Attachment 5

INSURANCE, AND LONG-TERM RISK MANAGEMENT

September 2016

Final Report for Resolution R-49-15 in support of the Sea Level Rise Task Force final recommendations

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Note on all figures:

If you have any questions or trouble reading any of the figures, please contact the Office of Resilience at green@miamidade.gov to request additional information or a higher resolution version.

Introduction – Supporting Resolution & Context

In January 2015, the Miami Dade Board of County Commissioners passed Resolution 49-15, which directed the Mayor

> "to initiate discussions related to climate change with private insurance and reinsurance professional organizations, member local governments in the Southeast Florida Climate Change Compact, the Florida Office of Insurance Regulation's Department of Finance Services, and other key stakeholders to develop long-term risk management solutions."

This resolution built upon previous efforts including a roundtable discussion in September 2014, hosted by the Mayor, the Beacon Council, the British Consulate General in Miami, and the British Ambassador to the United States, with key leaders from the insurance and business communities. This meeting focused on issues and opportunities associated with climate change and sea level rise in the U.K. and Southeast Florida. In addition, the Mayor announced he would convene a group of business, financial and insurance leaders to continue the dialogue around these critical business and financial issues at the Sixth Annual Southeast Florida Climate Leadership Summit.

To further this discussion the Office of Resilience, the Beacon Council, and the British Consulate General in Miami conveyed a second roundtable on January 11, 2015 with key representatives from the private and public sectors. A full list of meeting participants, the agenda, discussion questions, and presentations are provided in Appendices 1-4.

The three principle goals of this discussion were to draw upon the technical expertise of the private sector to help Miami-Dade County (County) staff:

1) better understand the physical and economic risks to Miami-Dade County,
2) improve the future insurability of County and privately-owned assets,
3) understand best practices and their potential implementation in Miami-Dade County

The roundtable discussion was held at the Beacon Council and included presentations from technical experts from the insurance and reinsurance industries, followed by a discussion structured around the three meeting goals.

The following report will first describe why the County chose to focus on insurance in the context of climate change and provide a summary of the key considerations and long-term risk management options available to the County that were discussed at the roundtable.

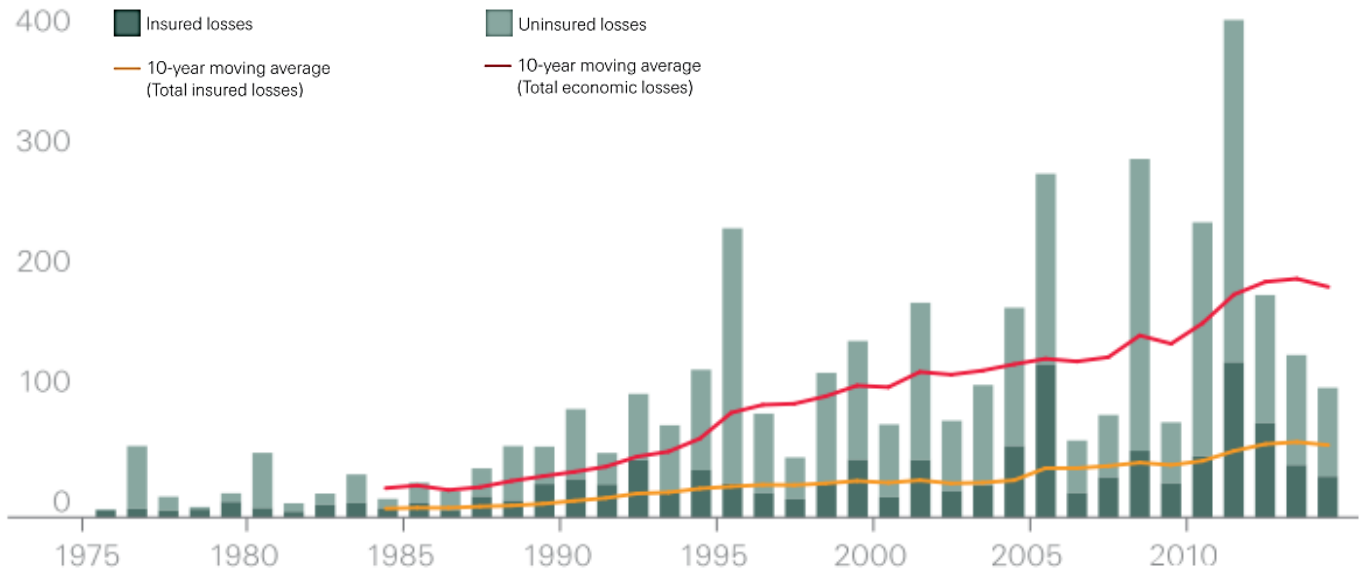
Why Focus on Insurance and Risk Management?

