



# Exploring the costs of sea level rise: should we focus on 'means' or 'extremes'?

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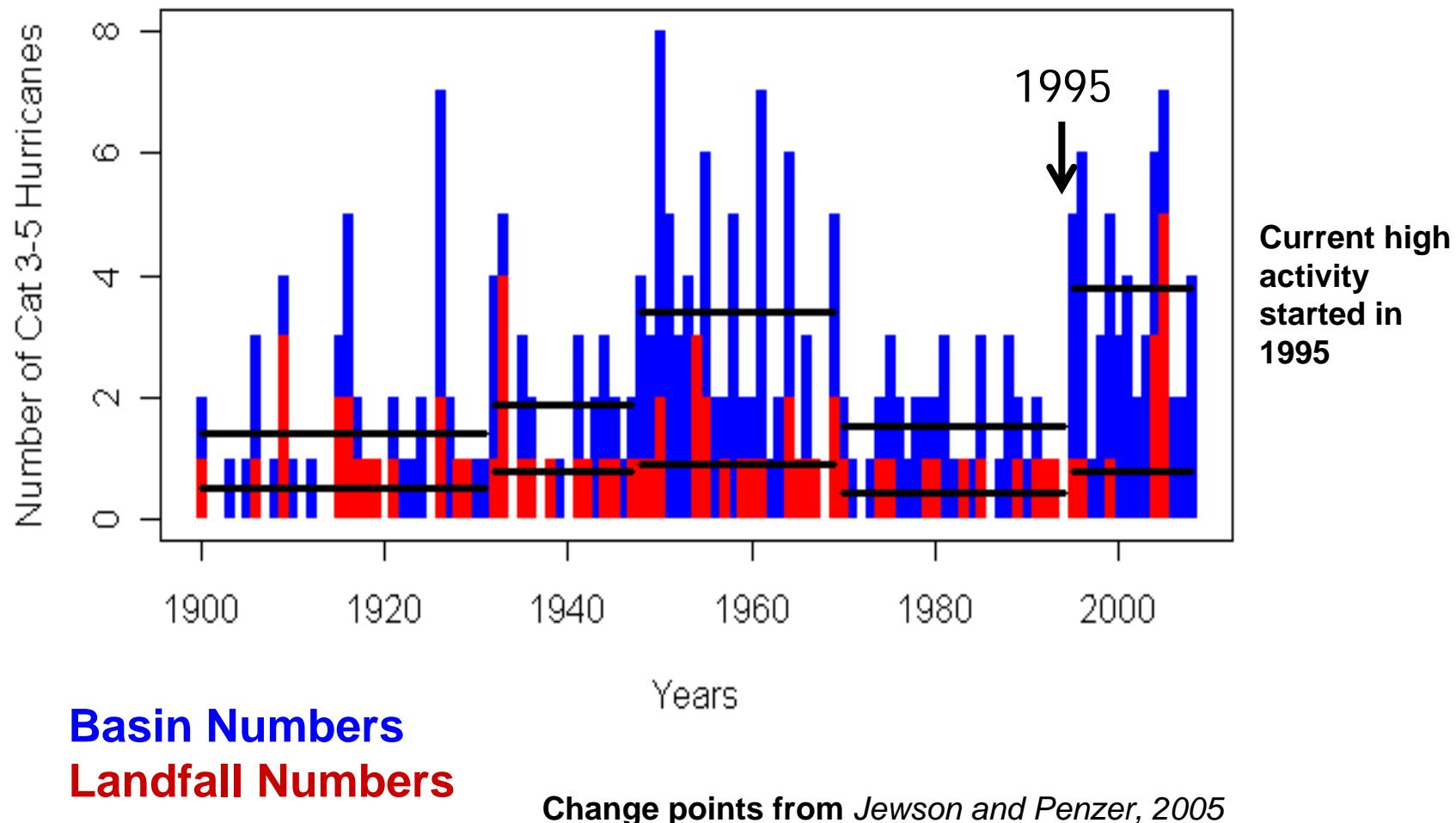
*Chief Research Officer, RMS*

