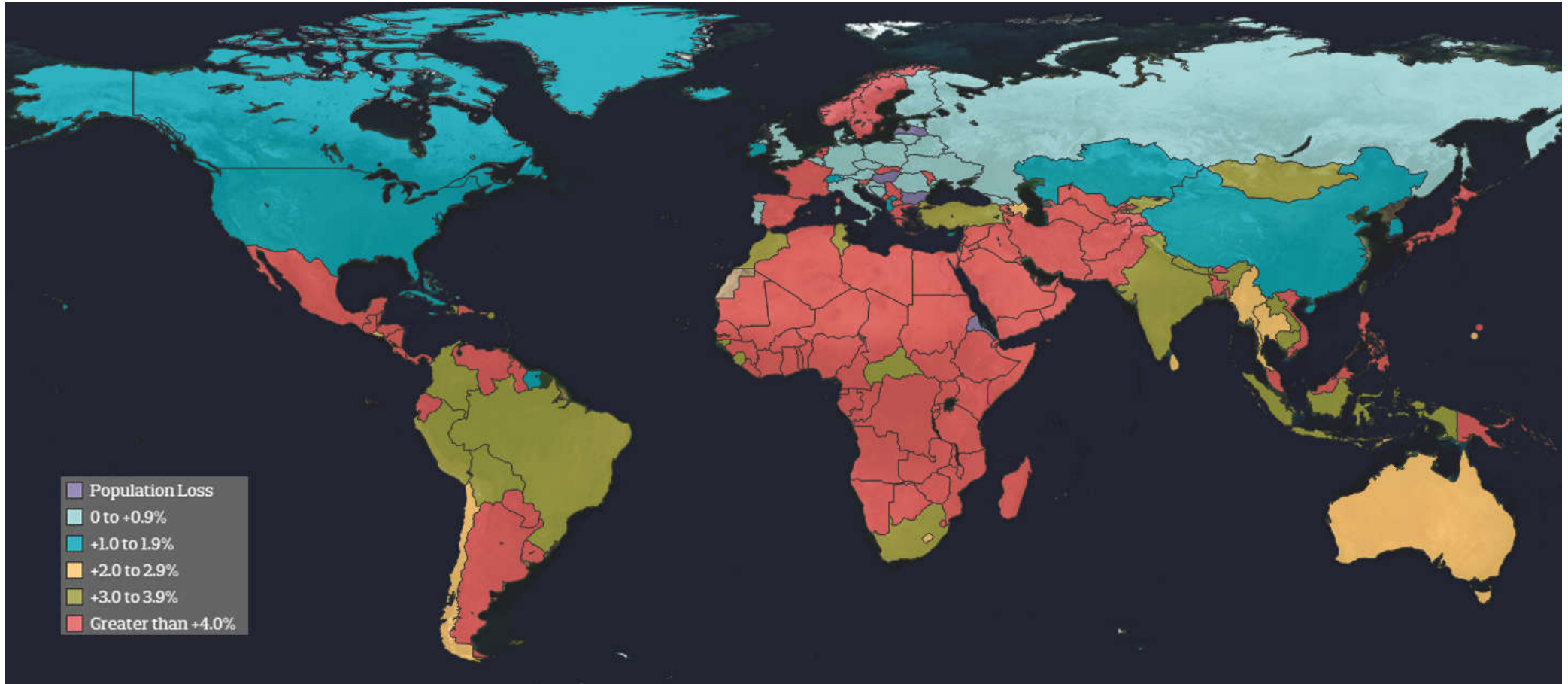
Challenges: Increasing Disaster Costs

3. APAC: Increasing Disaster Costs



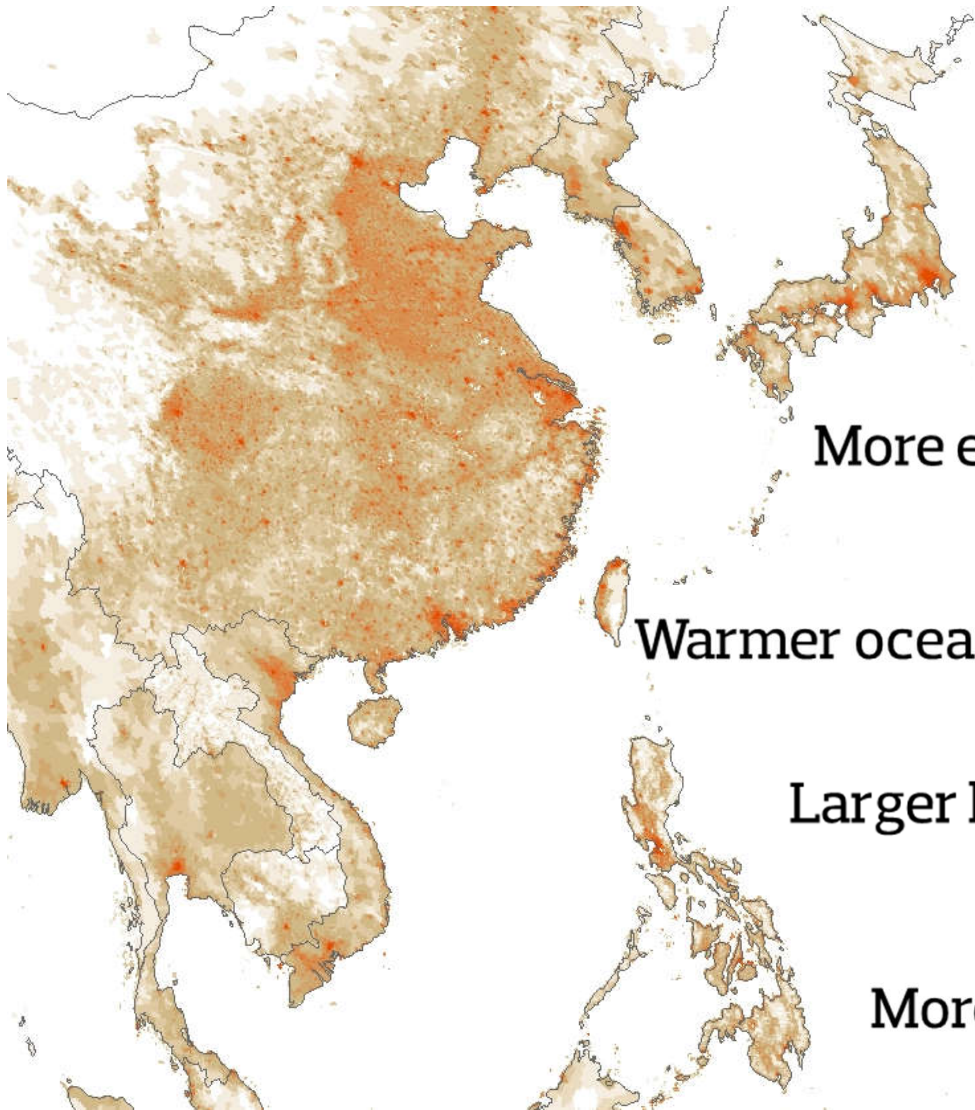
Source: Aon Benfield

Challenges: Annual Population Growth Rate



(1960-2017)

Challenges: Climate Change Exposure



Deeper & longer droughts?

