Hellenic Association of Insurance Companies

Summary of Dwelling Stock Study & Modelling Results

20th Insurance & Reinsurance Meeting –

Costa Navarino, 19-21 September 2018

ΕΝΩΣΗ
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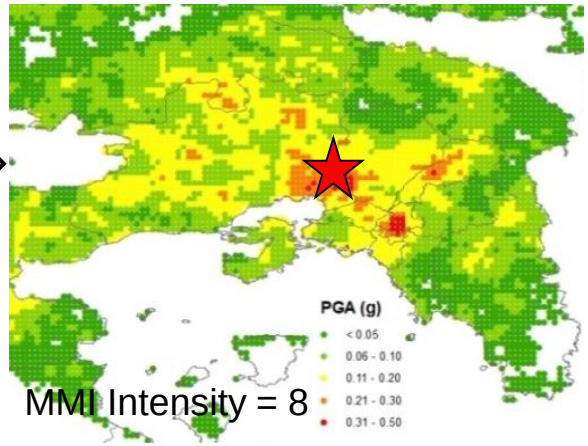
How it Works - Catastrophe Model Anatomy

1. Insured location #1

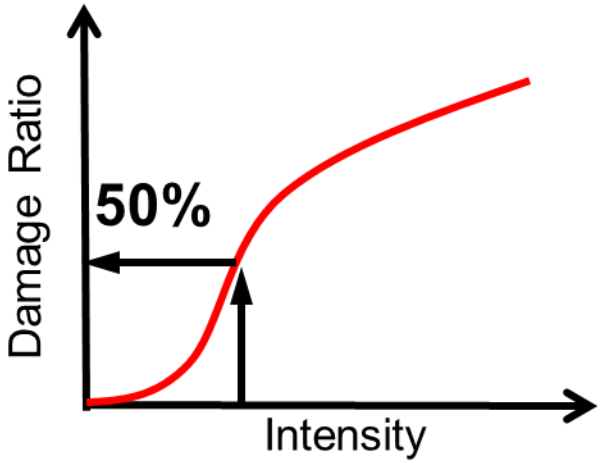
Location: 41.0° N
29.0° E
TIV = 1,000,000 EUR
Deductible = 20,000 EUR

2. Link with EQ intensity footprint simulated event #1



MMI Intensity = 8

3. Link with damage (vulnerability) function



4. Loss Calculation

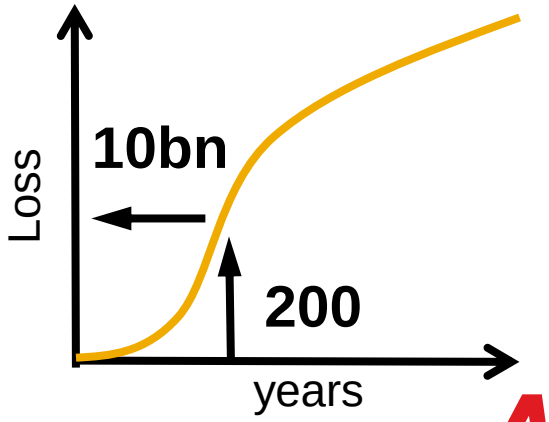
Ground Up Loss
1,000,000 * 0.5
= 500,000 EUR

Gross Loss
500,000 – 20,000
= 480,000 EUR

5. Repeat (for every location and every simulated event), sum up by event to get total loss

Event ID	Total loss
1	2,200,000
2	3,400,000
3	5,000,000
…	…
120,000	1,200,300

6. Calculate Exceedance Probability curve



Modelling of Catastrophe Losses

Similarity to crossing the street

- When you want to cross street (Reality) you don't have to check for traffic = you can just take the risk
- Using traffic light (Model) help you to minimise risk
- But you still think and use <u>all available info/ tools</u> before you cross the street, i.e. you don't take the traffic light as the only true source of information

  - Goal of Cat Modelling is to estimate possible losses while minimising uncertainties

