Assessing the impact from earthquakes and volcanoes: What is different and what is not

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VOLCANOES AND EARTHQUAKES

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VOLCANOES AND EARTHQUAKES

ARE THESE TWO PICTURES THAT DIFFERENT FROM A RISK ASSESSMENT POINT OF VIEW?

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RISK ASSESSMENT 101

INTEGRATED RISK

PHYSICAL RISK

Probability of damage and loss due to natural hazards

SOCIOECONOMIC INDICES

Measuring the vulnerability of a society or economy and their ability to cope with natural hazards

Hazard

Probability of occurrence of natural hazards

Exposure

Description of the assets at risk

Vulnerability

Probability of loss due to natural hazards

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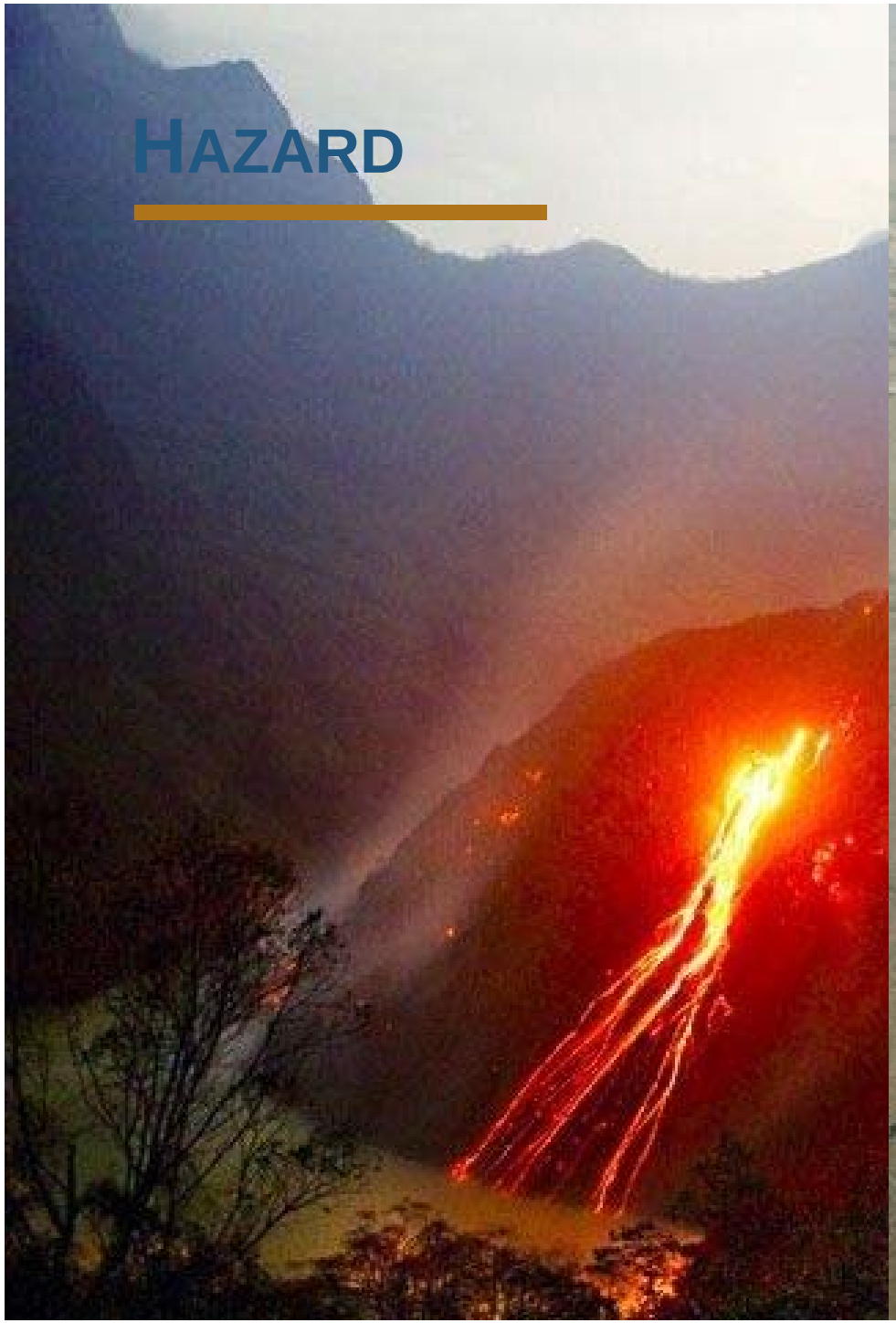
HAZARD



