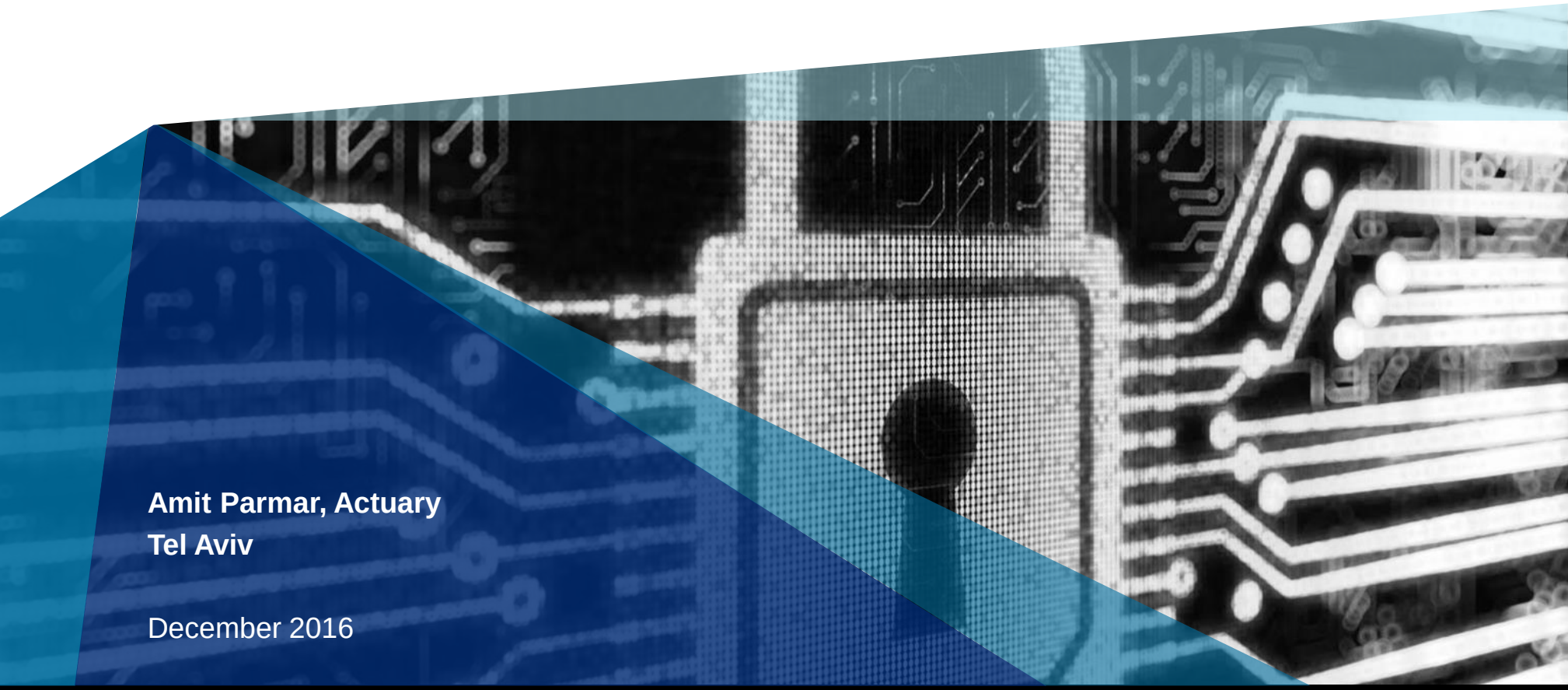
GUY CARPENTER

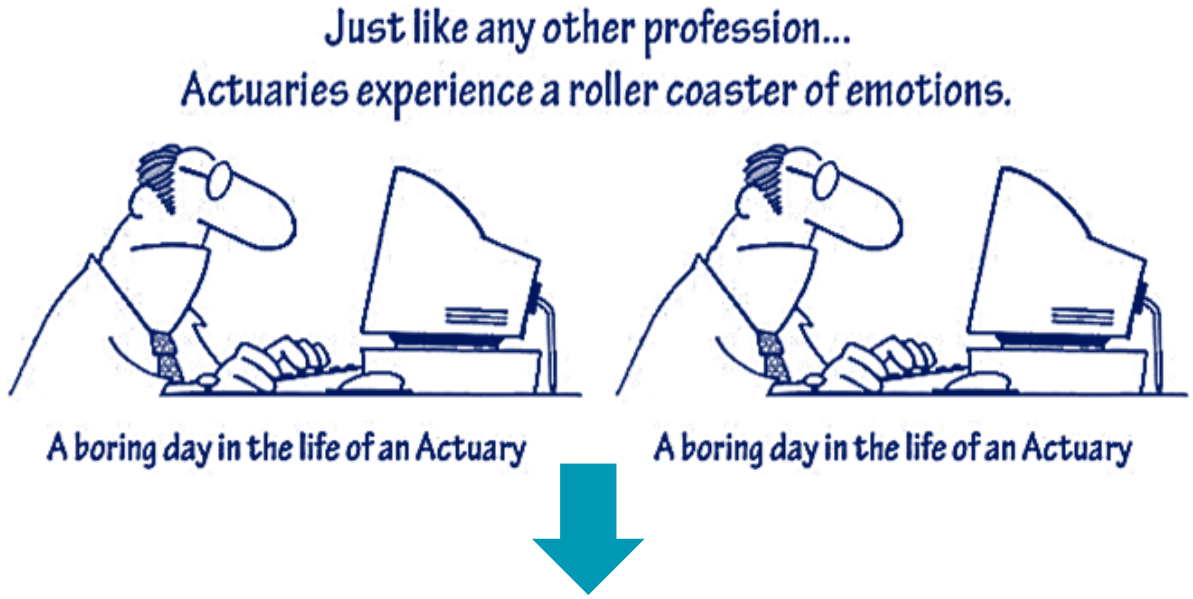
Actuary of the future
2016 Israeli Association of Actuaries