Some Quantifications to start with

6,459,759
conventional dwellings

EUR 559,717,899,000
total replacement cost

~ EUR 6,2 to 8,5 bn*
estimated modelled loss 1in200

of which **15.7%**
estimated to be insured

EUR **2,1 to 2,6 bn** *
1999 Parnitha (Athens)
as-if-today

* Range of models 1in200 / 2% deductible

Dwelling Database – Source Data

2011 Census

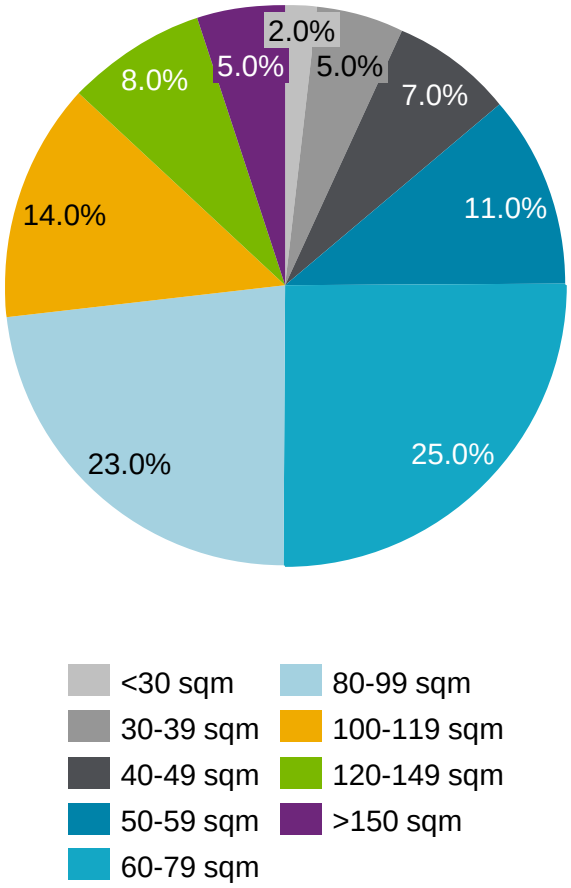
- Basic source of the data is the General Population census conducted by the Hellenic Statistical Authority between **10 and 24 May 2011.**
- The census data is available on the website of the Hellenic Statistical Authority (http://www.statistics.gr)
- **Available information important for the risk quantification:**
  - Number of dwellings per region
  - Number of dwellings by: surface area, age band, occupancy (apartment/house), usage (permanently occupied/vacant)
  - Number of buildings by: construction material, height (number of stories)
- **Geographical resolution of the data:**
  - Regions (Perifereies) – 13 units
  - Regional units (Perifereiakés Enótites) – 74 units
  - Municipalities (Dímoi) – 316 units

Post-2011 Data

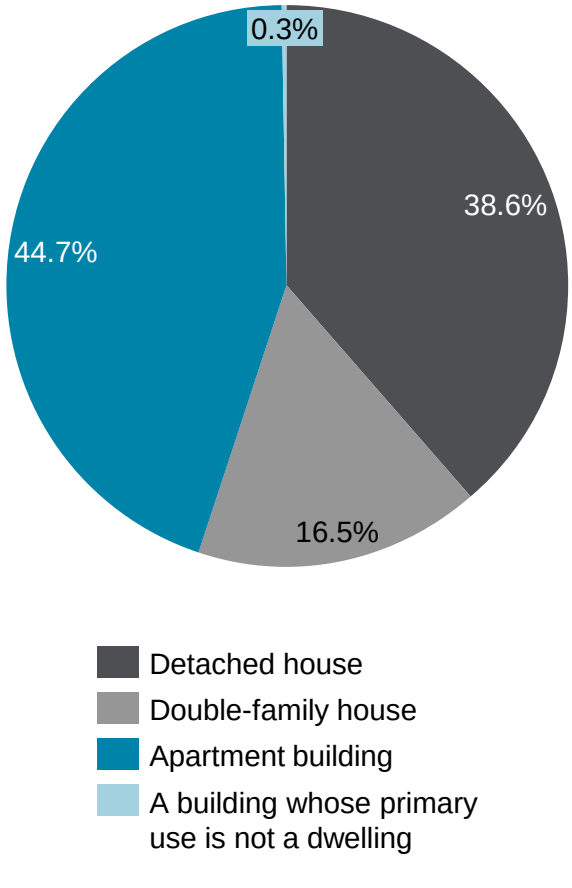
- The 2011 census data was supplemented by the data about newly constructed dwellings and their area, which is available till 2017.
- **Key figures:**
  - Number of conventional dwellings as at 2011 census: **6,371,901**
  - Number of conventional dwellings as at Dec-2017: **6,459,759** — **+1.4%** growth compared to 2011 census
  - Surface area as at 2011 census: **548,467,690 sq m**
  - Surface area as at Dec 2017: **559,717,899 sq m** — **+2.1%** growth compared to 2011 census