AAAS  
Chicago  
Feb 16<sup>th</sup> 2009

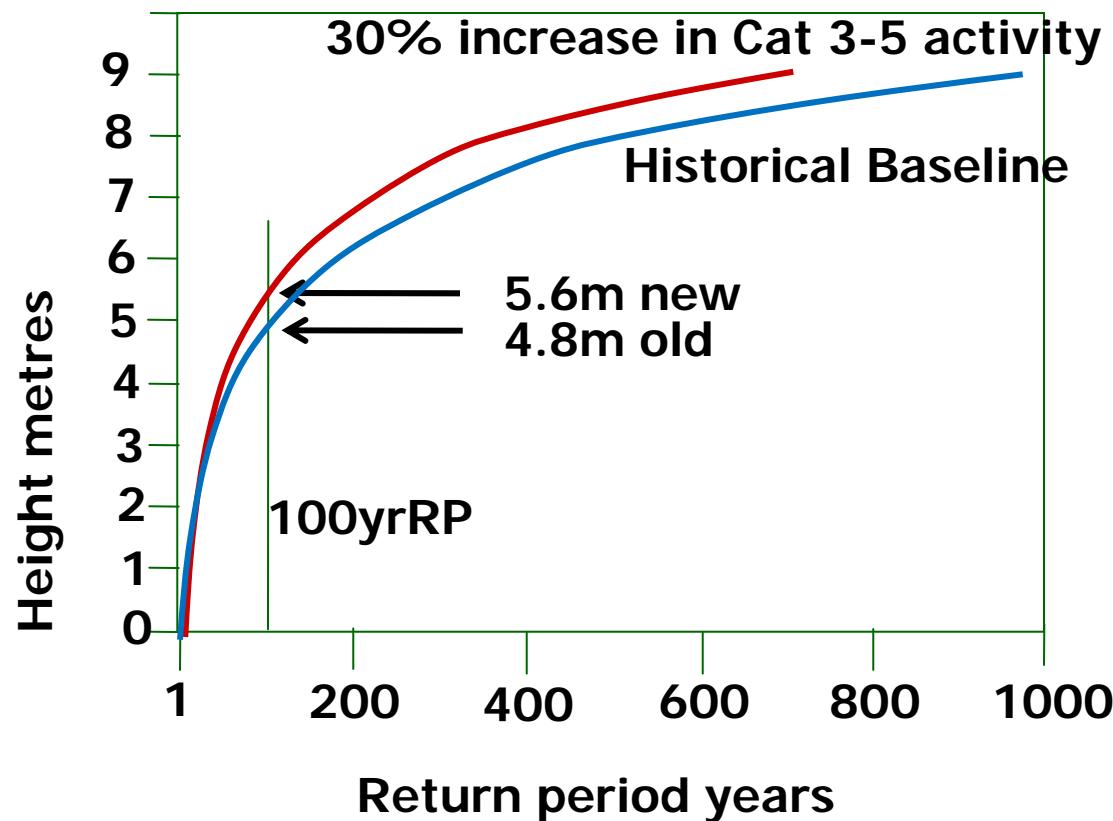


# Change Points in Cat 3-5 Hurricane Numbers (the drivers of major coastal storm surges)

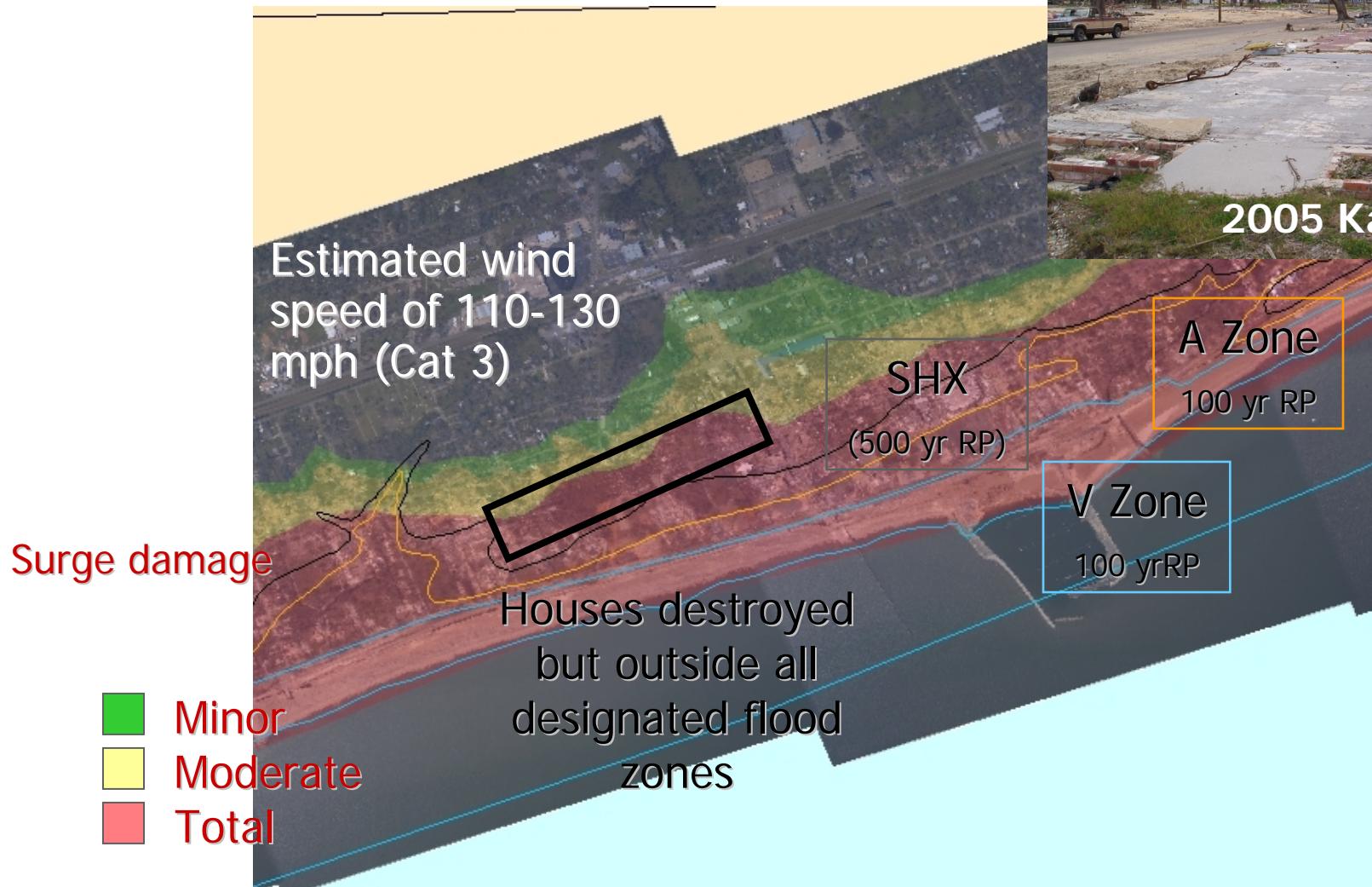
## Cat 3-5 Hurricanes



# Implications of changes in activity of intense