Amit Parmar, Actuary
Tel Aviv

December 2016

The future
Changing Role of the Actuary



Actuarial Work
Changing Role of the Actuary

Data Spec

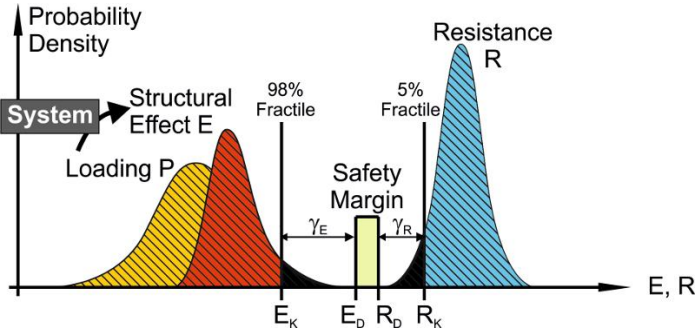
Clean Data

Summarise Data

Analyse Data
- Modelling
- Assumptions

Recommendations

Communication



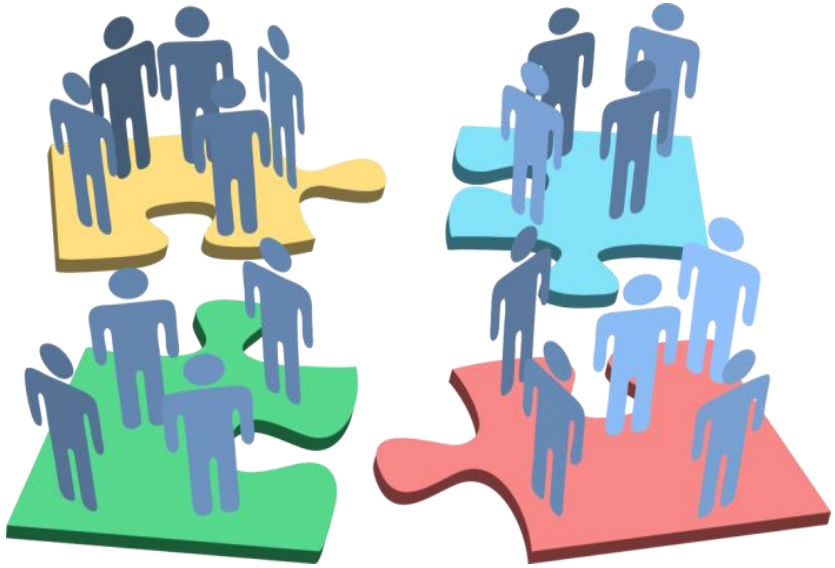
Actuarial Work
Changing Role of the Actuary

Gap between the actuaries and:

Knowledge

Perception

Expectation



Policyholders

Underwriters

Management / CEO

Rating Agency / Regulator

Shareholders / Board

Government

Actuarial Work
Better communication

Spend more time	• Explaining sensitivities • Looking at dependencies and correlations • Explaining effect on output
Be aware of	• Over fitting • Over confidence bias • Representative heuristic
Present	• Mix of detail and high level • Good use of charts and stats

Actuarial Work
Better Communication

Scenario Testing

↓

Stress Testing

↓

Reverse Testing

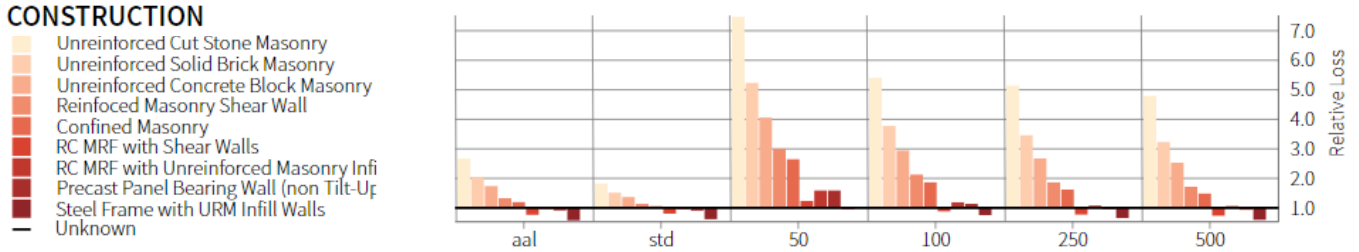
Actuarial Work
Scenario Testing– Cat modelling test C1-1

MODEL A MODEL B

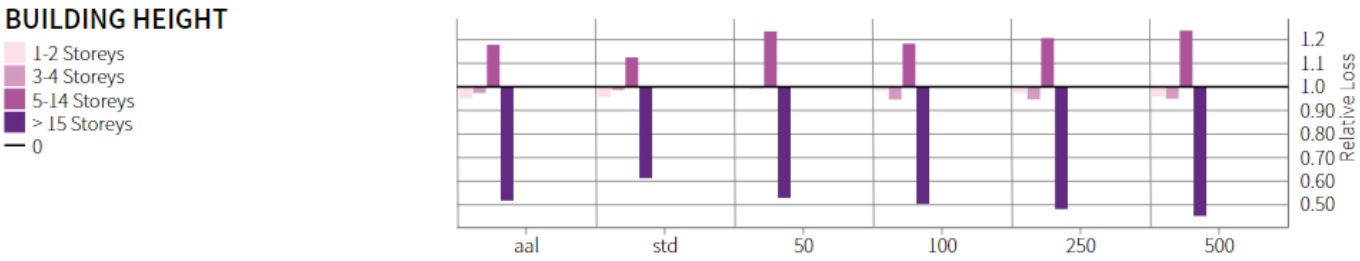
Explore sensitivity of losses by return period to changes in exposure primary modifiers