More intense tropical cyclones?

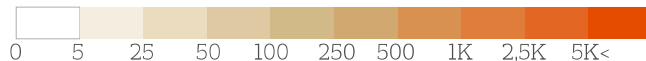
More exposure to earthquakes?

Warmer ocean waters... More northern latitude landfalls?

Larger hail events?

Bigger snowstorms?

More extreme monsoon season rainfall?



Map Data Source: NASA & Columbia University

Challenges: Reshaping Technologies into Products





Section 2: Solutions

- Overview of the World of Catastrophe Models
- Primary Underwriting
- Accumulation Control
- Portfolio Modelling

Modelled Perils



- Three major perils with many other sub-perils
 - Flood: rainfall flooding, storm-surge, tsunamis, land-slides,...
 - Windstorm: hail, storm-surge,...
 - Earthquake: fire following, liquefaction, tsunami,...
- Others
 - Fire, Terrorism, Worker's compensation,...
- Each country is affected by different perils or by their combinations
- Each peril has its own challenges to be modelled

Catastrophe Model Developers



Impact
Forecasting

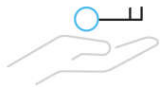


Impact Forecasting

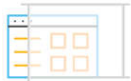


Over **100**
Catastrophe
Models

Customisable
Models



Transparent
ELEMENTS
loss calculation platform



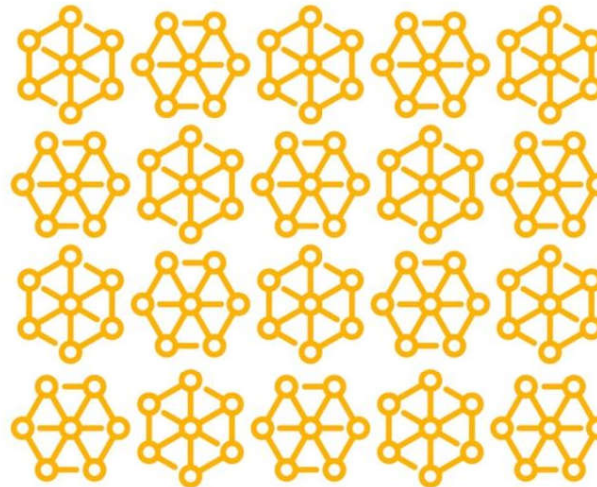
Universal Platform
running
Third Party
Models



60
countries



85+
modelling experts
over
5 time zones



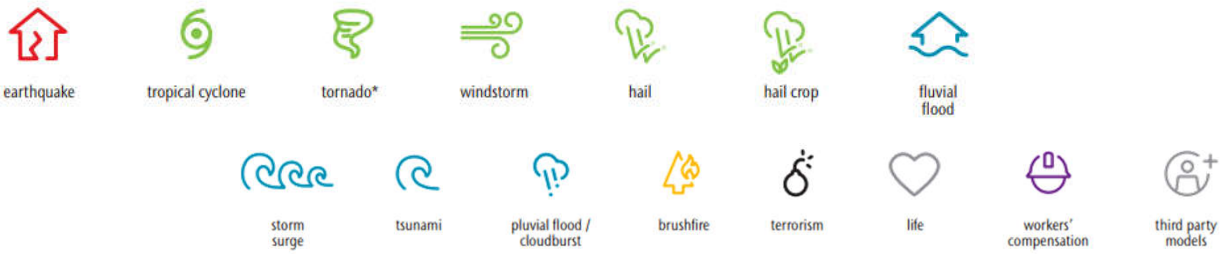
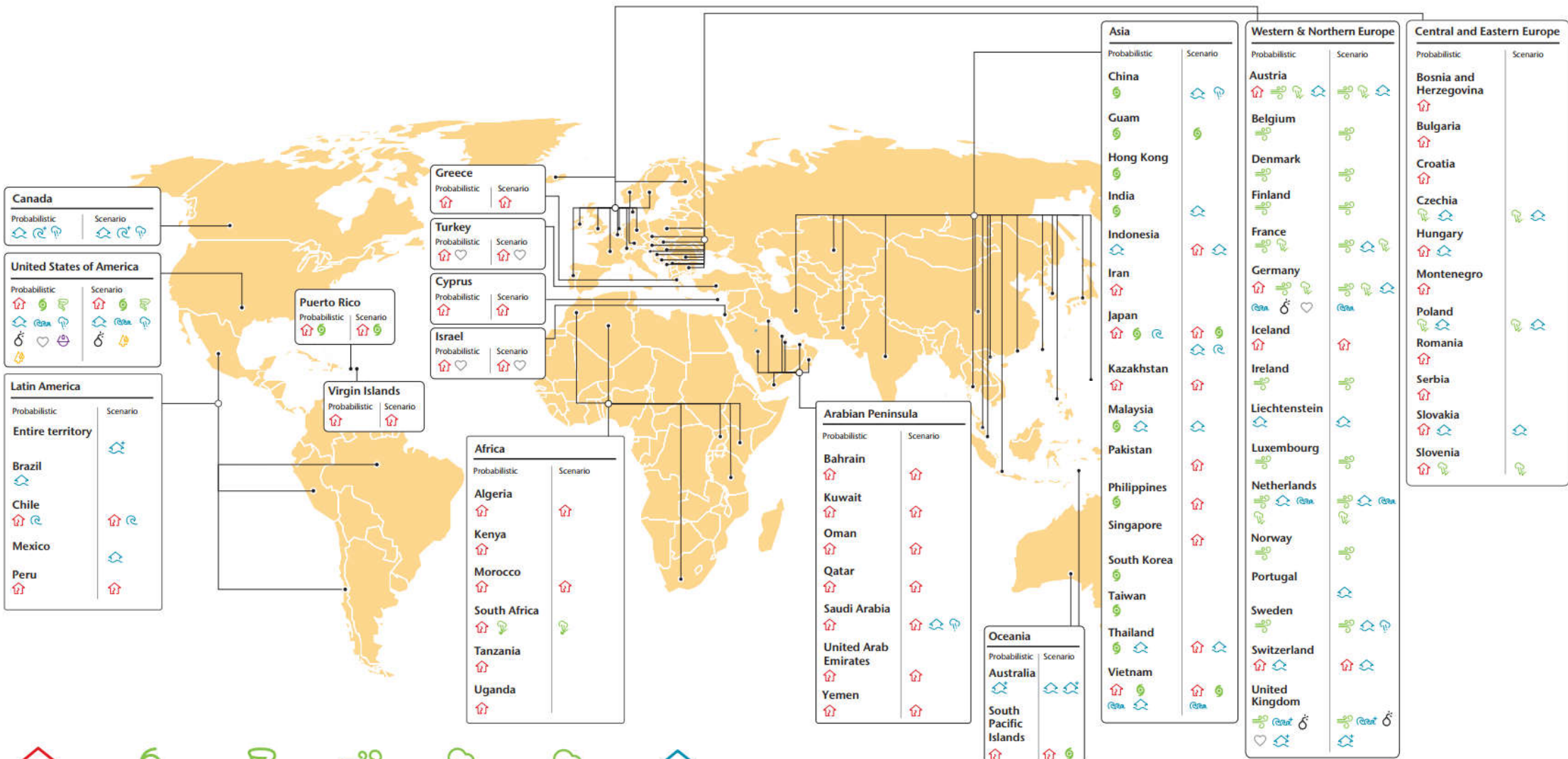
100+
Models