Miami-Dade County is vulnerable to multiple natural hazards which will likely be exacerbated by climate change, due to rising sea levels, the potential increase of more intense hurricanes, and changes in precipitation patterns. Despite projected risks, the County has a long history of preparing for similar hazards. Since Hurricane Andrew, the County has made substantial investments in preparing for hurricanes by strengthening building codes and improving internal capacity. As a result, the County can now draw upon both deep internal expertise within emergency management, risk management, stormwater management, and regional partners such as the South Florida Water Management District, the Southeast Florida Regional Climate Change Compact, and the Florida Climate Institute to better prepare for projected hazards.

As losses from disasters around the world increase (see Figure 1), governments are recognizing the importance of prioritizing investments in the long-term economic resilience of their communities. Hurricanes Sandy and Katrina underscore the importance of continually improving preparations and adopting new tools and best practices. The insurance and reinsurance industries have recently made significant improvements to their risk management tools and therefore engaging these industries to leverage their expertise can help the County better identify, prepare for, and insure the risks that cannot be mitigated.

Insurance and risk management are key components of Miami-Dade's long-term economic resilience. County residents annually pay more than $147 million in flood insurance premiums alone. The County, therefore, will continue to work cooperatively with the private sector and others to identify opportunities to more effectively prepare for hazards that will be exacerbated by climate change.

Figure 1: Global Natural Catastrophe Losses between 1975 and 2014 (in 2014 billion USD)



Source: Swiss Re Economic Research and Consulting and Cat Perils

Key Considerations

The following are key considerations that are likely to impact Miami-Dade County and the ability of local and regional private businesses and residents to acquire affordable insurance coverage.

- Recent development, population growth, and rising sea levels have increased the exposure of assets vulnerable to flooding and storms in Miami-Dade County

  A recent analysis by the World Bank economist Stephan Hallegatte, found that of 136 global metropolitan areas evaluated, Miami was the U.S. metropolitan area with the greatest exposure to a 100-year flood as measured by asset value. This study found that in the event of a 100-year flood Miami had over $366 billion in exposed assets.[1] The Miami metropolitan region was also considered most vulnerable when evaluated in terms of expected average annual loss with an expected loss of $672 million. The exposure identified in the study is growing due to population growth, coastal development, and rising sea levels. The study also examined implications of the mentioned factors on future risks and found that in 2050, average annual losses due to flooding in the Miami metropolitan area could approximate $7.34 billion without adaptation measures and $2.55 billion with adaptation.

  A separate study by Lloyd's and the University of Cambridge, *Lloyd's City Risk Index*, found that over the next ten years (2015-2025) Miami risks losing $4.02 billion to flooding losses and $2.28 billion to wind storms.[2] According to Florida International University's Florida Public Hurricane Loss Model, expected personal residential insured losses due to wind damage alone would be approximately $6.4 billion in a Category 1 storm and $31.6 billion in a Category 5 storm. These estimates were based on 2007 exposure data and do not include an increase in exposed assets since 2007.[3] Several other American cities, including New York and New Orleans are also among the worlds' most vulnerable. A recent report noted this is in part due to the fact that coastal assets in U.S. cities have, "a relatively high overall value and relatively low levels of protection compared to other wealthy countries."[4]

- The Federal Emergency Management Agency is currently remapping coastal areas within Miami-Dade County and insurance rates are likely to change in certain areas

  The National Flood Insurance Program (NFIP) administered by the Federal Emergency Management Agency (FEMA) provides the majority of flood insurance policies with the County. FEMA determines flood insurance premium rates based on the Flood Insurance Rate Maps (FIRM) they develop. These maps are periodically revised and the coastal portion of Miami-Dade County is currently under revision. The new maps are expected to be published in 2017-2018 and the revised maps are likely to show deeper potential flood depths along the coast and a floodplain that extends further west in some areas. Updated maps are likely to show a