- 9 Locations
- Includes all modelled unique exposure combinations (more than 30K)

Locations analysed:
- Ashdod
- Haifa
- Hevel Eilot
- Jerusalem
- Nazareth
- Netanya
- Petah Tikva
- Rishon LeZion
- Tel Aviv



MODEL A

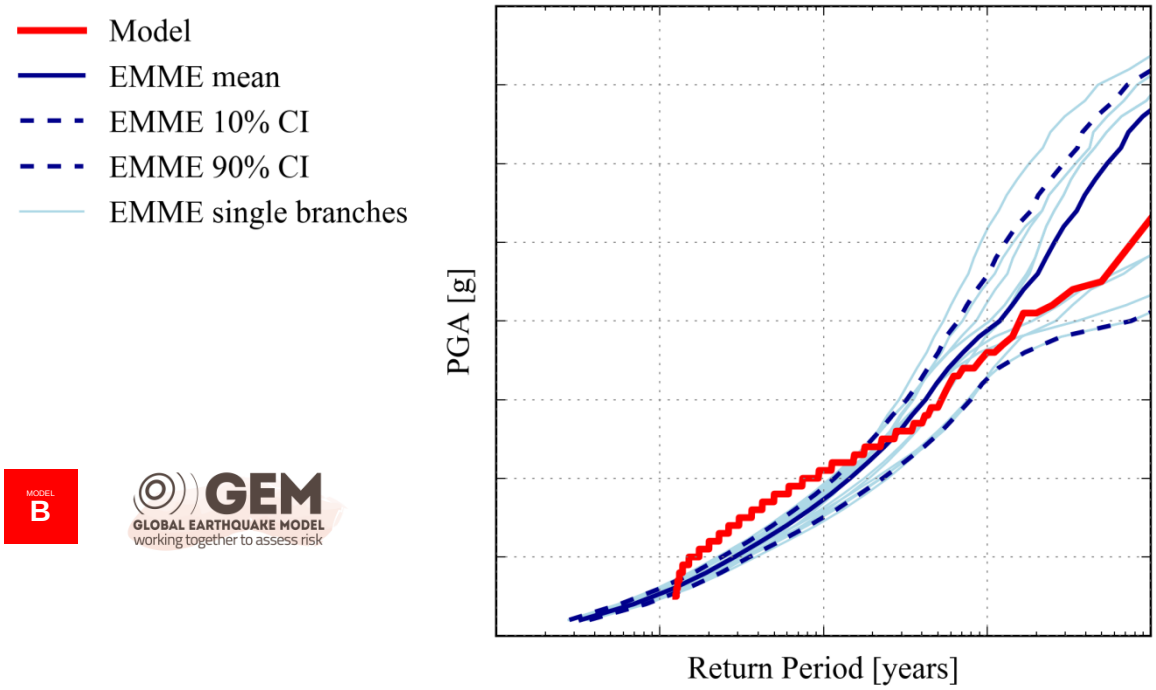


MODEL A

Actuarial Work
Scenario Testing - C3-2 Hazard Intensity Return Period

Compare return periods of different ground motions from the models to reference views

- Global Earthquake Model Earthquake Model for the Middle East (EMME) (2016)



Locations analysed:

- Ashdod
- Haifa
- Hevel Eilot
- Jerusalem
- Nazareth
- Netanya
- Petah Tikva
- Rishon LeZion
- Tel Aviv

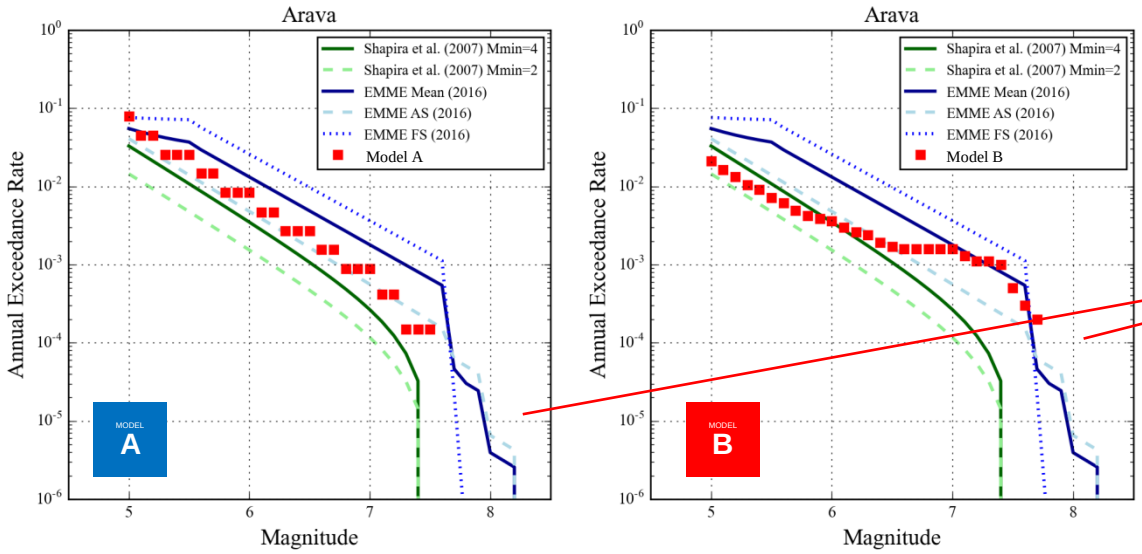
Actuarial Work
Scenario Testing - C3-3 Event Frequency by Severity