12
perils



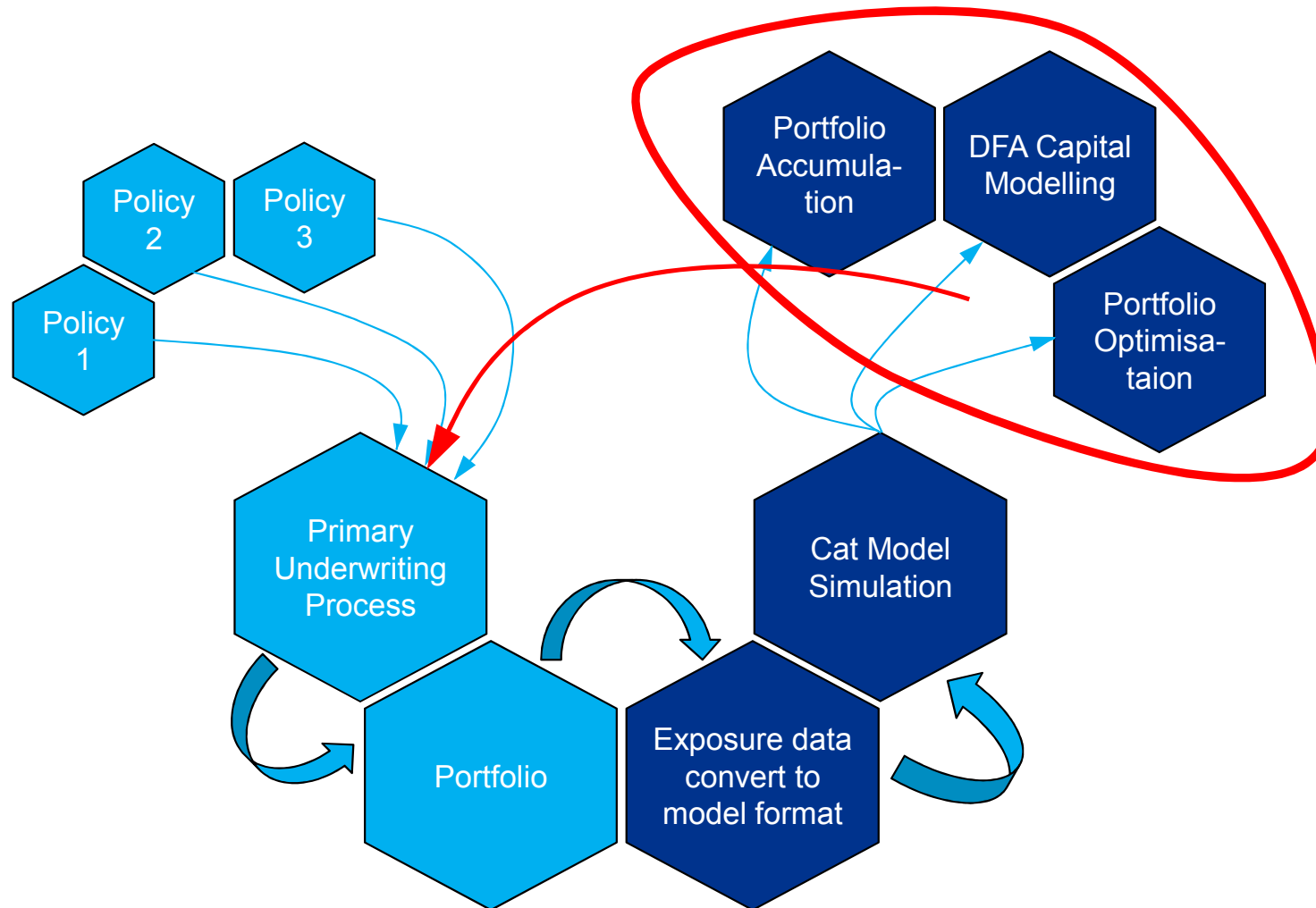
12,000+
events
in the catastrophe
insights
database

Impact Forecasting Model Coverage Map



Primary Underwriting – Company Underwriting Cycle

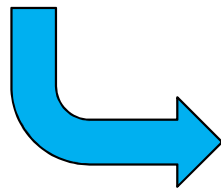
Standard insurance and re-insurance modeling workflow



0. Geocoding

- Conversion of the address string into latitude & longitude coordinates
 - Most commonly into WGS84 system (same as used by GPS)
 - Different level of accuracy