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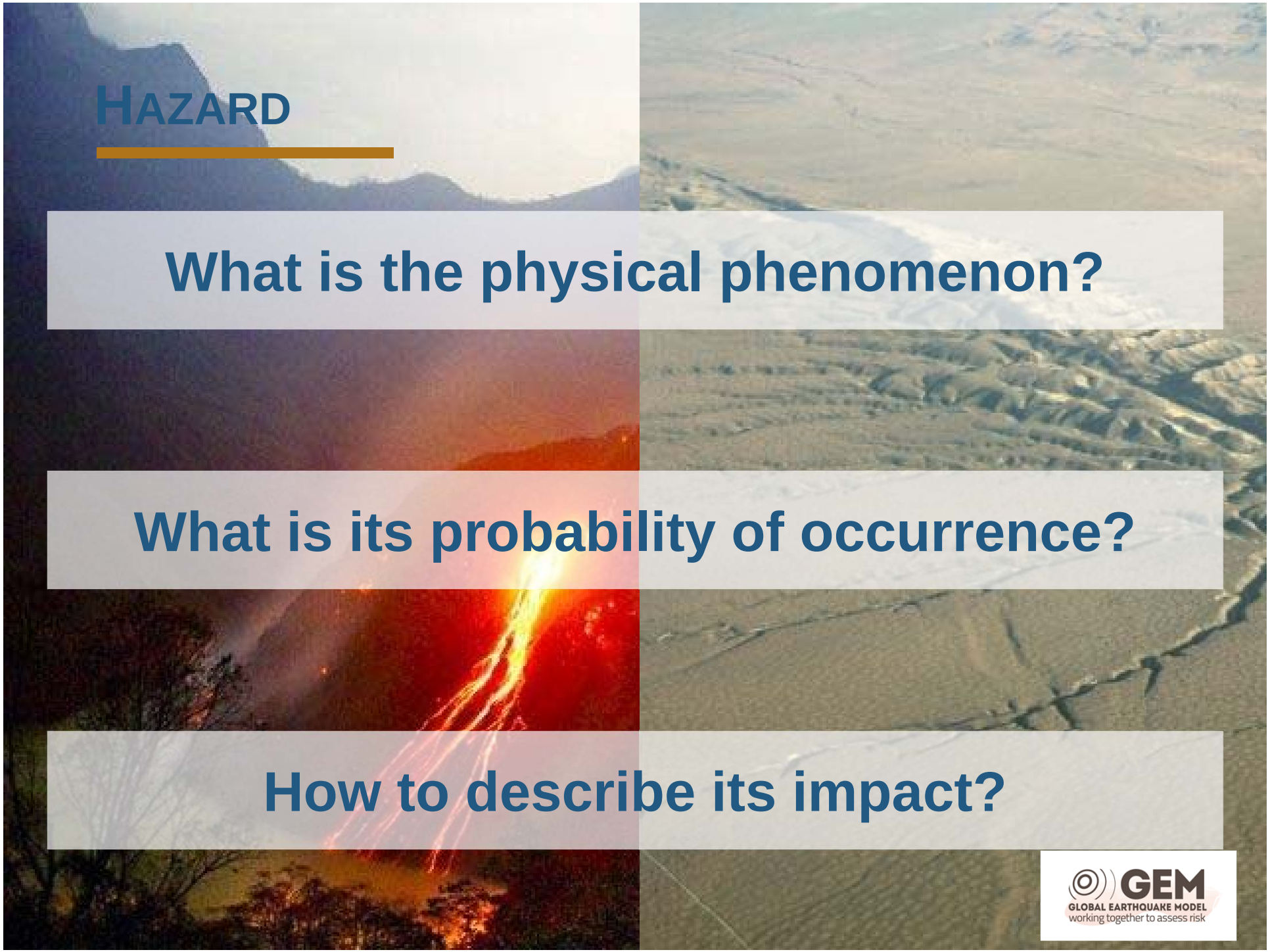
HAZARD
What is the physical phenomenon?
What is its probability of occurrence?
How to describe its impact?
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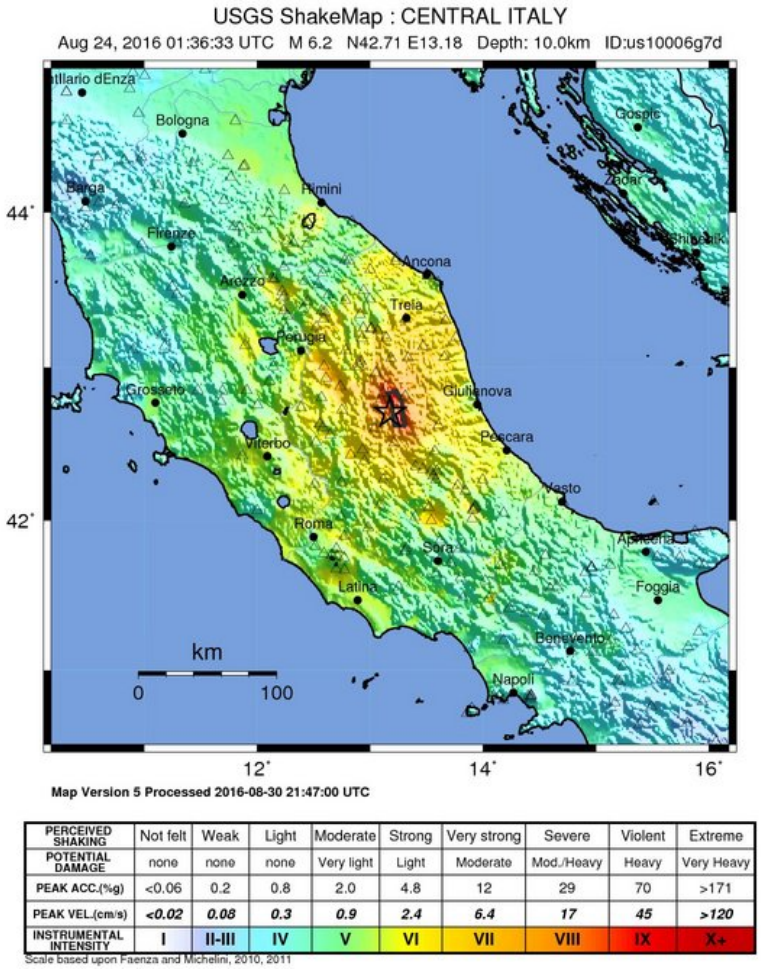
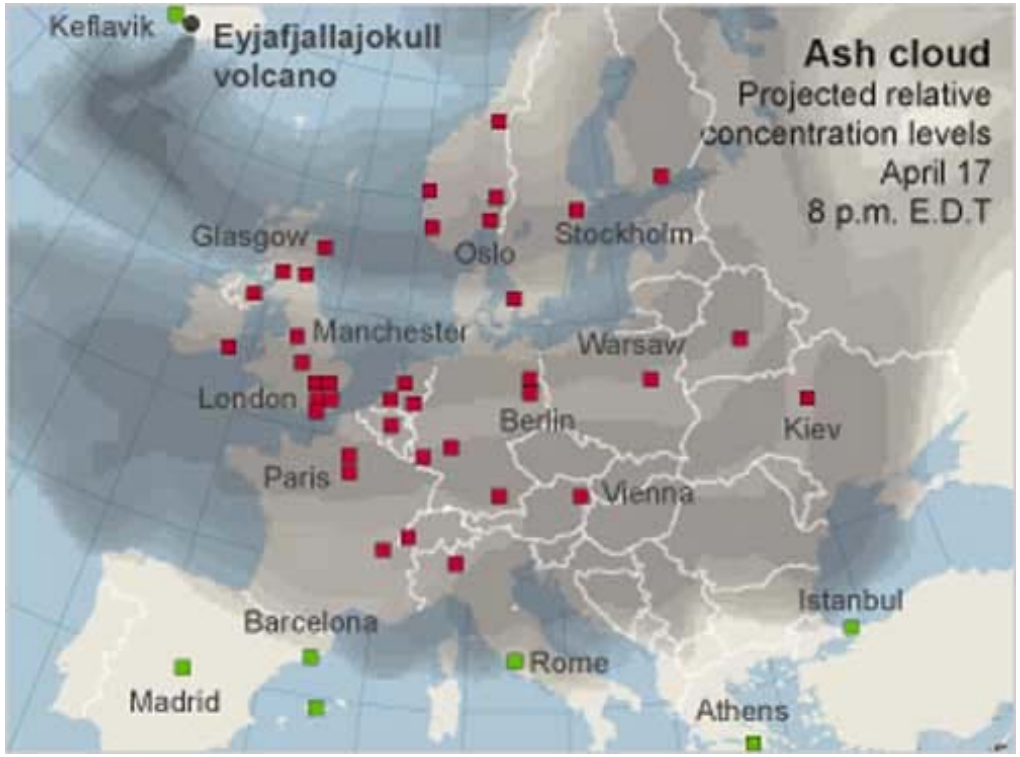
HAZARD