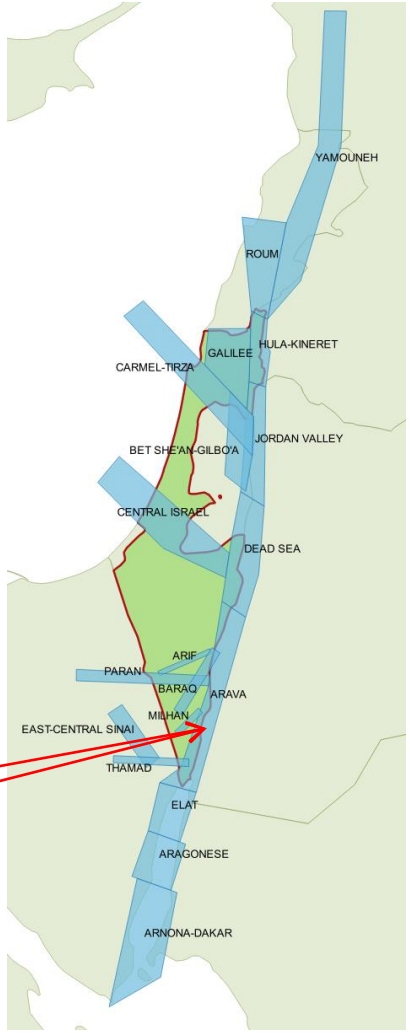
Compare frequencies of earthquakes of varying magnitudes from the models to reference views:

- Global Earthquake Model Earthquake Model for the Middle East (EMME) (2016)
- Shapira et al. (2007) report from the Geophysical Institute of Israel