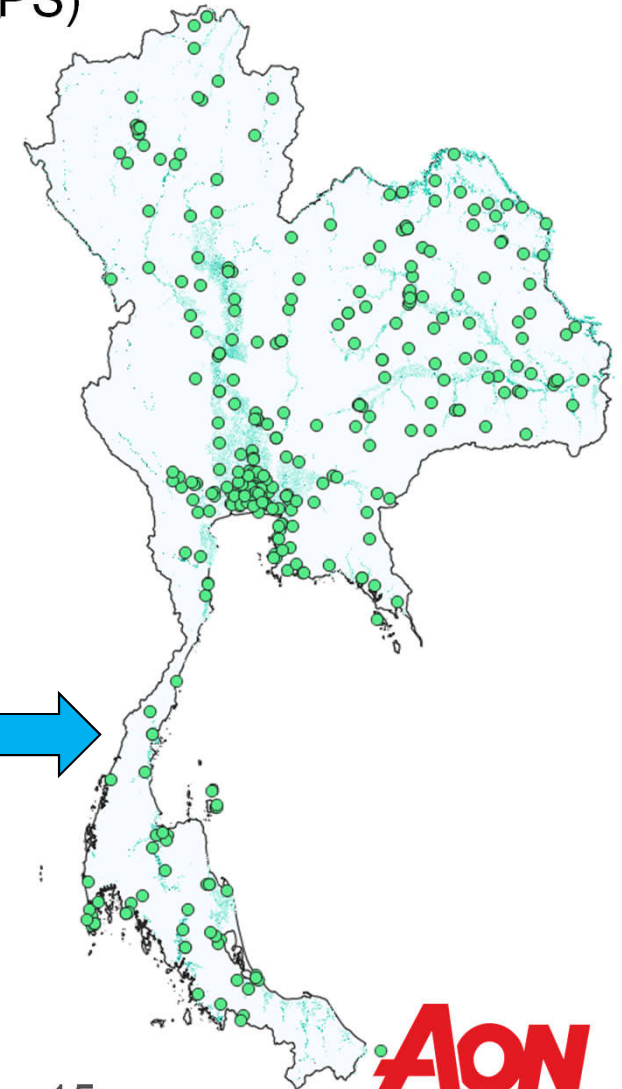
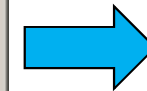
PolicyID	Address	PostalCode	City	Country
1	629/1;629/2 Nawamintr Road; Nuanchan; Bungkoom; Bangkok 10230	10230	Bangkok	Thailand
2	188/1 Moo 4; Phaholyothin Rd.; T. Lumsai; A. Wangnoi; Ayutthaya	13170	Ayutthaya	Thailand
3	Samkok : 30;30/1;30/2 Moo 6; T. Klongwai; A. Samkok	10150	Bangkok	Thailand
4	10/8 moo 3 T.BuengKumproy A. Lumlukka; Pathunthai			
5	15/18 Moo 6; Thalingchan-Suphan Road; T. Lahar; A.			
6	39/1 Moo 1 Super high way Chiang Mai - Lumphang; T			
7	72 Moo 11 T. Thaphra A.Amphur Muang Khonkaen; K			
8	8/88 Moo 3 T.Nongsai A. Phunphin Suratthani 841			
9	904/2 Moo 6 Srinakarin Rd.; Nongbon; Pravet; Bangk			
10	119 Moo 7; T. Tasai; A. Muang; Samutsakorn			
11	356 Moo 3; Mitrapab Rd.; Muang; Khonkaen			
12	408/2 Moo 12 Sukhumvit Rd.; T. Nongprue; A. Bangla			



Web Service Geocode

Input CSV File (UTF-8)
C:/Thai_Flood_Seminar/Example/Geocoding.csv

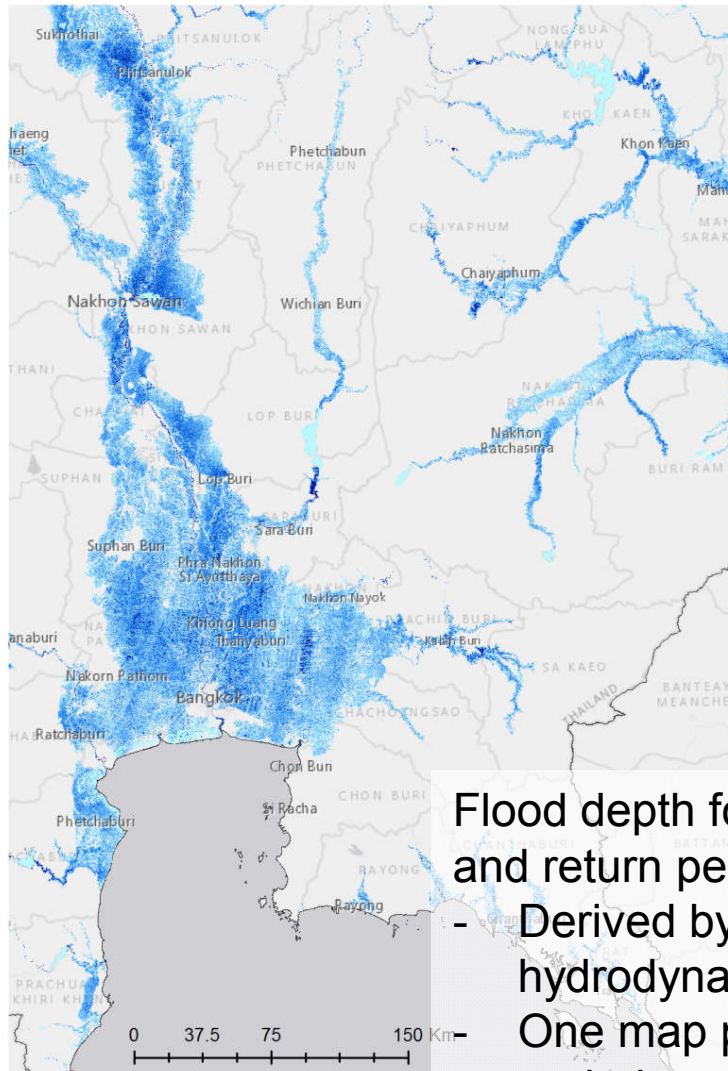
Address Field: Address
City Field: City
State Field: (none)
Country Field: Country
Web Service: Google Maps
Google API Key: (none)
Output Shapefile: C:/Thai_Flood_Seminar/Example/4GC.shp
Not Found Output List: C:/Thai_Flood_Seminar/Example/notfound.csv



More will be shown later in live DEMO

1. Single Policy Underwriting

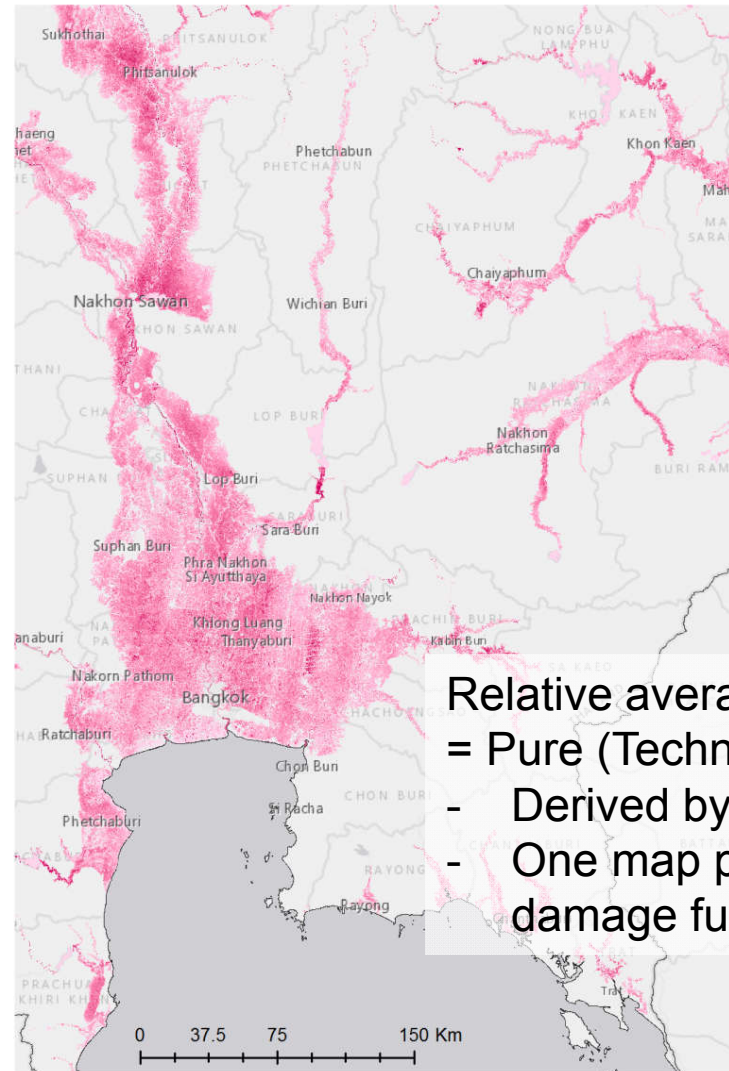
Flood hazard map(s)