- **EXAMPLE: GROUND SHAKING *VS* ASH FALL**



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.06	0.2	0.8	2.0	4.8	12	29	70	>171
PEAK VEL.(cm/s)	*<0.02*	*0.08*	*0.3*	*0.9*	*2.4*	*6.4*	*17*	*45*	*>120*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Faenza and Michelini, 2010, 2011



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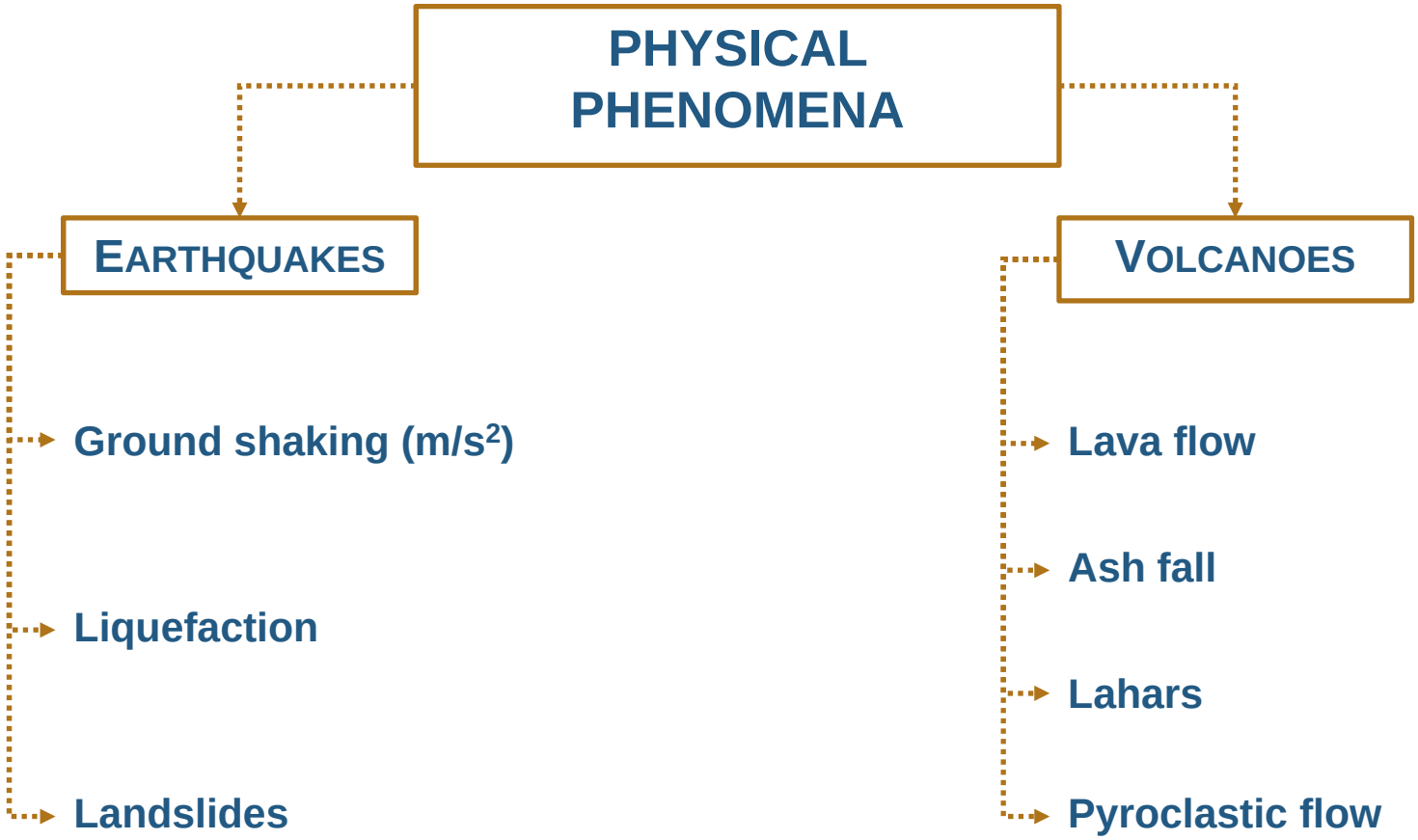
HAZARD