Dwelling Stock Database – Key Facts

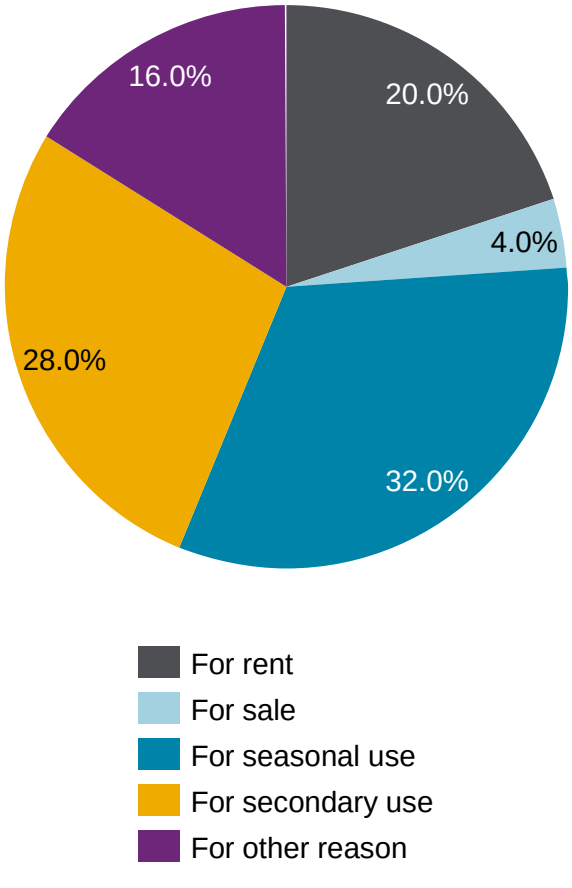
Distribution of Dwellings by **Size**



Distribution of Dwellings by **Type**

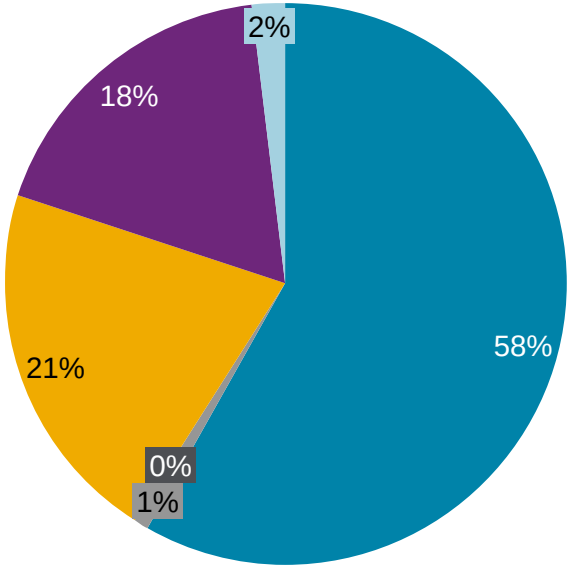


Vacant Dwellings by Usage

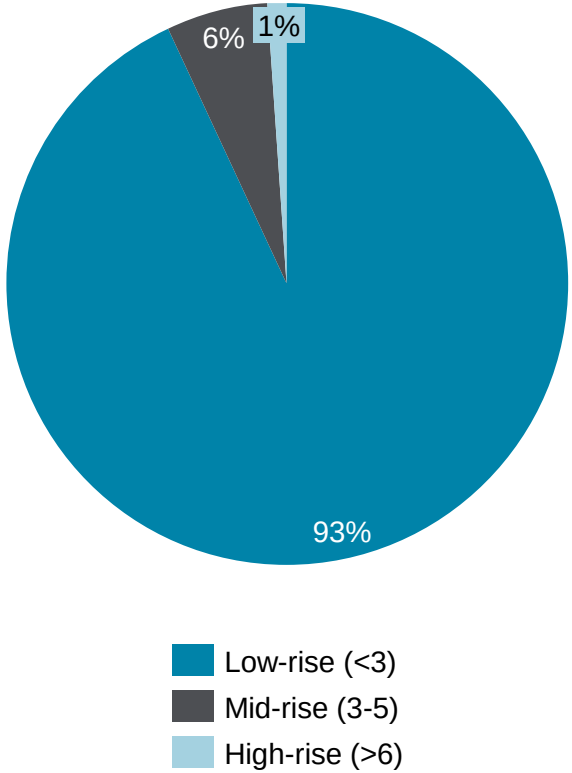


Dwelling Stock Database – Key Facts

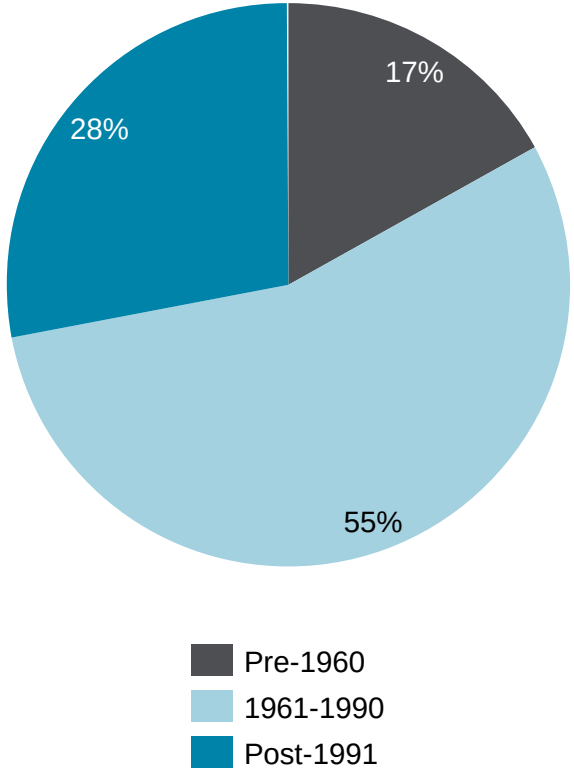
Distribution of Buildings by **Construction**



Distribution of Buildings by **Height**



Distribution of Dwellings by **Age**



- Above data only iro buildings not per dwelling.
- 2011 - No of buildings 4.105.637? No of dwellings 6.371.901

Modelling Assumptions

Key modelling assumptions

- **Modelled peril:** earthquake ground shaking
- Modelled **replacement** cost: **EUR 1,000** per sq m
- **Construction age and height** based on census data
- **Geographical resolution** of the modelling: Regional units (Perifereiakés Enótites) supplemented with 16 key cities
- **Deductibles**: 2% covered by policyholder, no deductible