Flood depth for every point and return period
 - Derived by hydrodynamic model
 One map per one return period

Proprietary & Confidential

Flood risk map(s)

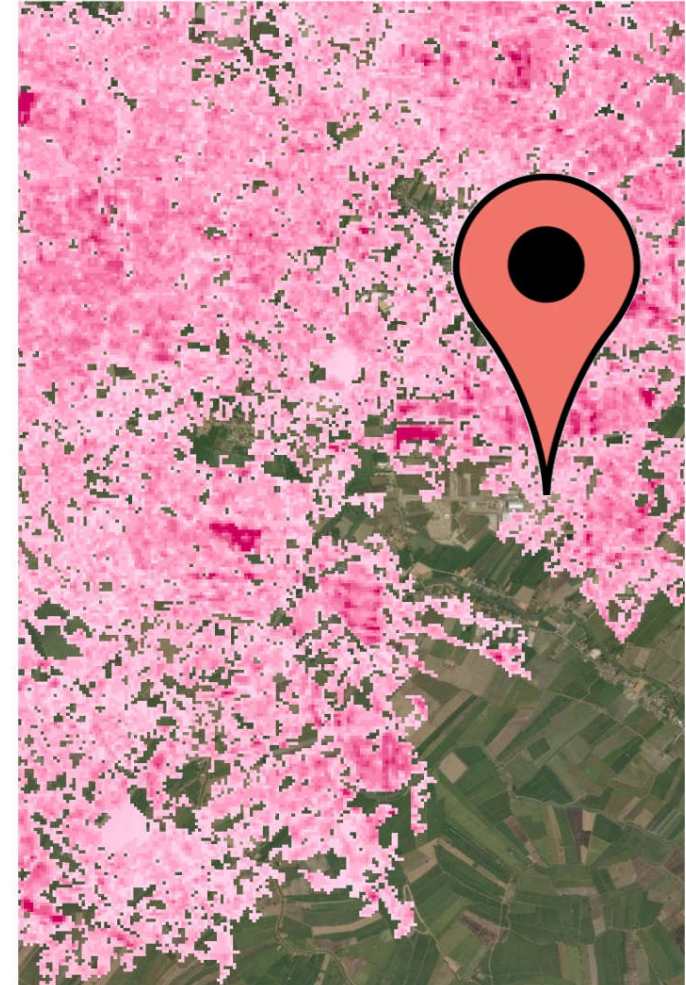


Relative average annual loss
 = Pure (Technical) Premium
 - Derived by Cat Model
 - One map per one damage function

1. Single Policy Underwriting

Simple Example #1:

- SME Policy, SI = 6,000,000 THB
- Located at
 - Latitude: N 018.059384
 - Longitude: E 111.202862



HAZARD Map overlay

Return Per.	1 in 20	1 in 50	1 in 100	1 in 250	1 in 500	1 in 1000
Depth [cm]	0	0	0(!)	0(!)	33	47

RISK Map overlay

Relative AAL for: Commercial occ. and unknown other modifiers

$$\text{AAL} = 0.12\%$$

$$\text{Technical premium} = 0.0012 * 6,000,000 = 7,200 \text{ THB}$$

$$\text{Full premium} = 7,200 * 2 = 14,400 \text{ THB} \text{ assuming 100\% loading as profit and admin margin}$$

2. Portfolio Accumulation

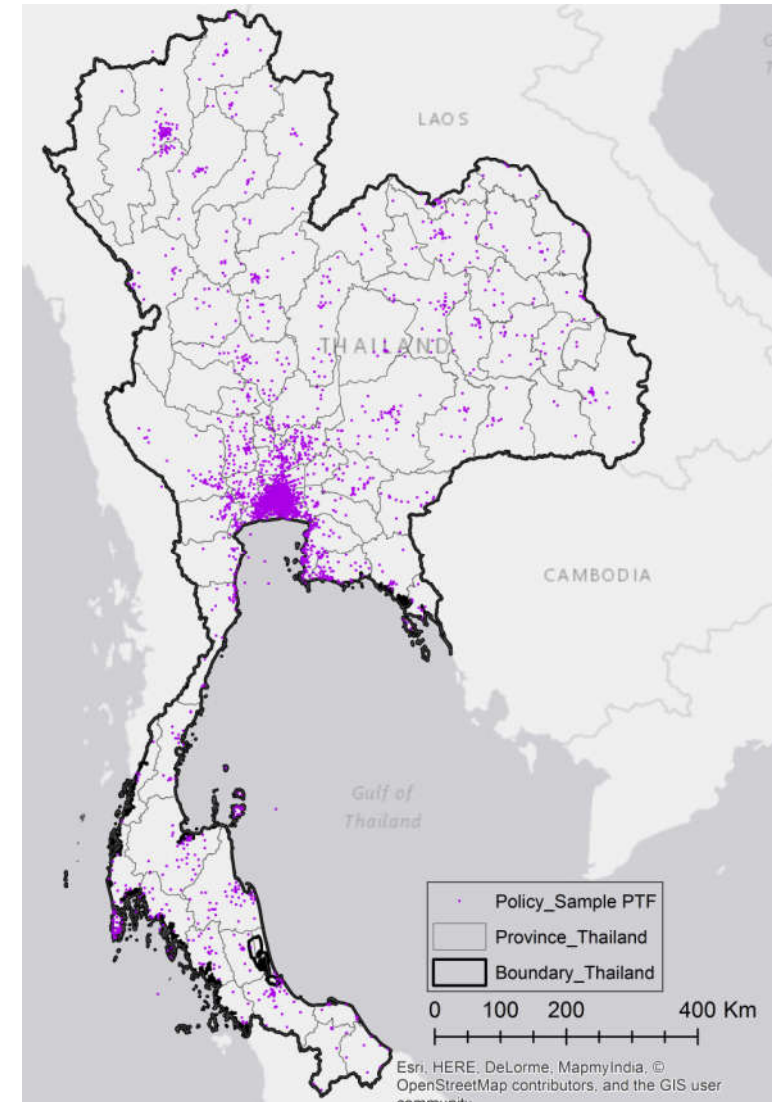
- Analysing efficiency of existing portfolio

Simple exercise #2:

- Loss** accumulation study on **Province** level

	TIV [THB]	% of total	No. Policies	% of total
Portfolio	373,630,796,310	100.00%	13,218	100.00%
Geocoded	371,980,161,469	99.56%	13,185	99.75%
Floodable	130,338,461,323	34.88%	4,728	35.86%

- Accumulation could be done by extracting values from flood risk map(s)
- Running catastrophe model on policy level and aggregating results per pre-defined areas



2. Portfolio Accumulation

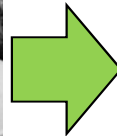
Simple exercise #2 – cont.