Hurricanes on extreme sea levels



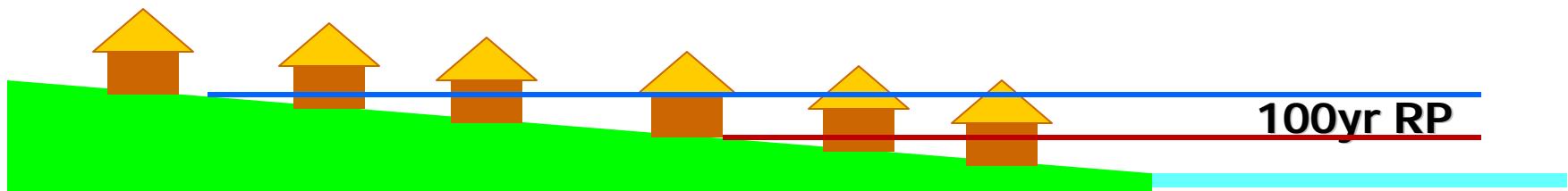
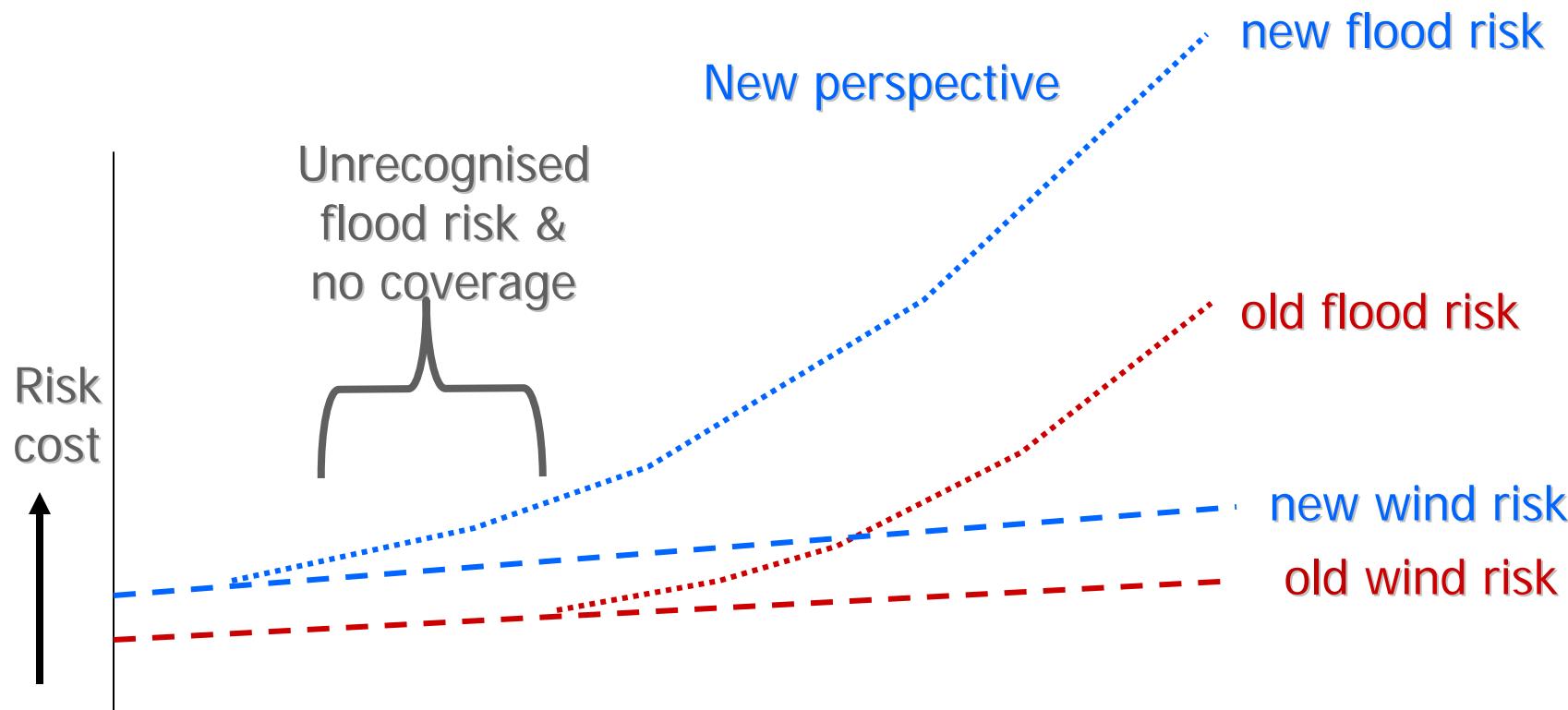
# Lessons for flood risk zoning Mississippi Coast



Confidential

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# Implications of an increase in Hurricane activity