MODEL A MODEL B

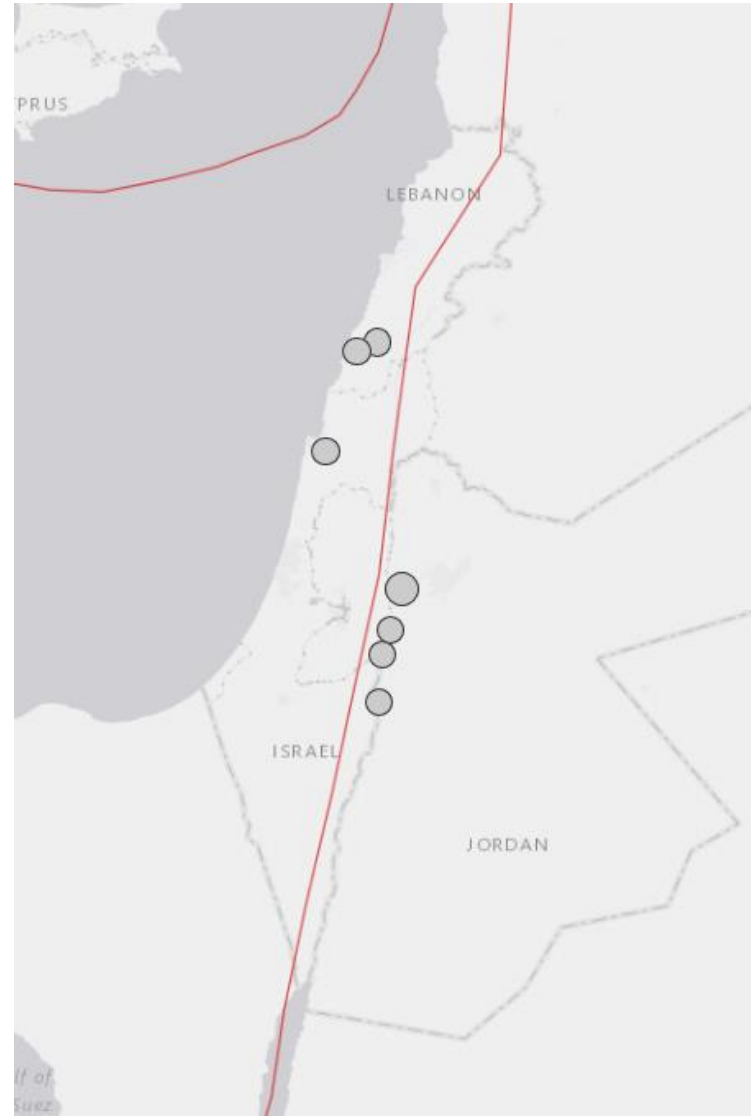
ZONE BY ZONE ANALYSIS



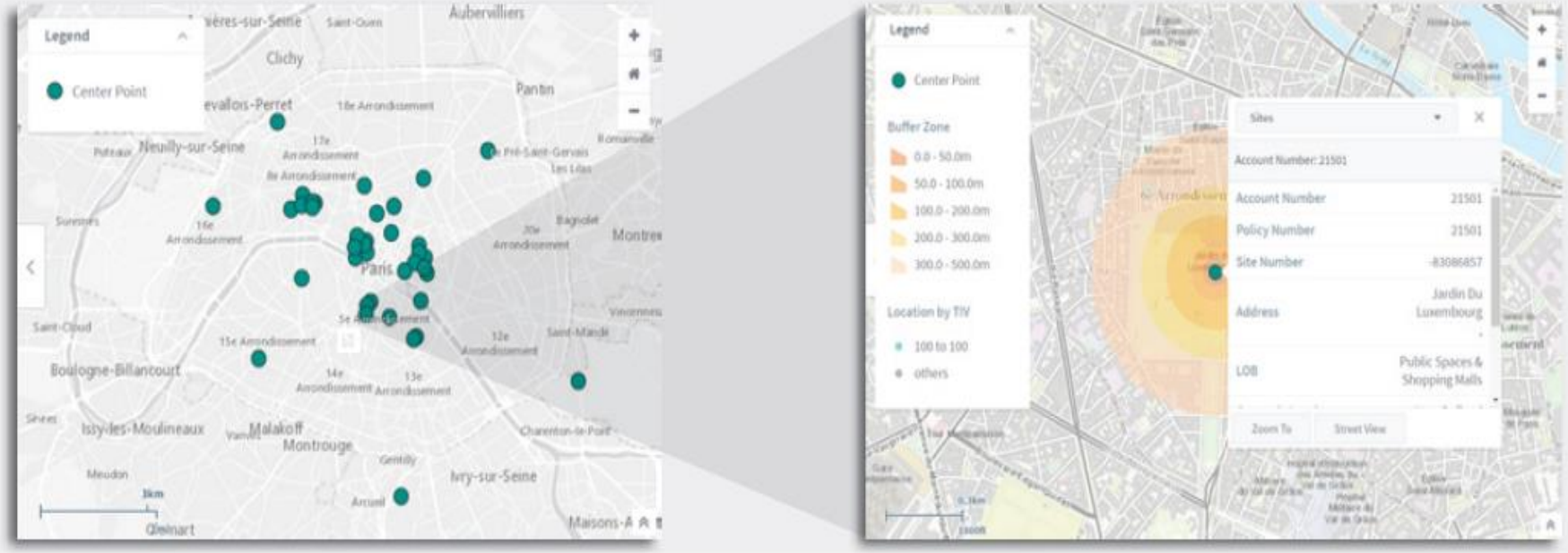


Actuarial Work
Reverse Stress Testing

5.1	**Lebanon - Syria region** 2008-02-15 10:36:19 (UTC)	10.0 km
5.3	**Dead Sea region** 2004-02-11 08:15:03 (UTC)	26.7 km
5.0	**Lebanon - Syria region** 1997-03-26 04:22:51 (UTC)	10.0 km
5.3	**Dead Sea region** 1984-08-24 06:02:24 (UTC)	24.3 km
5.1	**Dead Sea region** 1979-04-23 13:01:58 (UTC)	33.0 km
5.7	**Dead Sea region** 1956-12-18 17:53:06 (UTC)	15.0 km
6.3	**Dead Sea region** 1927-07-11 13:04:10 (UTC)	15.0 km