ID	Province Name	TIV_abs.	TIV_rel.	ModLoss_abs.	ModLoss_rel.	Loss Ratio	Effectivity
10	BANGKOK	140,935,335,638	37.72%	277,467,846	63.69%	0.197%	169%
11	SAMUT PRAKAN	22,867,412,526	6.12%	21,515,482	4.94%	0.094%	81%
20	CHON BURI	21,335,868,586	5.71%	141,201	0.03%	0.001%	1%
12	NONTHABURI	19,047,591,979	5.10%	15,353,415	3.52%	0.081%	69%
13	PATHUM THANI	15,940,335,520	4.27%	38,665,338	8.88%	0.243%	208%
21	RAYONG	14,847,045,657	3.97%	11,410,727	2.62%	0.077%	66%
83	PHUKET	13,096,307,803	3.51%	121,295	0.03%	0.001%	1%
14	PHRA NAKHON SI AYUTTHAYA	10,918,523,618	2.92%	6,326,074	1.45%	0.058%	50%
73	NAKHON PATHOM	9,678,937,902	2.59%	10,589,194	2.43%	0.109%	94%
74	SAMUT SAKHON	9,670,707,931	2.59%	6,635,550	1.52%	0.069%	59%
84	SURAT THANI	7,371,087,131	1.97%	27,796,014	6.38%	0.377%	323%
...							
25	PRACHIN BURI	6,298,933,246	1.69%	27,976	0.01%	0.000%	0%
...							
22	CHANTHABURI	493,737,472	0.13%	2,295,497	0.53%	0.465%	399%
...							
48	NAKHON PHANOM	20,720,608	0.01%	164,952	0.04%	0.796%	683%
...							
91	SATUN	19,194,251	0.01%	273,439	0.06%	1.425%	1222%
...							
TOTAL		373,630,796,310	100.00%	435,661,529	100.00%	0.117%	100%

How would such study looked like for Your portfolio?

2. Portfolio Accumulation

- Assessing accumulation on regular basis



ELEMENTS Accumulation Management

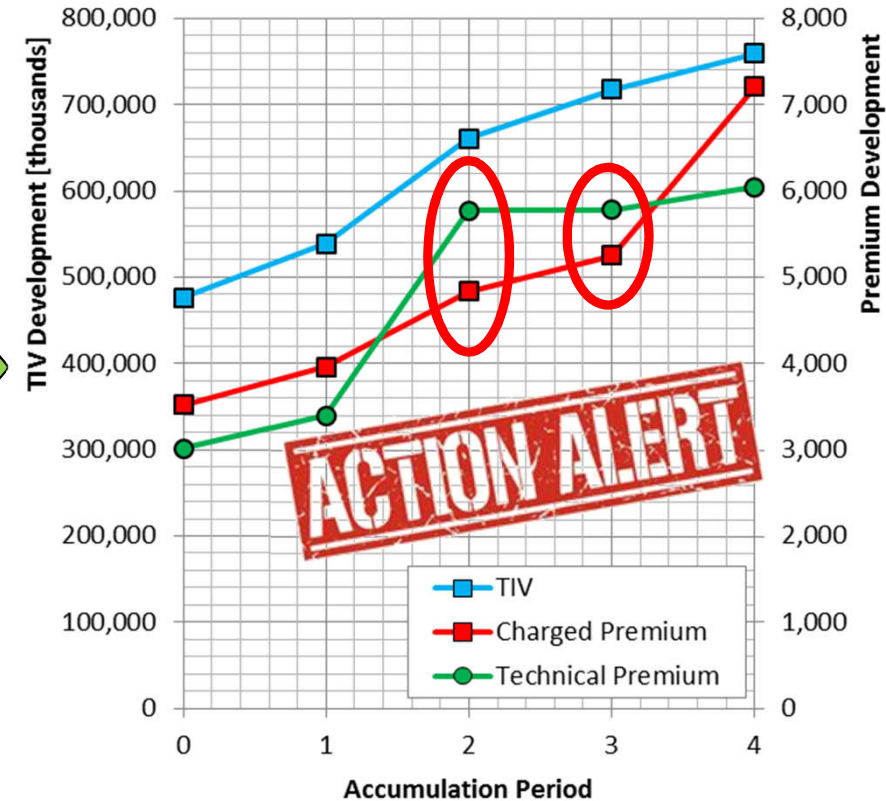
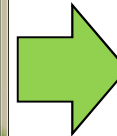
ELEMENTS API
For Accumulation Management Tool

Select ELEMENTS Server:

Select ELEMENTS input:

Current analysis settings:
Breakouts_District:0
Breakouts_Municipality:0
Breakouts_Cresta:1
Breakouts_Zipcode:0
Breakouts_Location:1
Breakouts_ICD:1

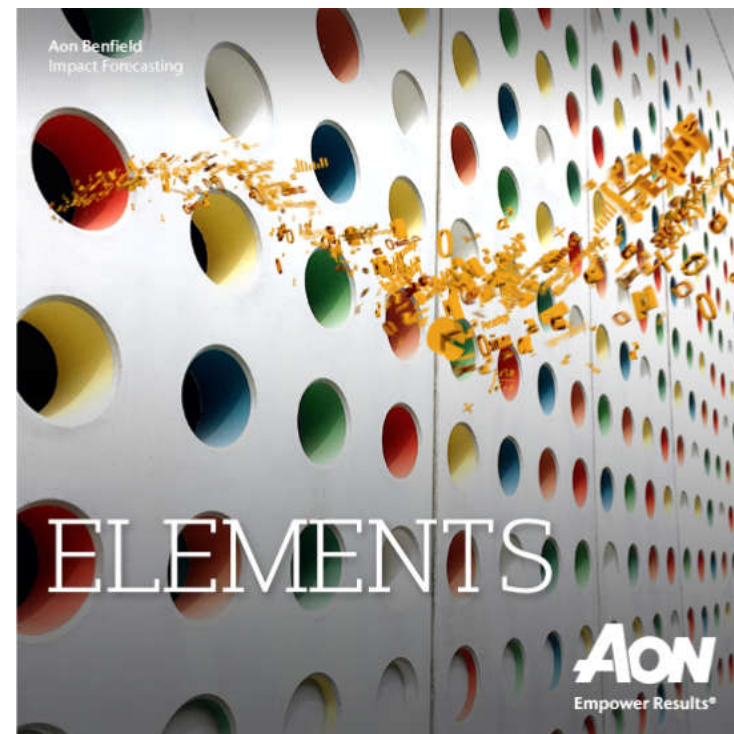
API logs:



Such a report could be generated on monthly/weekly basis

3. Catastrophe Modelling

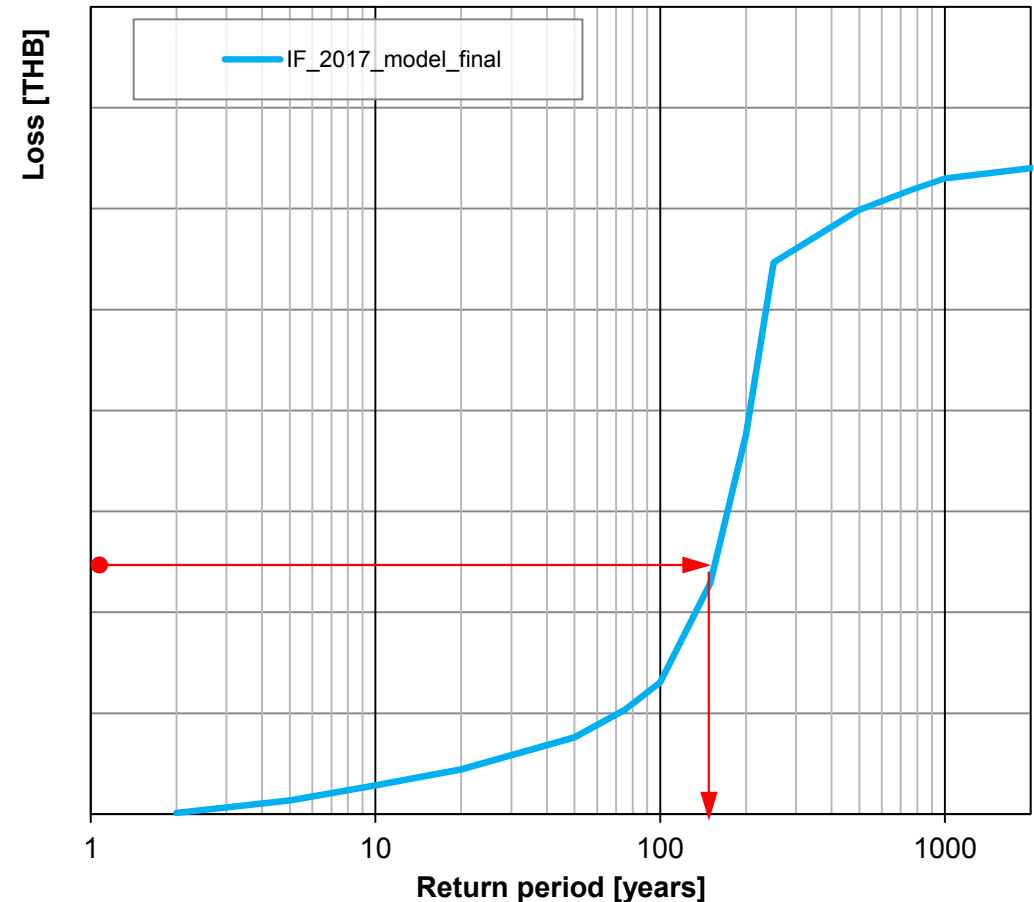
- Evaluate probable maximum natural catastrophe losses on entire portfolio to design optimal reinsurance protection
 - Contribution of all policies
 - Effect of financial conditions (limits and deductibles): FGU or Gross losses
- The application of probabilistic catastrophe model through the modelling platform (ELEMENTS)
- OEP and AEP perspectives
- Probabilistic and scenario models



3. Catastrophe Modelling Outputs

- Add EP curve & table to explain PML, AAL, STD, ELT, Historical Val.,...

Event ID	Probability	GU	SIR	GROSS
1	0.0001	16,832	1,164	15,668
2	0.0001	748,398	66,464	681,934
3	0.0001	91,038	12,612	78,425
4	0.0001	39,186	4,765	34,421
6	0.0001	959,045	66,168	892,876
7	0.0001	268,867	23,820	245,047
8	0.0001	1,529,784	171,452	1,358,333
9	0.0001	2,038,568	66,391	1,972,177
10	0.0001	595,510	62,475	533,034
11	0.0001	2,797,181	147,727	2,649,453
12	0.0001	350,833	9,508	341,324
13	0.0001	2,019,768	155,414	1,864,353
14	0.0001	1,833,589	82,567	1,751,022
15	0.0001	7,725,253	469,011	7,256,241
17	0.0001	5,705,808	601,452	5,104,357
18	0.0001	4,671,550	329,857	4,341,693
19	0.0001	1,655,050	142,320	1,512,730
120,000	0.0001	359,942	3,418	356,524