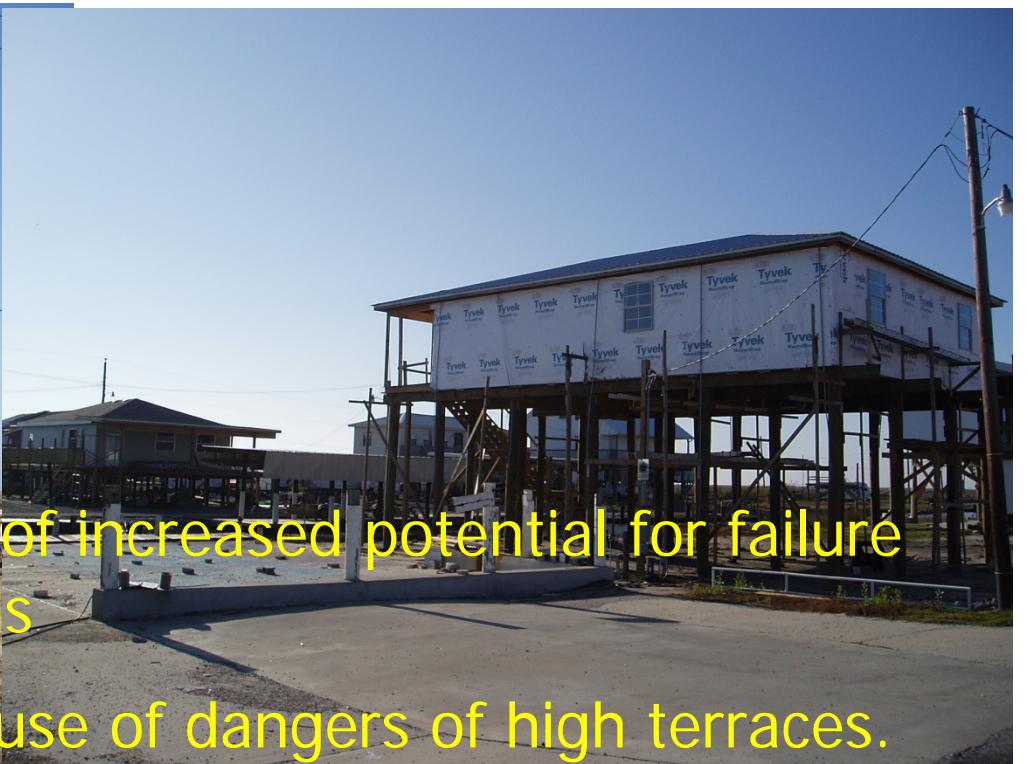
In Hancock County (Mississippi) – Nov 2005 - FEMA has admitted risk 'has increased' in the coastal Flood zone

- new and replacement buildings will need to be sited up to 10 feet higher
- V zone (high velocity flooding) extends to 12 feet higher

Q. However why haven't flood zones been expanded along all the hurricane coasts? A. Because this is politically unacceptable.

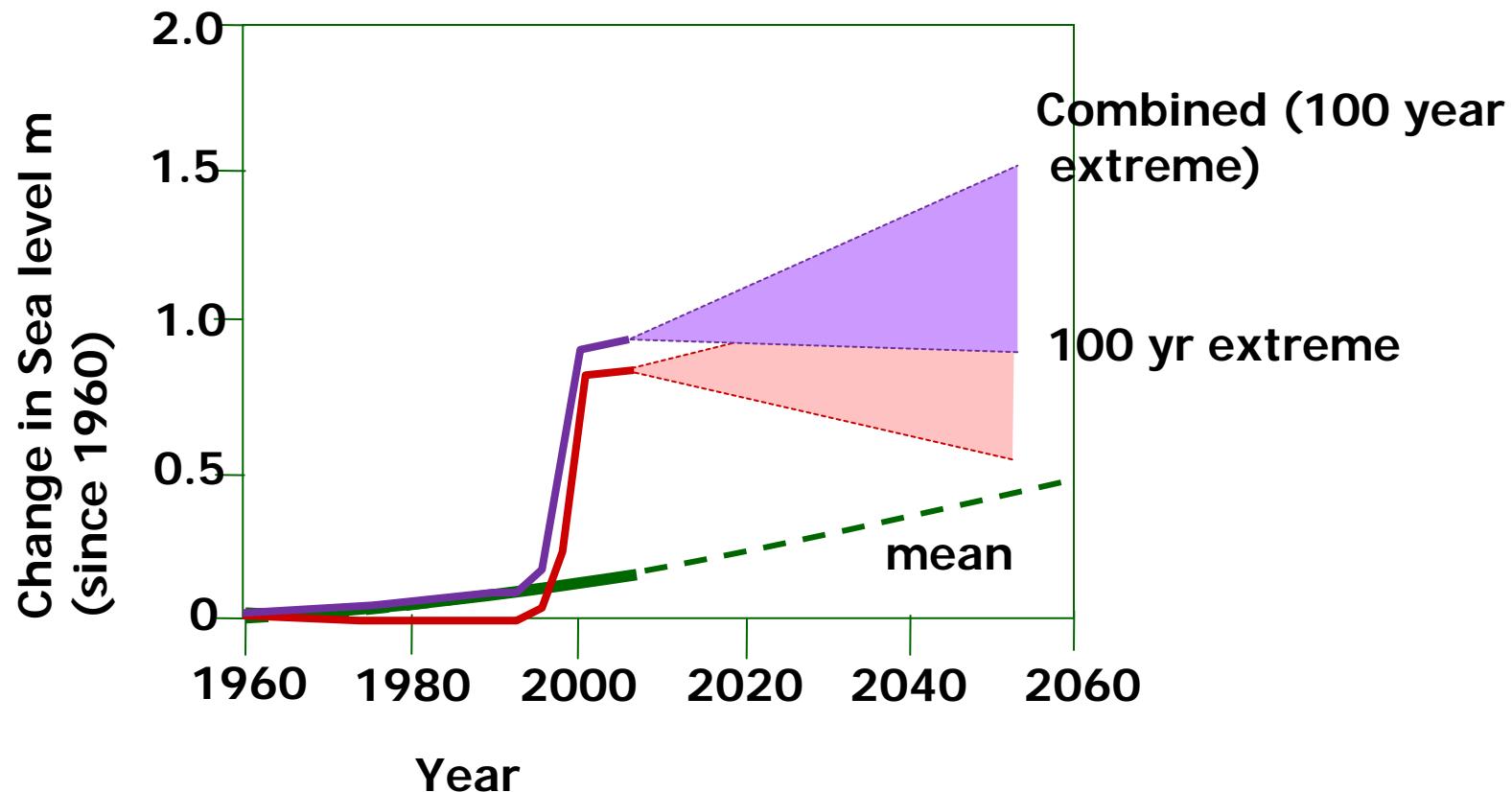
# FEMA as a force of adaptation (Grand Isle LA, Feb 07)