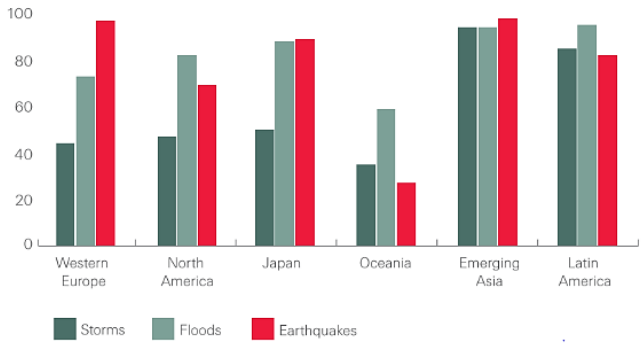
[1] Hallegatte, S. et al., "Future Flood Losses in Major Coastal Cities," Nature Climate Change 2013. Available at http://www.nature.com/nclimate/journal/v3/n9/full/nclimate1979.html
[2] Lloyd's City Risk Index 2015-2025 Miami, US Factsheet (2015). Available at www.lloyds.com/cityriskindex
[3] This is not accounting for deductibles. Source: S. Hamid, H. Loss, P. Model "The Florida Public Hurricane Loss Model"
[4] Eddins, Q., "Rising Vulnerability to floods risk devastating property losses in U.S. cities" CBRE 27 Oct. 2015

higher base flood elevation (or the expected height of a 100-year flood) in certain areas. This means that new buildings will need to be built at a higher elevation and flood insurance premiums will be higher for buildings built below this height. Insurance rates are likely to change in certain areas as a result of changes in floodplain boundaries or expected flood elevations, which determine insurance premiums. Rates are more likely to increase for older buildings, constructed under less restrictive building codes and prior to the publication of the first Flood Insurance Rate Maps. These changes may disproportionately affect lower income areas in the County.

- Many businesses and families vulnerable to flooding do not have adequate insurance

Because disasters are relatively rare, people systematically underestimate their risk. One study found that because people underestimate risk, they are often unwilling to pay the actuarially fair rate for insurance premiums. [5] This may lead people to drop insurance coverage because it is perceived as too expensive. In other cases, financial hardship causes people to drop coverage. Many residents also incorrectly assume that their homeowners insurance includes coverage from flood damage.

Figure 2: Uninsured natural catastrophe losses as a percent of economic losses by region 1975-2014 based on events from which insured and economic losses were known and for which total losses were larger than USD



Source: Swiss Re Economic Research and Consulting and Cat Perils;

When Hurricane Sandy hit New York, most affected property owners did not carry adequate flood insurance. More than half of the buildings flooded were outside FEMA's 100-year floodplain, so they were not required to carry flood insurance. Even for those within the demarcated floodplain, less than 50 percent of residential buildings had flood insurance. [6] According to FEMA, nearly 25 percent of all National Flood Insurance Program claims are received from people outside of the mapped high-risk flood areas. [7] Neither Citizens Property Insurance Corporation nor the National Flood Insurance Program maintain current figures on the number of property owners within Miami-Dade County who do not maintain insurance, making it challenging to quantify exactly how many owners do not carry insurance. A recent report from The Wharton Risk Management and Decision Processes Center found an average NFIP market penetration rate of 30 percent (meaning approximately 70 percent are without flood

[5] Logue, K., Ben-Shahar, O., "The Perverse Effects of Subsidized Weather Insurance" Law & Economics Working Papers. Paper 111. 1 May 2015. Available at http://repository.law.umich.edu/cgi/viewcontent.cgi?article=1221&context=law_econ_current

[6] "Stronger More Resilient New York" PlanNYC. (2013) http://s-media.nyc.gov/agencies/sirr/SIRR_singles_Lo_res.pdf

[7] "Low-Risk Flood Zone." Federal Emergency Management Agency, 26 Sept. 2014. https://www.fema.gov/faq-details/Low-Risk-Flood-Zone

insurance).[8] In some watersheds the coverage rate ("the implied market penetration rate") was as low as 10 percent (C-3 West) and 17 percent (C-7).