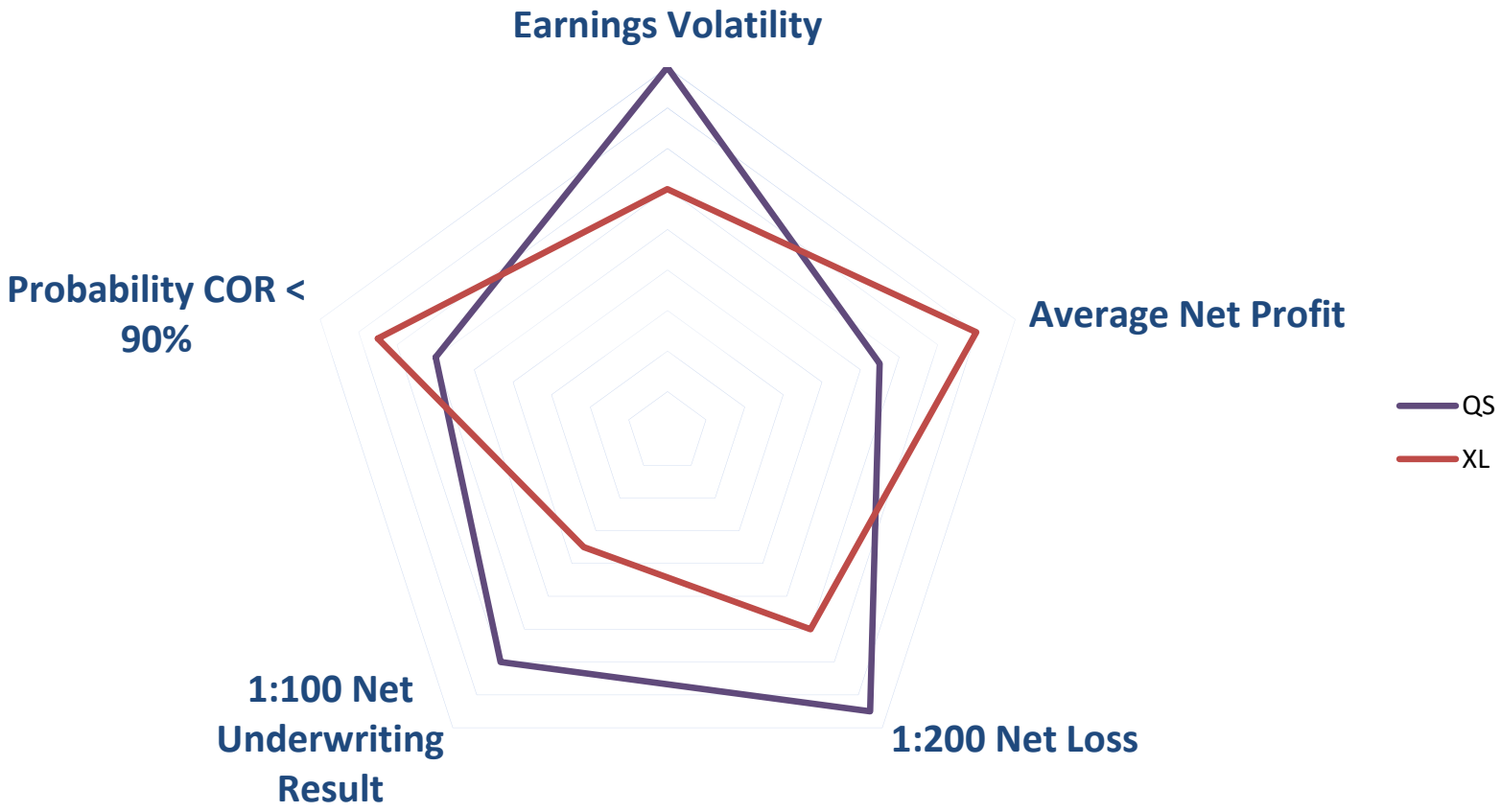


Actuarial Work
Reverse Stress Testing

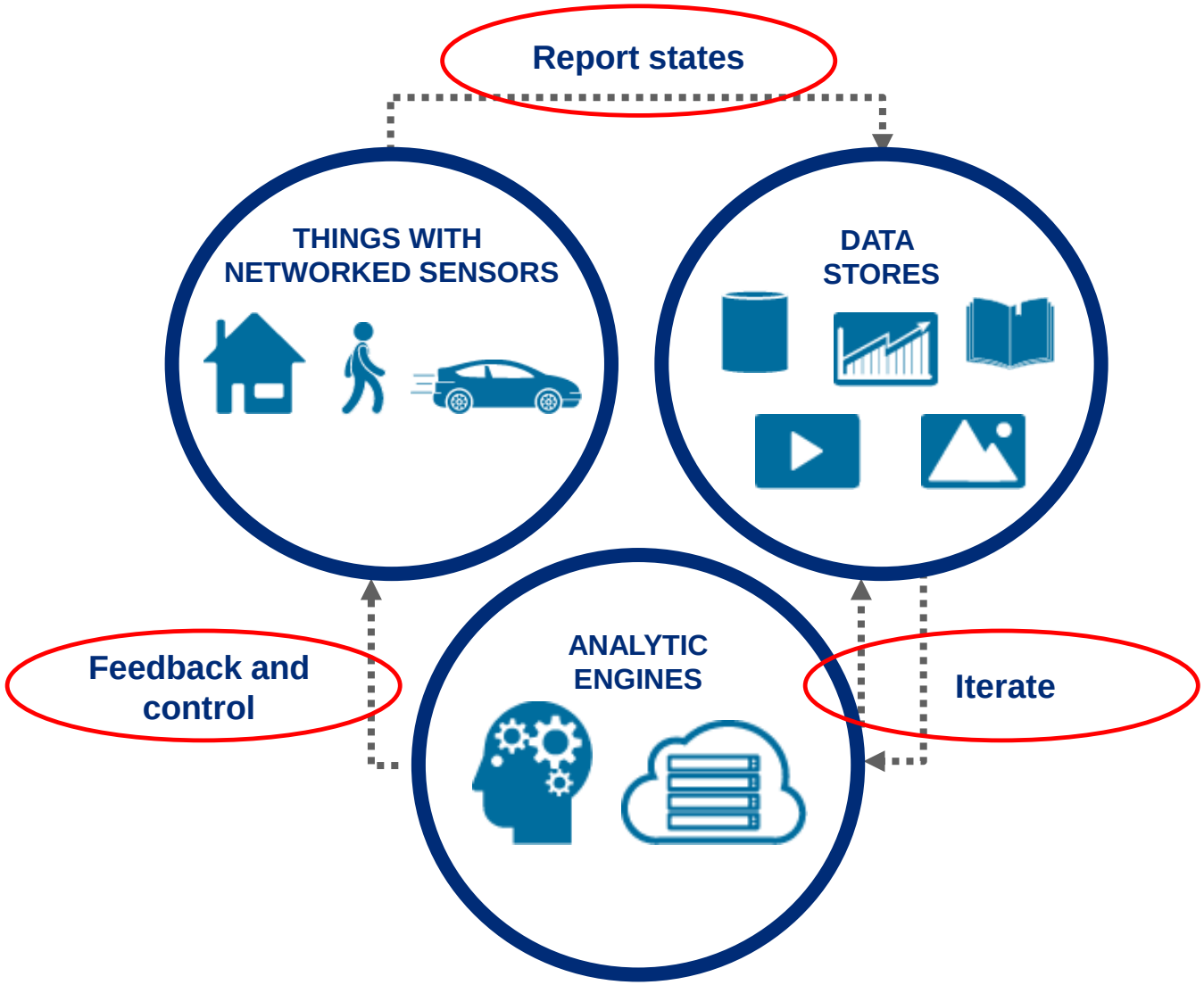


- Accumulation around particular point of interest
  - Terror target
  - Rivers
  - Particular historical scenario
  - Man made scenario
- Monitor exposure
  - Solvency 2
  - Scenario modelling