- DIFFERENCES BETWEEN BOTH HAZARDS



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EXPOSURE

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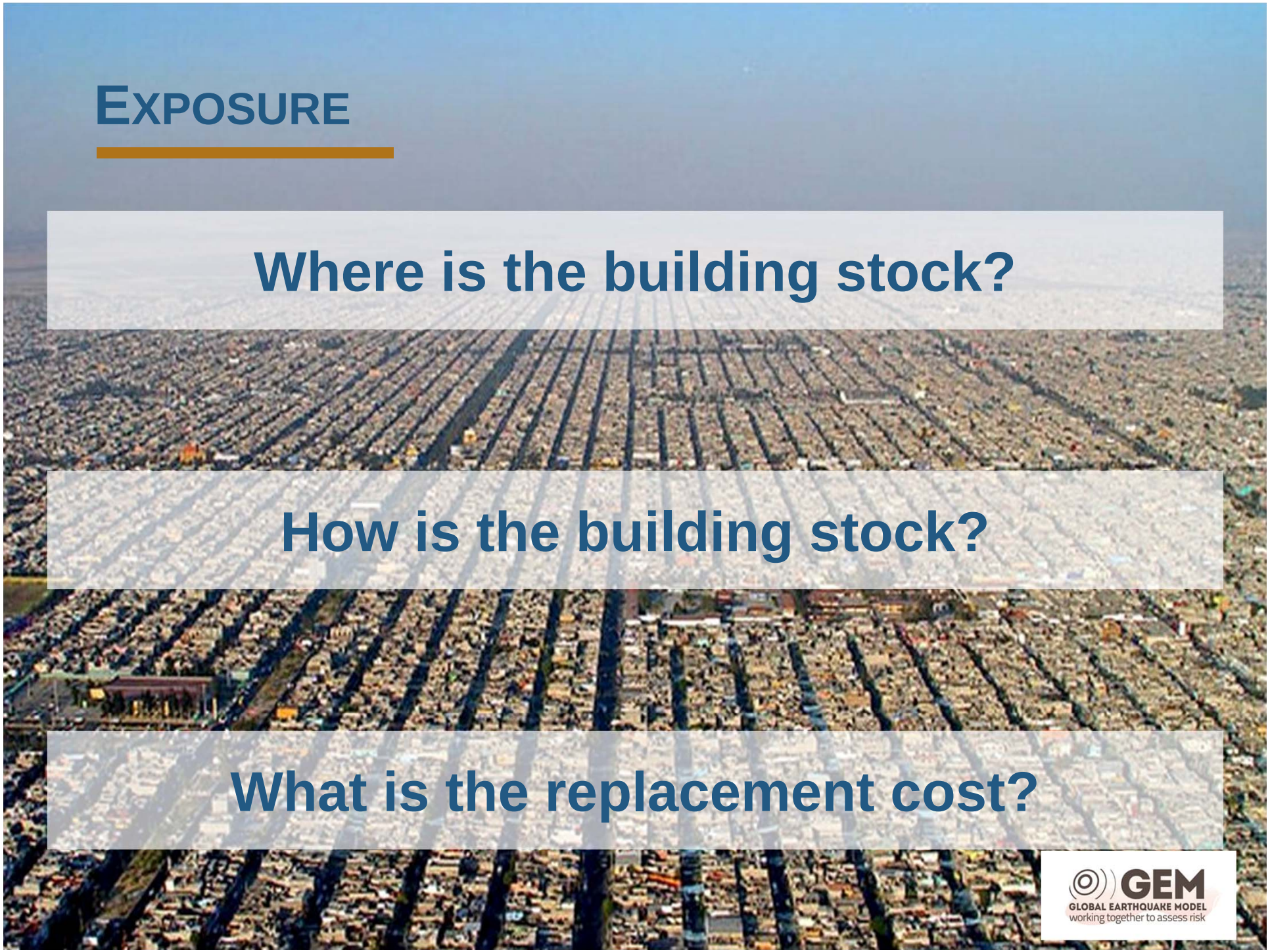
EXPOSURE



Where is the building stock?

How is the building stock?

What is the replacement cost?

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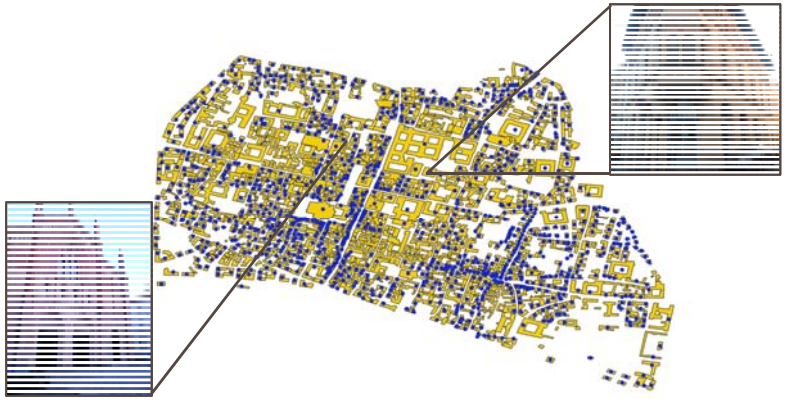
EXPOSURE

- WHERE IS THE BUILDING STOCK?



Local survey (e.g. Inventory Data Capture Tools)