Model validation on historical events: Loss “as-if” 2011



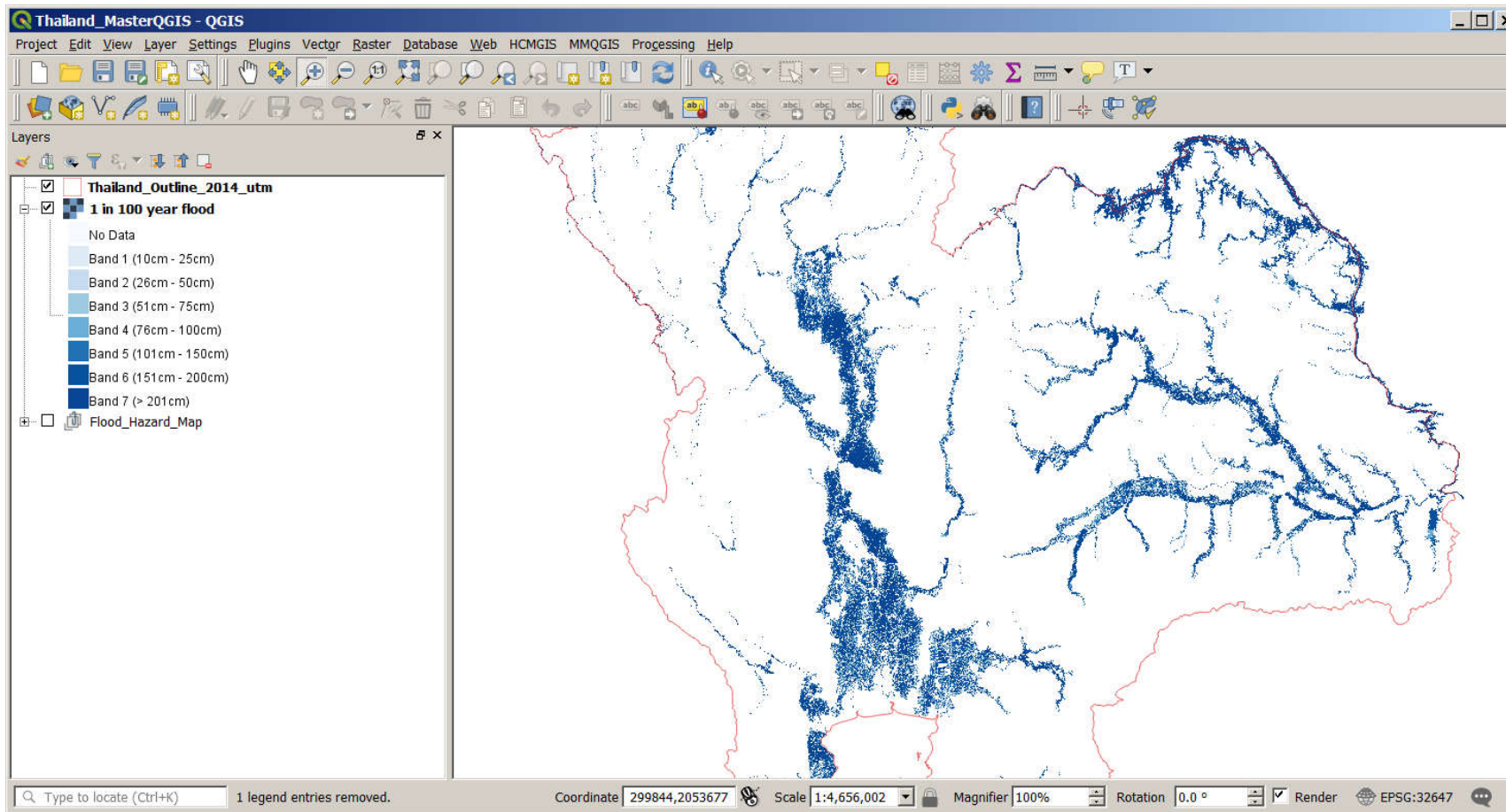
Section 3: Benefits

Benefits

- There are simple and ready-to-use tools and technologies that allows transitions towards analytically-minded insurance company
- Selective underwriting and related analytics help you to
 - reduce your risk and
 - increase the insurance capacity – both with greater confidence!
 - Decrease your reinsurance costs
- Consistent tools and approaches through entire underwriting cycle developed in house specifically for Thailand

A Gift at the End

- Impact Forecasting is releasing 1 in 100 years flood hazard map with depth band indication for free general use!
 - Accessible via WMS service and/or free and open-source GIS (QGIS)
 - Register at <https://support.impactforecasting.com>



Contacts

Panchit Ekaraphanich

Aon Benfield Thailand

+662 305 4666

panchit.ekaraphanich@aonbenfield.com

Dr. Petr Punčochář

Aon Benfield, Impact Forecasting, Prague

+420 776 368 670

petr.puncochar@aonbenfield.com

Disclaimer

Legal Disclaimer

© Aon UK Limited trading as Aon Benfield (for itself and on behalf of each subsidiary company of Aon Plc) (“Aon Benfield”) reserves all rights to the content of this report or document (“Report”). This Report is for distribution to Aon Benfield and the organisation to which it was originally delivered by Aon Benfield only (the “Recipient”). Copies may be made by that organisation for its own internal purposes but this Report may not be distributed in whole or in part to any third party without both (i) the prior written consent of Aon Benfield and (ii) the third party having first signed a “recipient of report” letter in a form acceptable to Aon Benfield. This Report is provided as a courtesy to the recipient and for general information and marketing purposes only. The Report should not be construed as giving opinions, assessment of risks or advice of any kind (including but not limited to actuarial, re/insurance, tax, regulatory or legal advice). The content of this Report is made available without warranty of any kind and without any other assurance whatsoever as to its completeness or accuracy.

Aon Benfield does not accept any liability to any Recipient or third party as a result of any reliance placed by such party on this Report. Any decision to rely on the contents of this Report is entirely the responsibility of the Recipient. The Recipient acknowledges that this Report does not replace the need for the Recipient to undertake its own assessment or seek independent and/or specialist risk assessment and/or other relevant advice.

The contents of this Report are based on publically available information and/or third party sources (the “Data”) in respect of which Aon Benfield has no control and such information has not been verified by Aon Benfield. This Data may have been subjected to mathematical and/or empirical analysis and modelling in producing the Report. The Recipient acknowledges that any form of mathematical and/or empirical analysis and modelling (including that used in the preparation of this Report) may produce results which differ from actual events or losses.

Limitations of Catastrophe Models

This report includes information that is output from catastrophe models of Impact Forecasting, LLC (IF). The information from the models is provided by Aon Benfield Services, Inc. (Aon Benfield) under the terms of its license agreements with IF. The results in this report from IF are the products of the exposures modelled, the financial assumptions made concerning deductibles and limits, and the risk models that project the pounds of damage that may be caused by defined catastrophe perils. Aon Benfield recommends that the results from these models in this report not be relied upon in isolation when making decisions that may affect the underwriting appetite, rate adequacy or solvency of the company. The IF models are based on scientific data, mathematical and empirical models, and the experience of engineering, geological and meteorological experts. Calibration of the models using actual loss experience is based on very sparse data, and material inaccuracies in these models are possible. The loss probabilities generated by the models are not predictive of future hurricanes, other windstorms, or earthquakes or other natural catastrophes, but provide estimates of the magnitude of losses that may occur in the event of such natural catastrophes. Aon Benfield makes no warranty about the accuracy of the IF models and has made no attempt to independently verify them. Aon Benfield will not be liable for any special, indirect or consequential damages, including, without limitation, losses or damages arising from or related to any use of or decisions based upon data developed using the models of IF.

Additional Limitations of Impact Forecasting, LLC

The results listed in this report are based on engineering / scientific analysis and data, information provided by the client, and mathematical and empirical models. The accuracy of the results depends on the uncertainty associated with each of these areas. In particular, as with any model, actual losses may differ from the results of simulations. It is only possible to provide plausible results based on complete and accurate information provided by the client and other reputable data sources. Furthermore, this information may only be used for the business application specified by Impact Forecasting, LLC and for no other purpose. It may not be used to support development of or calibration of a product or service offering that competes with Impact Forecasting, LLC. The information in this report may not be used as a part of or as a source for any insurance rate filing documentation.

THIS INFORMATION IS PROVIDED “AS IS” AND IMPACT FORECASTING, LLC HAS NOT MADE AND DOES NOT MAKE ANY WARRANTY OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, WITH RESPECT TO THIS REPORT; AND ALL WARRANTIES INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED BY IMPACT FORECASTING, LLC. IMPACT FORECASTING, LLC WILL NOT BE LIABLE TO ANYONE WITH RESPECT TO ANY DAMAGES, LOSS OR CLAIM WHATSOEVER, NO MATTER HOW OCCASIONED, IN CONNECTION WITH THE PREPARATION OR USE OF THIS REPORT.