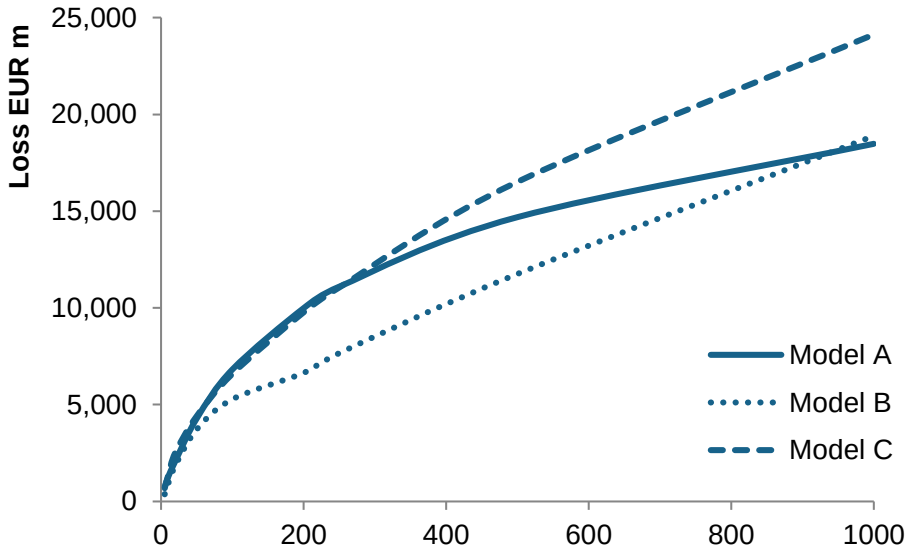
Models used

Model A	Model B	Model C
Latest update: 2011	Latest update: 2011	Latest update: 2015
Provider: A	Provider: B	Provider: Aon Benfield

Modelling Results – No Deductibles

Modelled PMLs in millions EUR, 100% penetration

Return period [years]	Model A	Model B	Model C
5	750	363	677
10	1,273	923	1,355
20	2,085	1,856	2,530
50	4,286	3,721	4,407
100	6,818	5,276	6,589
200	**9,987**	**6,639**	**9,772**
250	11,097	7,661	11,055
500	14,690	11,755	16,515
1000	18,480	18,890	24,129
AAL	**950**	**434**	**843**

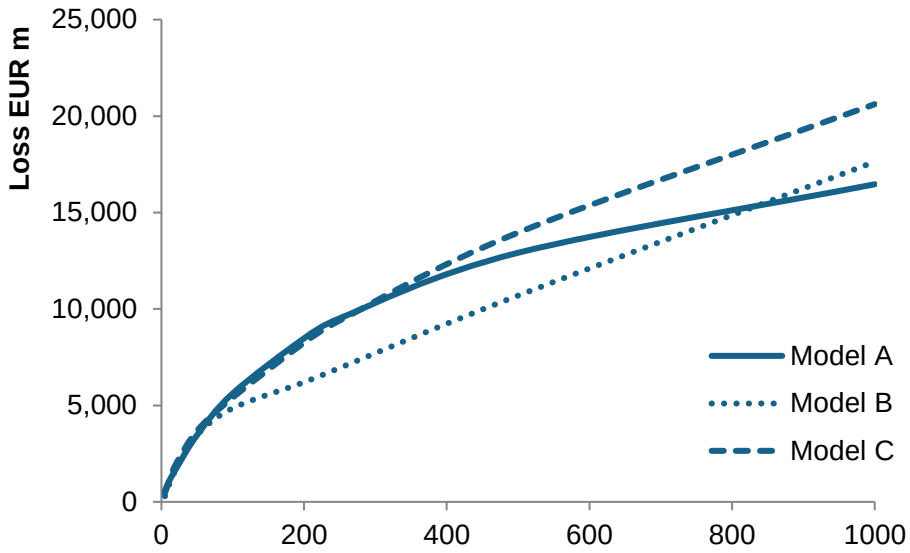


- Ground-up loss perspective assumes **no deductibles**
- **Model A and Model C are very similar up to 1in250 PML**. Losses > 1in250 are higher in Model C due to the higher frequency of strong subduction events.
- **Model B is the lowest model** due to low sensitivity of the model to Attiki region, where we observe the highest concentration of the exposure

Modelling Results – 2% Deductible Covered by Policyholder

Modelled PMLs in millions EUR, 100% penetration

Return period [years]	Model A	Model B	Model C
5	574	293	456
10	1,011	805	979
20	1,679	1,658	1,931
50	3,460	3,458	3,686
100	5,624	4,857	5,408
200	**8,481**	**6,204**	**8,249**
250	9,519	6,946	9,404
500	12,914	10,696	13,959
1000	16,466	17,629	20,616
AAL	**652**	**373**	**558**
1in200 diff to ground-up	-15.1%	-6.6%	-15.6%