Satellite imagery

Night lights

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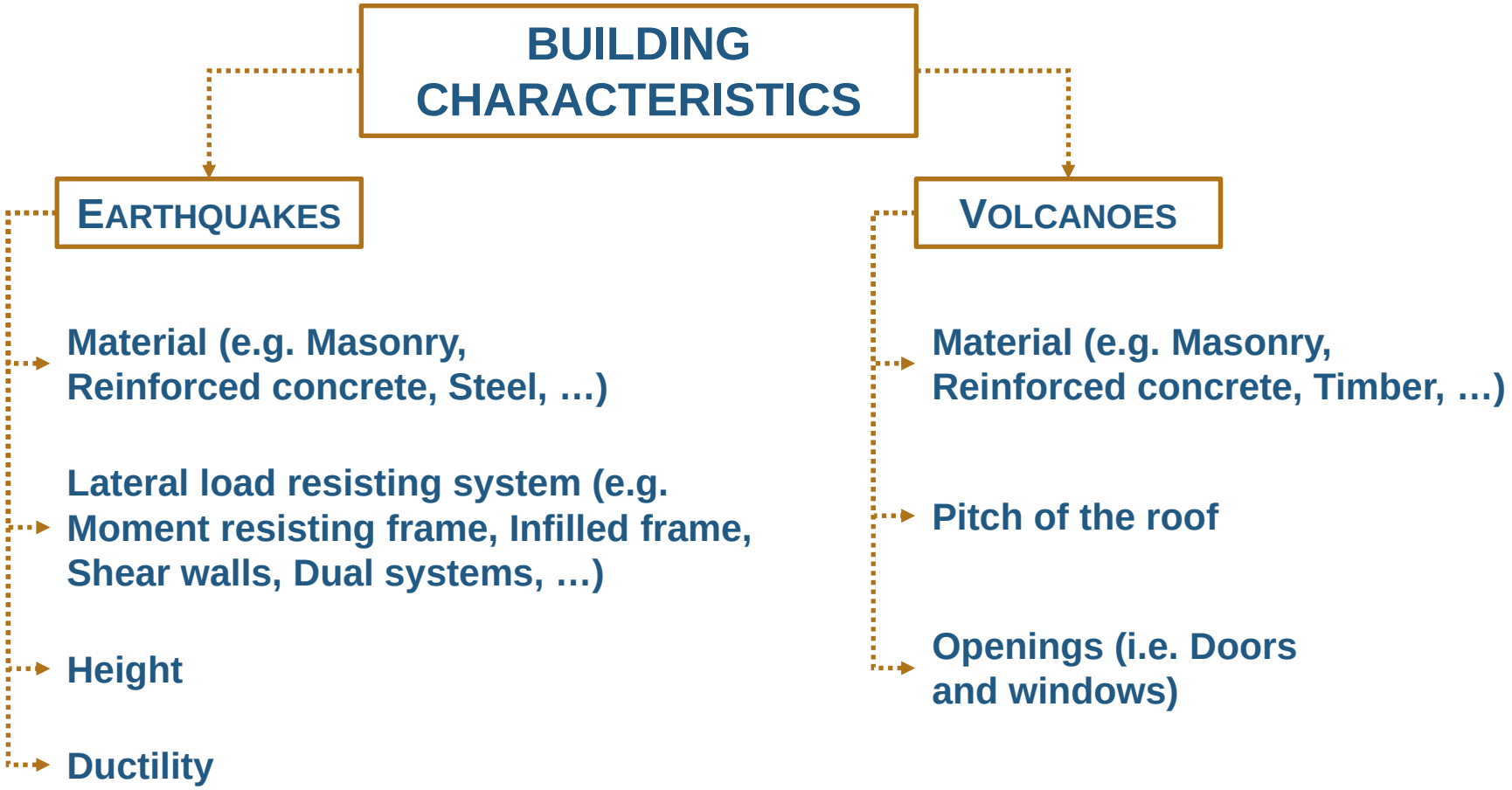
EXPOSURE

- HOW IS THE BUILDING STOCK?



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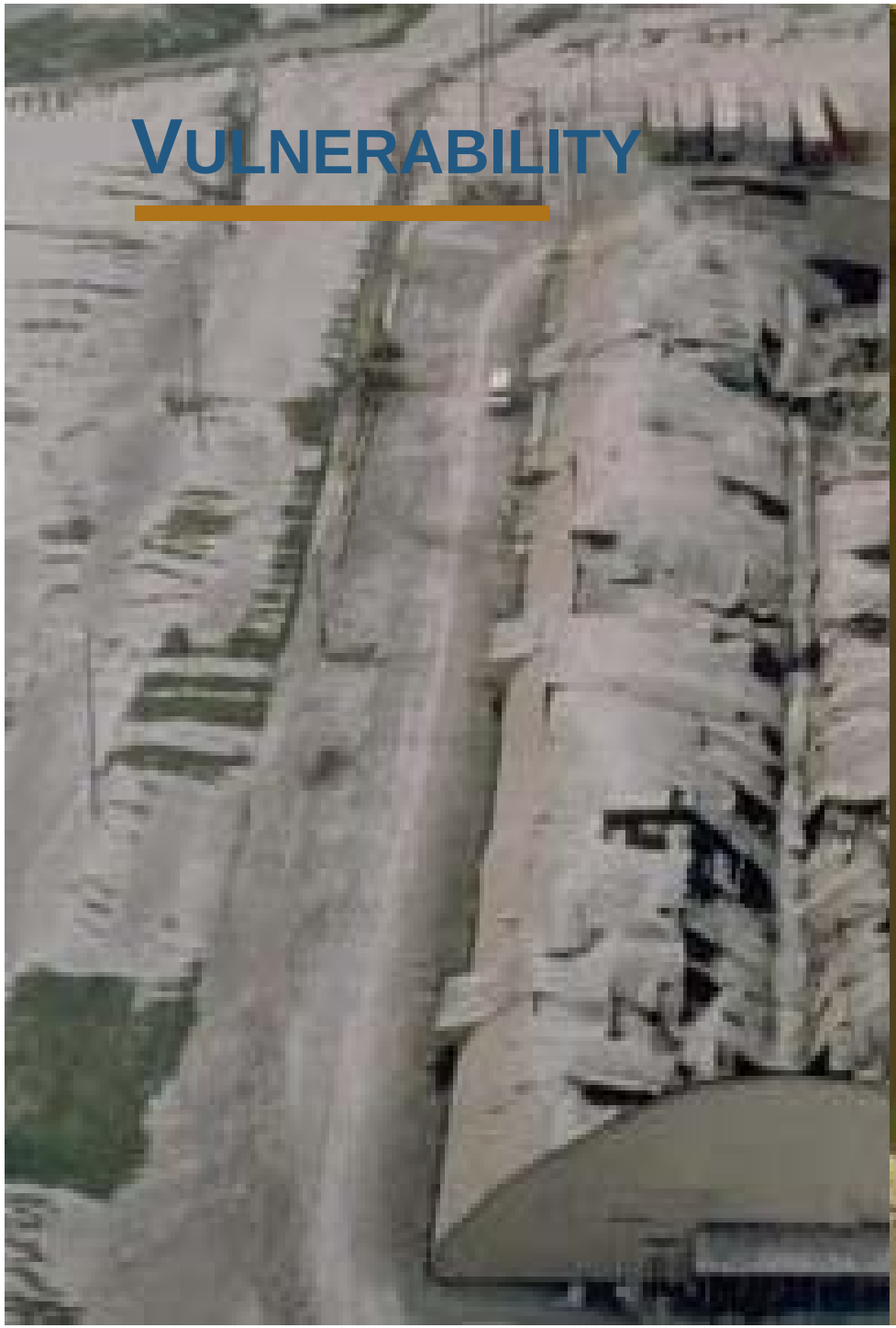
VULNERABILITY