Actuarial Work
Reinsurance decision making



The future
Internet of Things



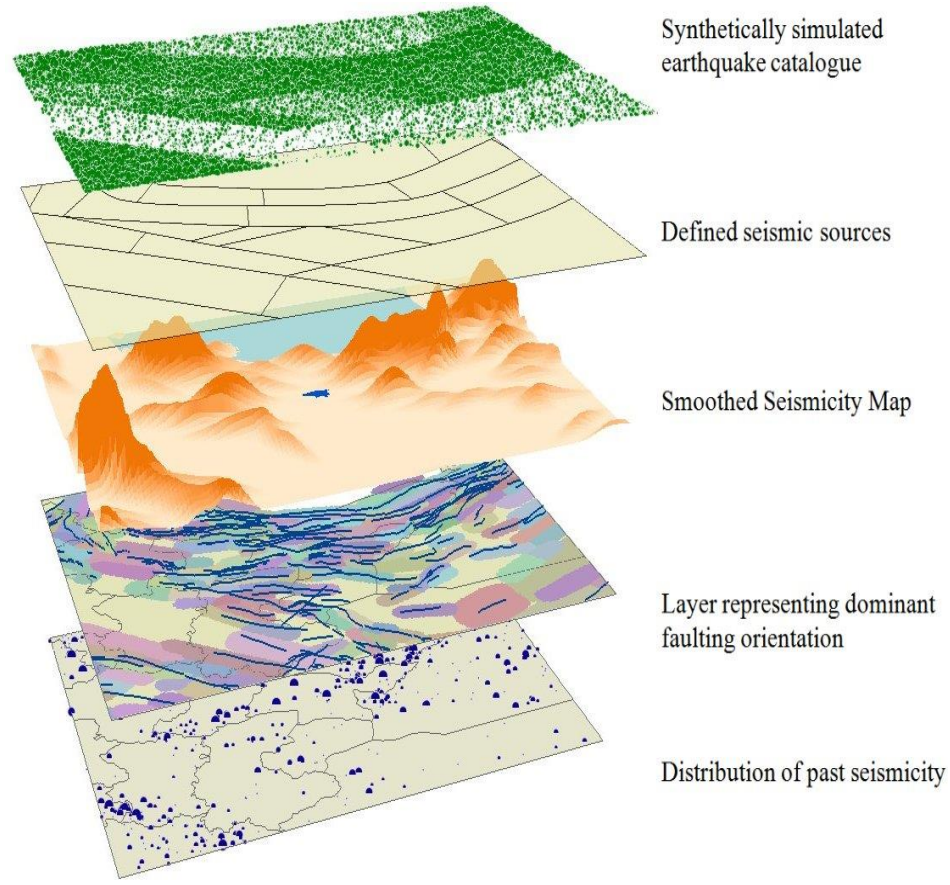
Actuarial Work
Modelling Techniques

Earthquakes are **predicted** using the statistical analysis of **historical** and **instrumental** data.

Earthquake sources are modelled by **real source zones**.

A synthetic earthquake catalogue is generated by **Monte Carlo** simulation on the probabilistic function used to generate events.

The corresponding **event-to-year mapping** is supplied with the model



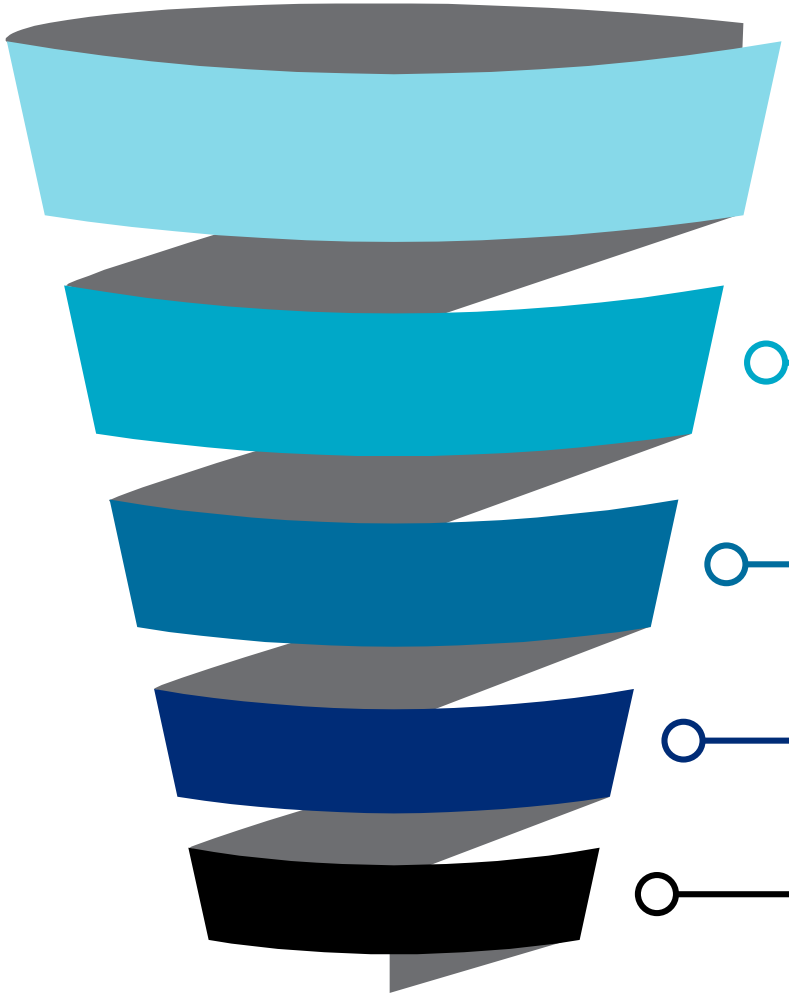
The future
Impacting Every Part of the Insurance Value Chain





Product Design	Pricing	Underwriting	Policyholder Service	Claims
• Types of sensors • Sensor output • Type of network • Feedback control effectiveness	• New data elements • New pricing algorithms based on models/analyses	• New elements in scores and decisions: based on prior or current output of sensors • New kinds of data and information (video or images)	• Responsible for feedback and control operation • Must work well with people and objects • Must understand how to impact motivation and behavior	• Use new data elements, models, analyses to understand causation and responsibility • Fraud mitigation tools use broader and better data and algorithms