- Buildings being raised 1.5m to achieve new FEMA base flood elevation (and therefore be eligible for NFIP)



- However no consideration of increased potential for failure due to hurricane wind loads
- Insurability problems because of dangers of high terraces.

# Rates of sea level rise (US Gulf Coast)



**Oil refineries around the Gulf Coast were sited during a period of lower hurricane activity and are very hard to relocate**



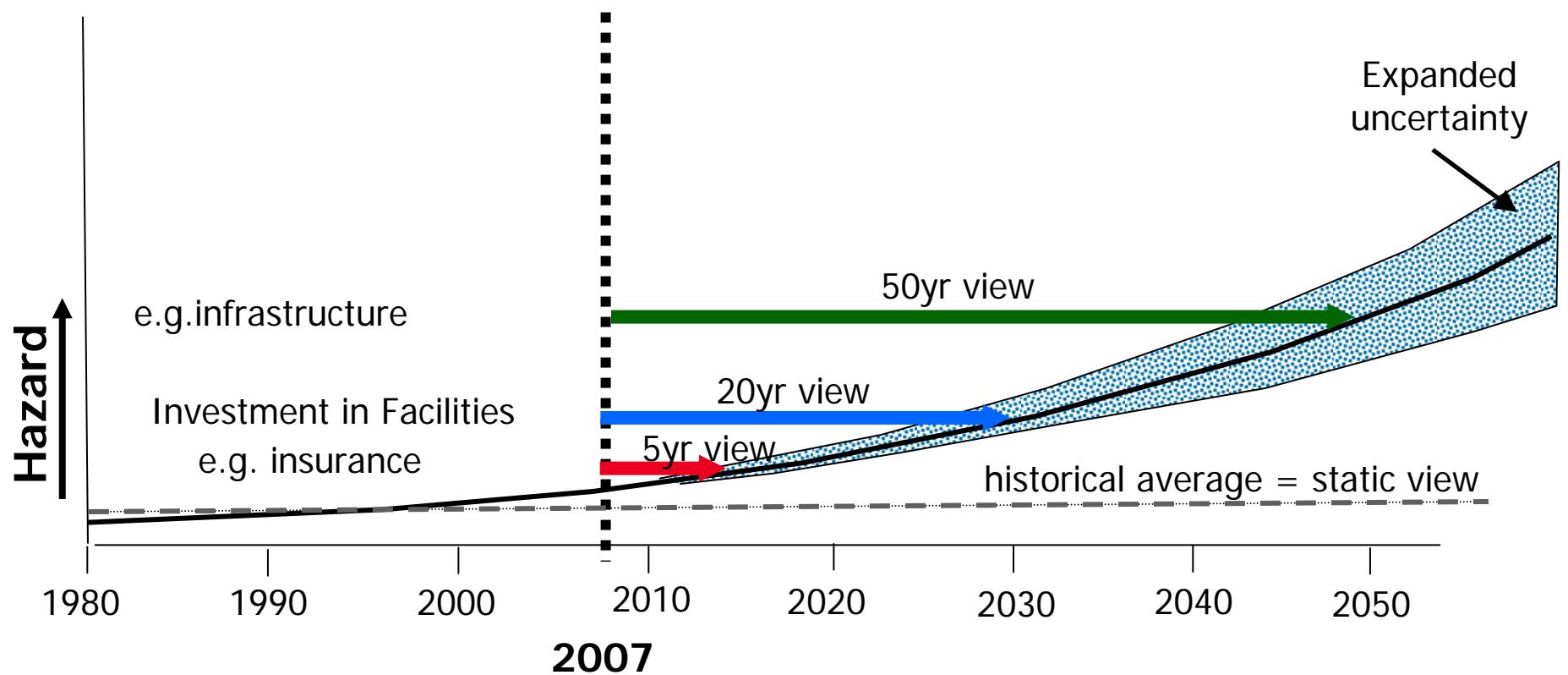
# Many Critical assets are located close to sea level

- Le Blayais Nuclear Power Plant on the Gironde estuary SW France, 50km NW of Bordeaux
- Site protection height of 5.02m
  - Protected by 5.2m dyke in front 4.75m at the side
- Dec 27<sup>th</sup> 1999 Surge from Windstorm Martin
  - Reached c 5.3m



- Water entered the general gallery at 6-12m<sup>3</sup>per sec. – total of around 90,000m<sup>3</sup> of water – 0.3m deep
- Inundated and disabled the essential service water pumps to Unit 1
- Level 2 onsite emergency Plan put into operation. Reactors all shut down.
- Rising sea levels and storm surge heights will be an increasing problem for coastal Nuclear Power Plants.