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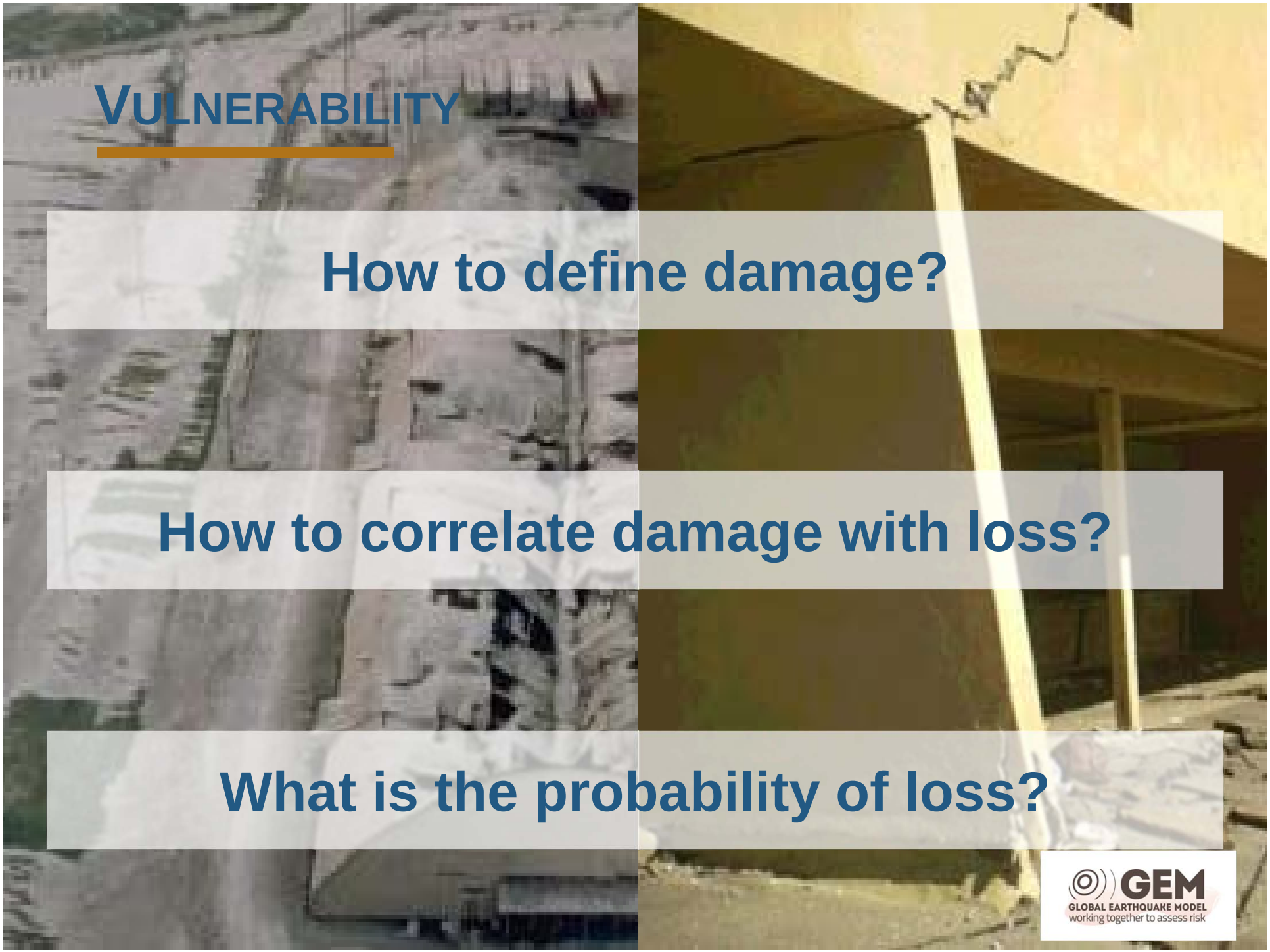
VULNERABILITY
How to define damage?
How to correlate damage with loss?
What is the probability of loss?
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VULNERABILITY

- HOW TO DEFINE DAMAGE?

Undamaged

Extensive damage

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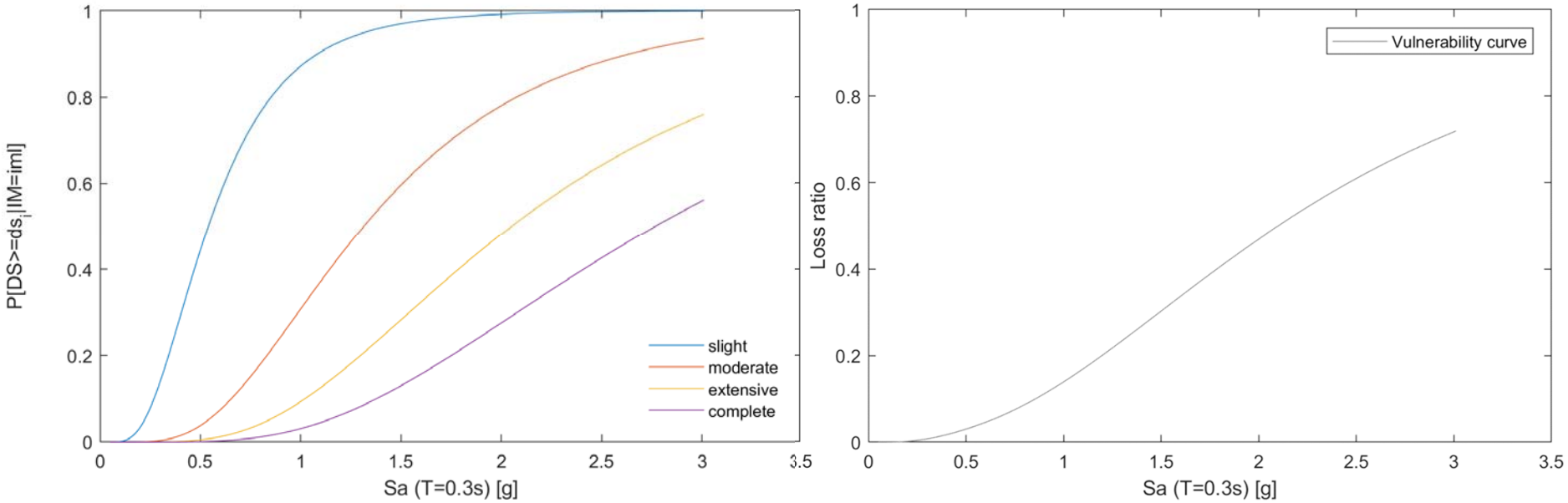
VULNERABILITY