Summary



Deliver results in holistic way
Feedback loop

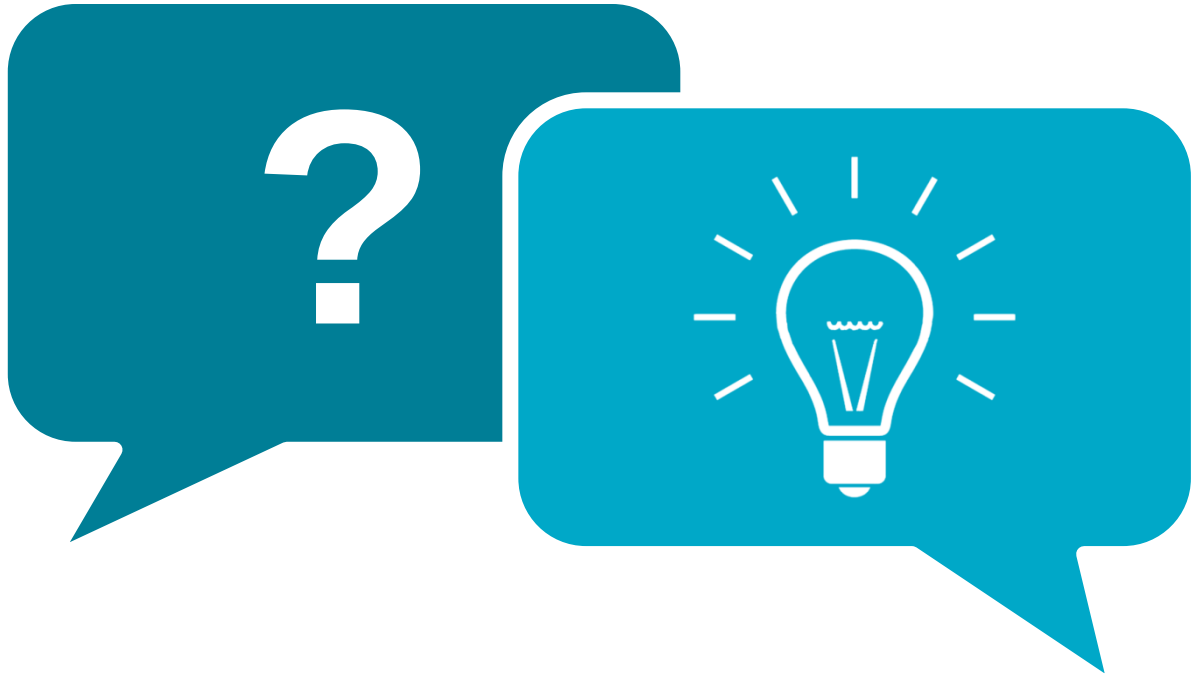
Scenario test
Stress test
Reverse stress test

Learn new techniques
Invest in data and technology

Communicate what has been done
Communicate what hasn’t been done

Understand the basics
What are we trying to achieve
Build model fit for purpose

Discussion and Questions

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Statements or analysis concerning or incorporating tax, accounting or legal matters should be understood to be general observations or applications based solely on our experience as reinsurance brokers and risk consultants and may not be relied upon as tax, accounting or legal advice, which we are not authorized to provide. All such matters should be reviewed with the client's own qualified advisors in these areas.

This presentation (report, letter) is not intended to be a complete actuarial communication. Upon request, we can prepare one. We are available to respond to questions regarding our analysis.

There are many limitations on actuarial analyses, including uncertainty in the estimates and reliance on data. We will provide additional information regarding these limitations upon request.

As with any actuarial analysis, the results presented herein are subject to significant variability. While these estimates represent our best professional judgment, it is probable that the actual results will differ from those projected. The degree of such variability could be substantial and could be in either direction from our estimates.

The estimated cash flows may vary significantly from amounts actually collected, particularly in the event that a reinsurer is unwilling or unable to perform in accordance with the terms of the reinsurance contract.

The results in this report are generated with software models provided by AIR Worldwide Corporation.

Developing models to estimate losses resulting from catastrophes or other large-scale events is an inherently subjective and imprecise process, involving judgment about a variety of environmental, demographic and regulatory factors. The assumptions and methodologies used by AIR in creating the models may not constitute the exclusive set of reasonable assumptions and methodologies. The use of alternative assumptions and methodologies could yield materially different results. Also, the output of the models depends on data and inputs supplied by others, and any gaps, inaccuracies, or changes to the inputs can substantially affect the output.

Israel C3-3 Event Frequency by Severity

Compare frequencies of earthquakes of varying magnitudes from the models to reference views:

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- Shapira et al. (2007) report from the Geophysical Institute of Israel

SUMMARIES BY ZONE BY MAGNITUDE

MODEL A

Region	Zone	M5	M6	M7	M8
1. Dead Sea Transform	Arava				
	Central Israel				
	Dead Sea				
	Hula-Kineret				
	Jordan Valley				
2. DST Branches	Arif				
	Baraq				
	East-Central Sinai				
	Milhan				
	Paran				
3. North DST	Bet She'an-Gilbo'a				
	Carmel-Tirza				
	Galilee				
	Roum				
	Yamouneh				
4. South DST	Aragonese				
	Arnona-Dakar				
	Elat				
	Thamad				

MODEL B

Region	Zone	M5	M6	M7	M8
1. Dead Sea Transform	Arava				
	Central Israel				
	Dead Sea				
	Hula-Kineret				
	Jordan Valley				
2. DST Branches	Arif				
	Baraq				
	East-Central Sinai				
	Milhan				
	Paran				
3. North DST	Bet She'an-Gilbo'a				
	Carmel-Tirza				
	Galilee				
	Roum				
	Yamouneh				
4. South DST	Aragonese				
	Arnona-Dakar				
	Elat				
	Thamad