1. Once a damaged structure has been repaired, does it have reduced vulnerability?

Yes—when a structure is repaired after damage from a specific hazard, its vulnerability to future events of the same type is often reduced, assuming the repairs are done properly. This is typically due to the use of newer materials, modern construction techniques, and upgrades that address weaknesses revealed by the initial damage. The extent of vulnerability reduction depends on factors such as repair quality, adherence to updated codes, and whether resilience enhancements were included. However, vulnerability will be increased during the period between damage and completion of repairs; any risk analysis performed prior to the damage should be updated post-event to reflect the change in vulnerability.

1. Can you comment on the reliability of JUST using the engineering curves to estimate financial damage to a property?

Engineering curves are a very good starting point when no empirical data is available. However, they are very sensitive to modelling assumptions thus the user must be careful to understand very well the difference between the property they wish to estimate damage for, and the engineering assumptions that were made in deriving the curves. Additionally, engineering curves tend to be more reliable for large losses (high levels of damage) than for low losses (low damage states). This is because engineering curves are very good at capturing structural damage mechanisms, but poorly captures non-structural damage processes, which drive the lower losses.

1. Would a vulnerability curve library help the community?

Yes, as it would allow everyone to access a clear, curated repository of curves for all to refer to and use. It would help developers address gaps in data availability by using previously derived curves as a baseline for curve porting (adjusting curves fir use in geographies they were not originally developed for), help researchers focus efforts on plugging the gaps (which are more easily identifiable through a single source of information) or improve existing curves rather than duplicating curves, and help users access and better understand the curves that fit their needs more efficiently. One issue here is the tug of war between the shared need for more widely available information, and IP considerations where non-academic players do not have an incentive to share their results. This problem will need to be resolved if such a library is ever to spread beyond academically-derived curves.

1. How will expanding, albeit imperfect, satellite damage observations affect vulnerability modelling?

Any additional damage data will be useful in refining vulnerability functions. Satellite data is often best suited to the capture of large quantities of coarse damage data (e.g., collapsed vs standing buildings), and may not help much in refining estimations for lower damage states but will definitely be a game changer in regions / for severe events where it is challenging to capture a large enough sample of good quality empirical data. Ground surveys of damaged and undamaged buildings in the areas for which Earth Observation (EO) data is captured, would be important to build confidence in the analysis of damage from the EO data.

1. Is there an overlap between modelling Business Interruption and PLA?

Business interruption (BI) and Post-Loss Amplification (PLA) can be both seen as “indirect” losses, consequences of the primary damage suffered by the property / asset under consideration. However, BI and PLA are distinct concepts, 2 different types of “indirect” losses if you will, thus they are modelled separately. While PLA captures all increases in losses specific to an event / location that cannot be represented through the main vulnerability curve (e.g., labour or material cost inflation, for example), BI specifically captures the revenue lost as a result of the property being damaged, and therefore only applies to commercial or industrial lines. PLA may apply to all coverages, including residential. The economic cost of disruption to service infrastructure is an area of increasing interest for governments – for example cost to the economy of decreased tourism if the main airport on an island is damaged, or cost due to damage of the transport network that interrupts supplies or forces longer routes.

1. You have to be careful you don’t introduce too much correlation of the secondary uncertainty, as much of the differences can be down to building design or construction modifications which may be unknown or uncategorised.

Indeed, it is difficult to know exactly which amount of correlation is appropriate in each case. It is however good to be aware of its effects on the losses, and take it into account when performing sensitivity analyses or calibrating models.