- WHAT'S THE PROBABILITY OF DAMAGE/LOSS?



- **Example of fragility and vulnerability curves for RC ductile moment frame low rise**

Fragility and vulnerability models computed using the NLTHA module of GEM's Risk Modeller's Toolkit software package (Silva et al 2015).

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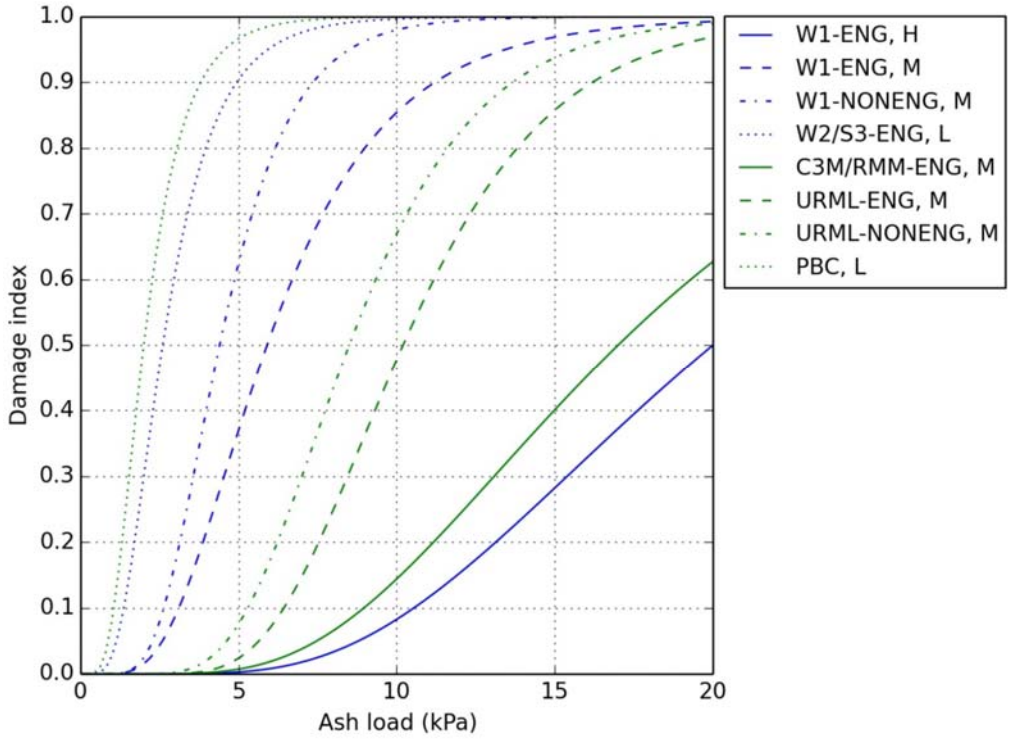
VULNERABILITY

- WHAT'S THE PROBABILITY OF DAMAGE/LOSS?



- **Benchmark curves developed during the volcanic ash sub-workshop (GAR 2015)**

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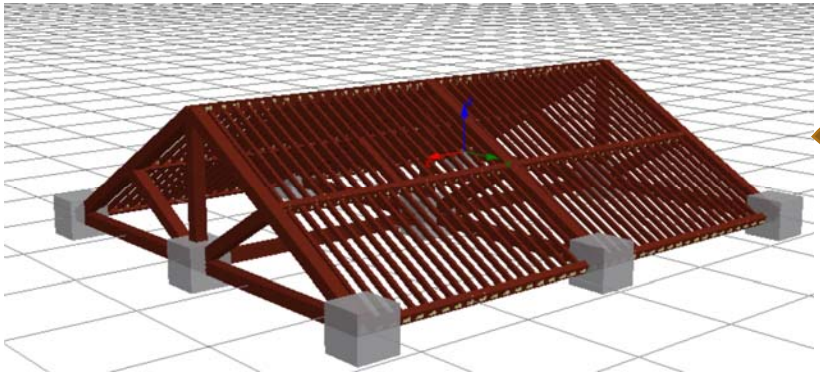
VULNERABILITY

- DEVELOPING ANALYTICAL VULNERABILITY MODELS FOR ASH FALL

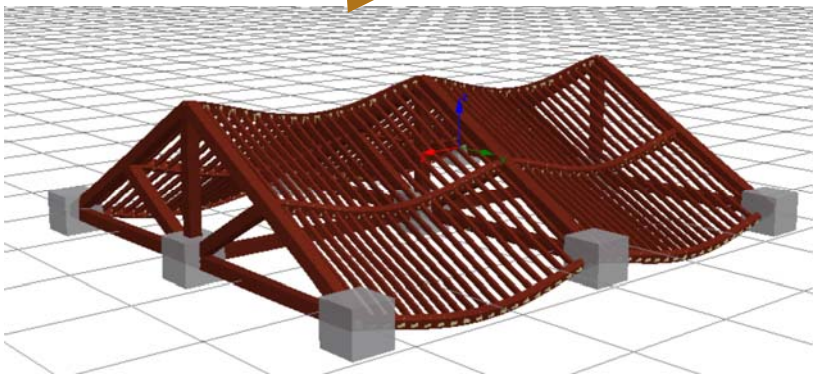


Initial shape

Example of model based on roof type A (Spence et al 2005)