# Implications of changing hazards on investment horizon

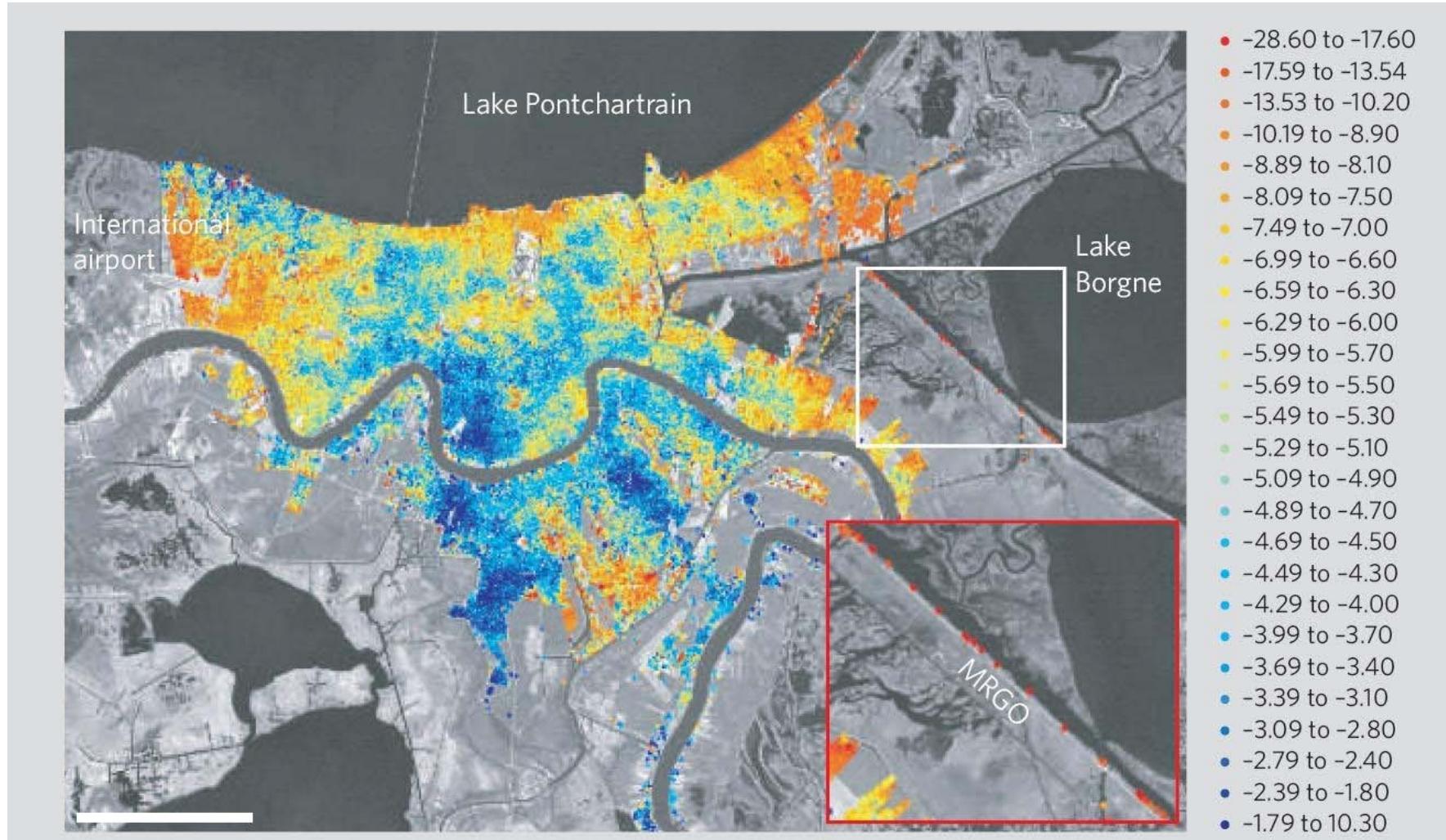


**Each horizon gives a different perspective**

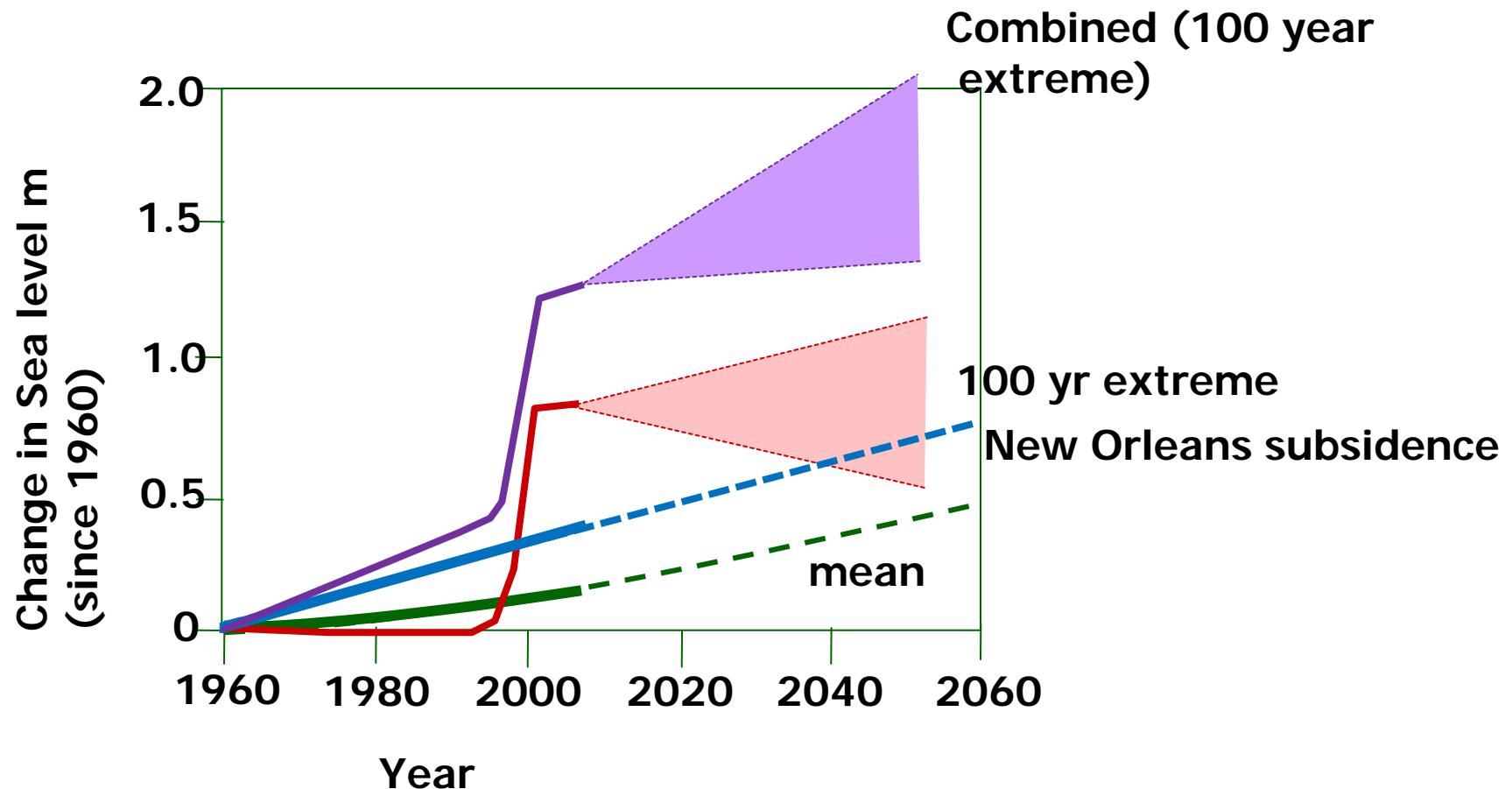