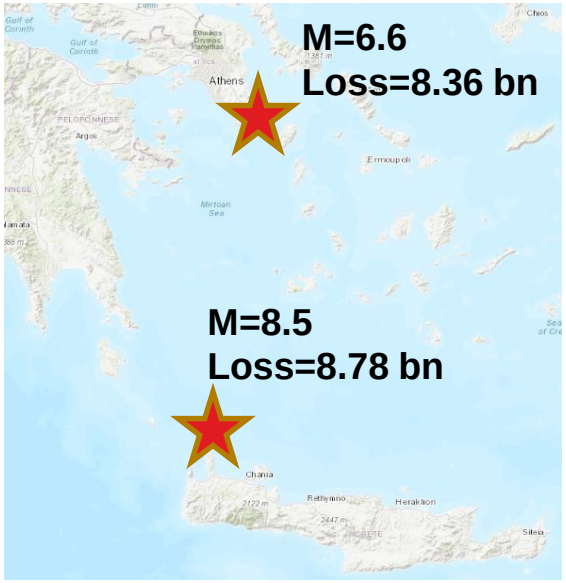


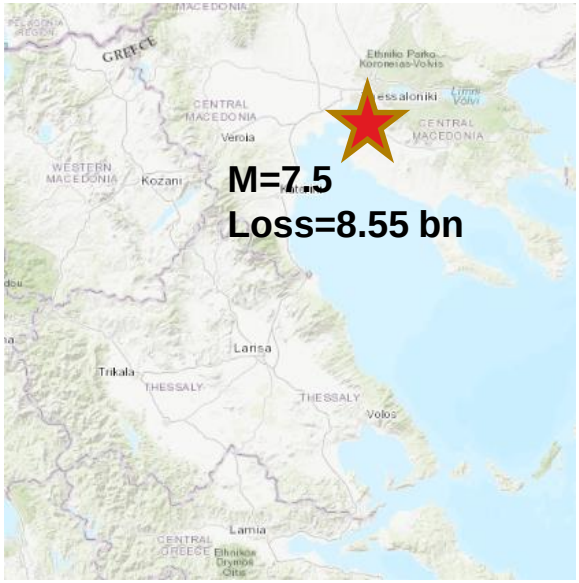
- Parnitha 1999 earthquake was generated for the actual exposure.
- The estimates from three different models (table below) are between 2bn and 4.5bn EUR

Parnitha 1999 earthquake as-if today	Model A	Model B	Model C
Loss [EUR m]	2,075	4,540	2,578

Historical as-if Scenarios

Historical scenarios represent the as-if loss on the current exposure





Policyholder deductible	2%
Loss perspective	Gross
Total Replacement Cost	559,717,899,000

Event Year	Event Description	Event Loss
2008	Achaia - Ilia	319,728,598
2003	Lefkada	99,822,177
1999	Parnitha (Athens)	2,074,554,552
1995	Aegion	137,946,711
1986	Kalamata	465,533,554
1978	Thessaloniki	919,451,436

None of the historical events reaches the 1in200 level

Possible realizations of 1in200 PML from Model A stochastic catalogue:

- **Event ID 2968043** (**Gulf of Corinth** - East), **South-East of Athens** region, **M=6.6**, Loss 8,355,366,311 EUR
- **Event ID 2950756** (Volvi 4) **Thessaloniki**, **M=7.5**, Loss 8,546,008,785 EUR
- **Event ID 2945567** (Western **Hellenic Subduction Zone**), **NW of Crete**, **M=8.5**, Loss=8,782,957,614 EUR

Insurance Penetration Levels – Impact on 1in200 PMLs

		Insurance Penetration			
Model	**Policyholder deductible**	**100%**	**75%**	**50%**	**25%**
Model A 1in200 [mil EUR]	2%	8,481	6,361	4,240	2,120
	0%	9,987	7,491	4,994	2,497
Model B 1in200 [mil EUR]	2%	6,204	4,653	3,102	1,551
	0%	6,639	4,979	3,320	1,660
Model C 1in200 [mil EUR]	2%	8,249	6,187	4,124	2,062
	0%	9,772	7,329	4,886	2,443

- Modelled PMLs for penetration levels < 100% were **derived on a proportional basis** → this means that for all the levels 25% - 75% we assume uniformly reduced penetration across all regions, construction types and age bands.

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