Incremental vertical load

(e.g. Accumulation of ash)



Deformed shape

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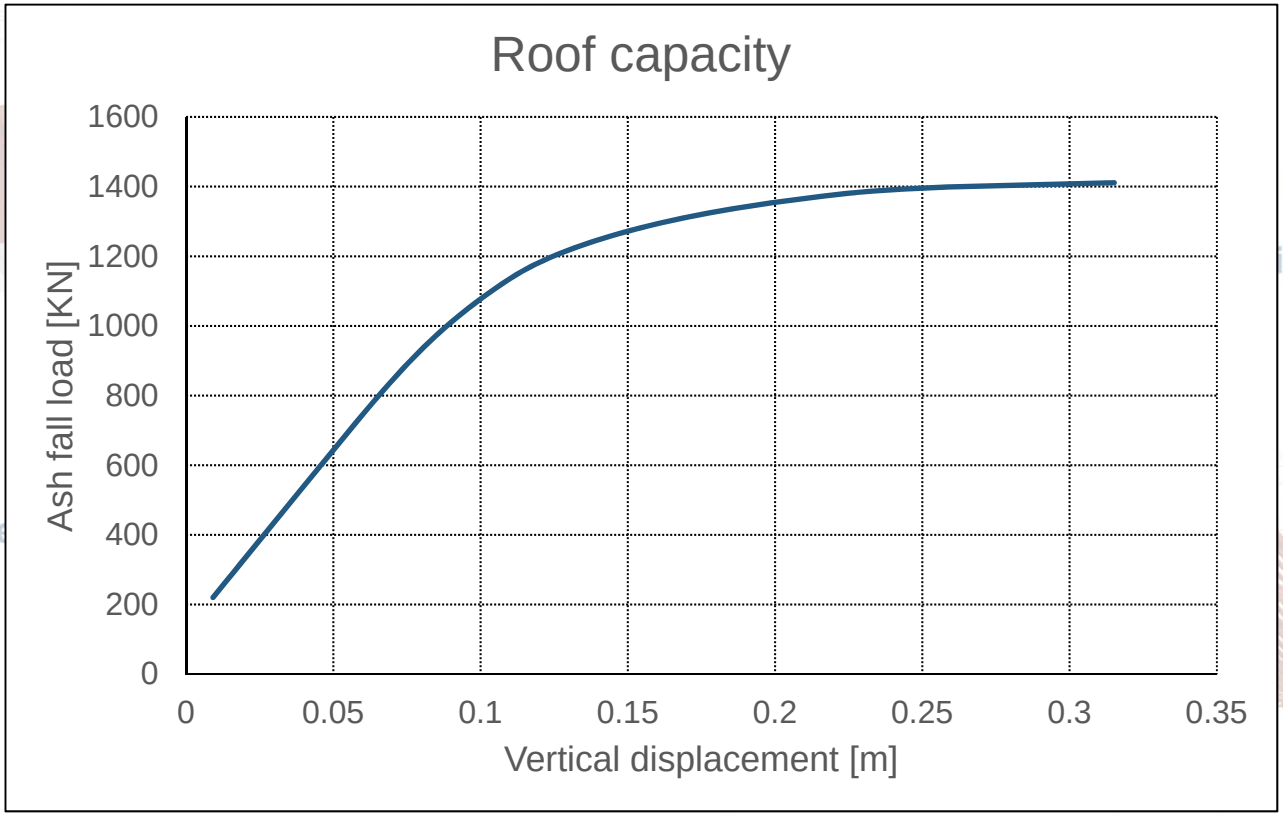
VULNERABILITY

- DEVELOPING ANALYTICAL VULNERABILITY MODELS FOR ASH FALL



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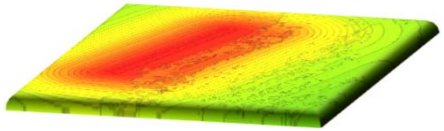
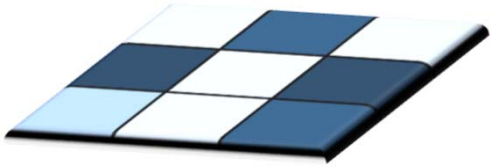
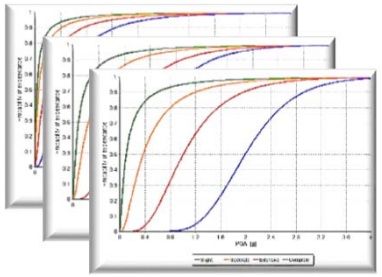
OQ Engine and Risk assessment



Intensity field

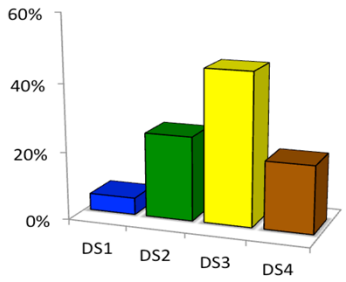


Exposure model

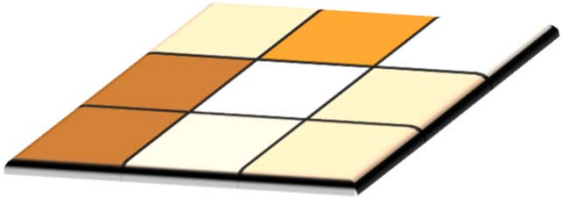


Fragility/vulnerability functions

OPENQUAKE
calculate share explore



Damage Distribution



Damage/loss map

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WHAT HAVE WE LEARNT?

- The mathematics of risk assessment is the same for earthquakes and volcanoes;
- The majority of differences come from the building information required (i.e. exposure) and the representation of the hazard;
- Collaboration can improve the understanding of both hazards

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