# The future of New Orleans



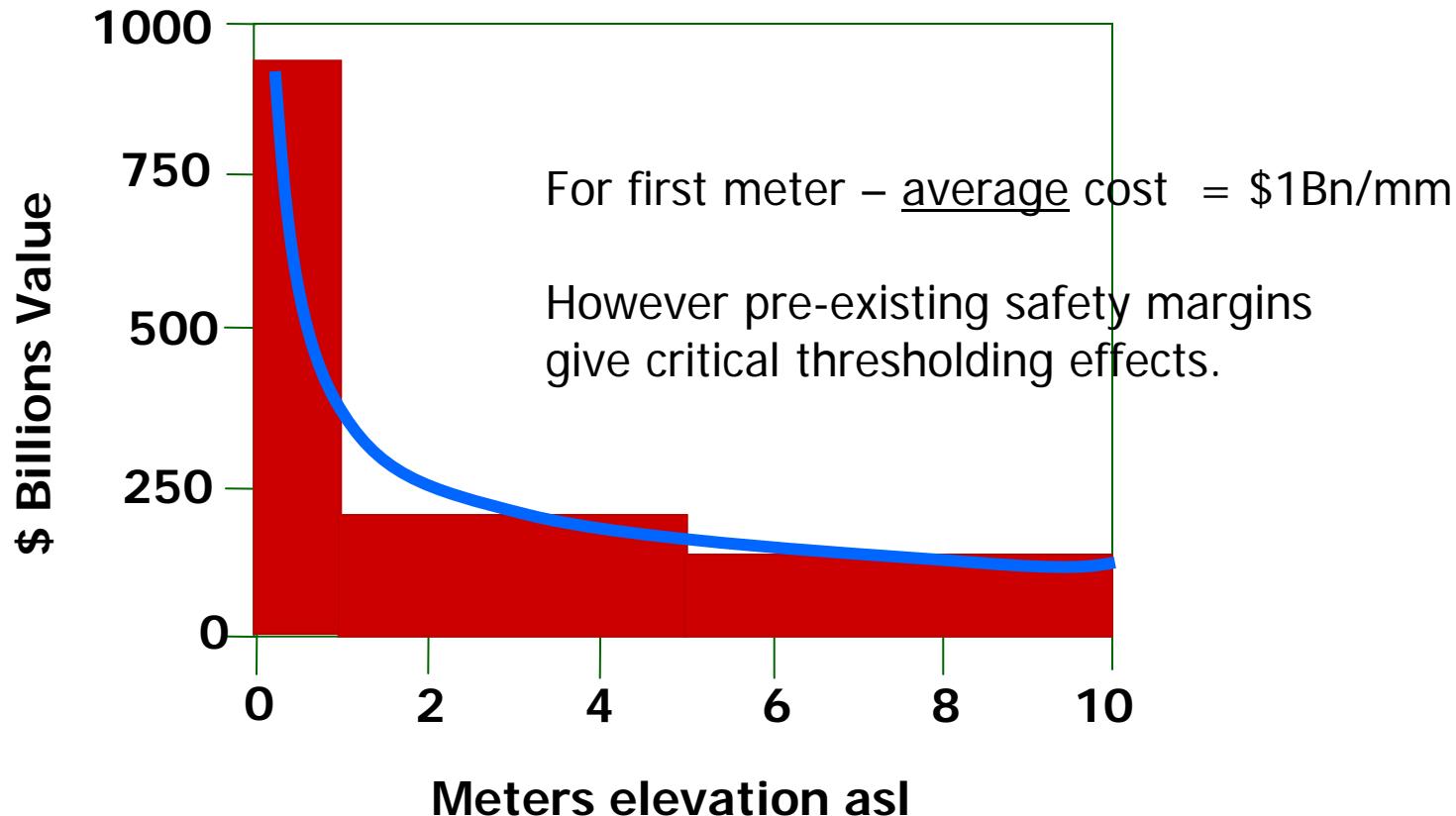
# Subsidence from radar interferometry



# Rates of sea level rise (New Orleans)

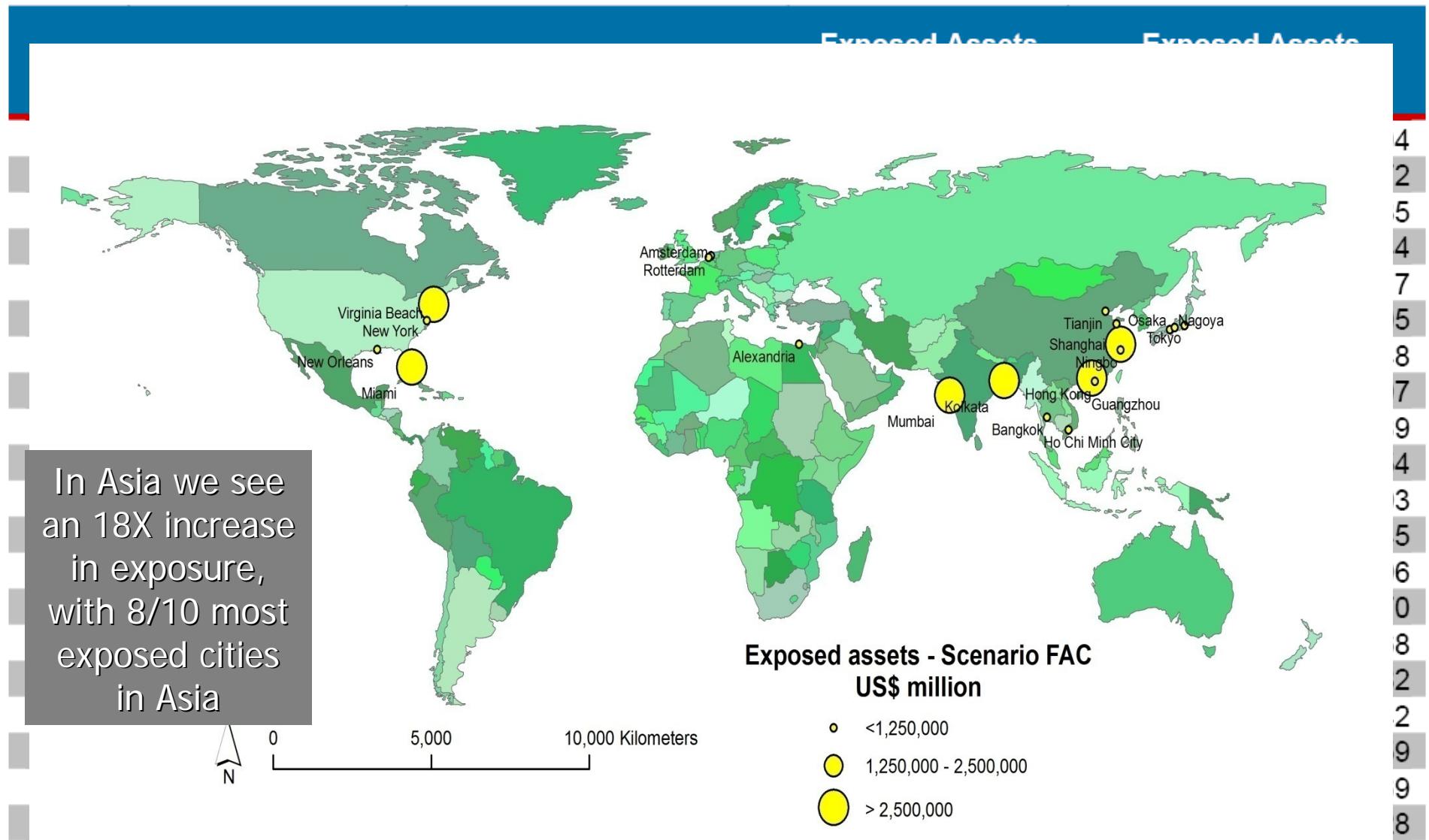


# The PDF of global exposure value by elevation



Reconstructed from Anthoff et al., (2006)

# Top 20 Cities for 'Exposed Assets' by 2070s



# Retreat as a form of Adaptation



Dauphin Island, Alabama  
(hit by Ivan, Dennis & Katrina)