When property owners do not maintain insurance it directly affects their families and businesses by slowing recovery after an event, therefore affecting a region's resiliency. Inadequate insurance also affects the wider economy following an event. According to SwissRe,

> "By facilitating investment and reconstruction, insurance can minimize the negative impact of natural catastrophes on economic growth... In a poorly insured catastrophe … uninsured losses were the driver of an output decline over several years. This is consistent with the findings of a 2012 study… which looked at nearly 2,500 major natural catastrophes that occurred between 1960 and 2011. In countries with high insurance penetration, the study concluded, the indirect costs of a natural catastrophe event are lower, the overall economic impact is lower, and these countries recover faster from catastrophic events than less-insured countries." [9]

The level of insurance coverage in Miami-Dade County will impact not only uninsured and underinsured families and businesses following an event, but has the potential to impact the wider regional economy and the speed of recovery. In North America, uninsured flood losses between 1975 and 2014 accounted for upwards of 80 percent of total economic losses (see Figure 2).[10]

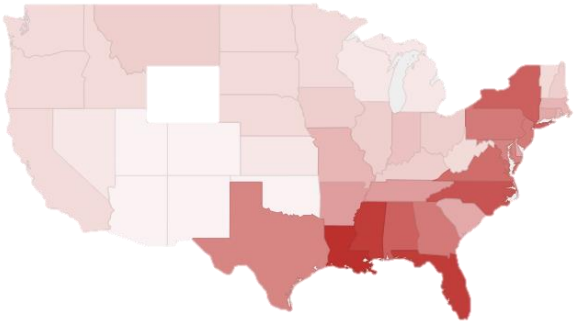
- The County's economy and credit rating could be affected by a natural disaster

A recent article published by Fitch Ratings underscored that sea level rise may become increasingly important as a credit factor in Fitch's rating decisions. This report notes that, "local governments that respond hesitantly to climate change may face higher mitigation costs and potentially much higher disaster recovery costs in the future, particularly should federal support mechanisms decrease over time."[11] A report released in September 2015 from Standard & Poor's (S&P) Rating Services also noted that severe natural disasters can impact a government's credit standing.[12] In a separate report S&P noted that their rating services consider, "the dangers from rising sea levels to be a long-term macro-credit risk that is unlikely

[8] Czajkowski, J. et al. "Economic impacts of urban flooding in south Florida: Potential consequences of managing groundwater to prevent salt water intrusion" (2015) Wharton University of Pennsylvania.
[9] "Closing the protection gap – Disaster Risk Financing: Smart solutions for the public sector" (2015) Swiss Re. Zurich. http://media.swissre.com/documents/Closing_the_Gap_2015_FINAL.pdf
[10] "Closing the protection gap – Disaster Risk Financing: Smart solutions for the public sector" (2015) Swiss Re. Zurich. http://media.swissre.com/documents/Closing_the_Gap_2015_FINAL.pdf
[11] Levitz, L. et al., "Sea Level Rise May Pose Challenges for Some US Local Governments" Fitch Ratings 16 Sept. 2015
[12] "Storm Alert: Natural Disasters Can Damage Sovereign Creditworthiness" Standard and Poor 10 Sept. 2015

to be a significant factor in the next five years. But in our view, the failure of states and localities to start planning for the logistical, structural, and financial risks of more water in the wrong places could leave them struggling to protect existing investments in seaside infrastructure."[13]

Figure 3: 1980-2014 Billion-Dollar Flooding and Tropical Cyclone Disasters by State (CPI – Adjusted)



***Please note that the map reflects a summation of billion-dollar events for each state affected (i.e. it does not mean that each state shown suffered at least $1 billion in losses for each event).**

Source: "Billion-Dollar Weather and Climate Disasters: Mapping" National Oceanic and Atmospheric Administration, http://www.ncdc.noaa.gov/billions/mapping

Maintaining adequate insurance can help partially insulate the County from this risk as a recent report from SwissRe illustrated,

> "The rating agency Standard & Poor's (S&P) also emphasizes the positive role of disaster insurance arrangements on sovereign financial resilience. The economy with higher insurance coverage recovers more quickly and suffers from a lower cumulative GDP damage than in absence of insurance coverage. For a sample of 48 countries and a hypothetical natural disaster shock equivalent to 5% of a country's capital stock, S&P estimates that credit ratings would on average decline between two and three notches if there was no insurance protection at all. This compares to a decline of only about one notch, if 50% of the damage was insured."[14]

Standard & Poor also notes that insurance cannot completely offset the economics and ratings impact of a disaster and therefore local governments must prepare. They note that, "even with insurance coverage at 100%, it will take time to rebuild infrastructure and other capital. During that time government spending is likely to be at least as high as in the absence of a natural disaster while tax receipts will fall comparatively short, leading to a deterioration of the fiscal position."[15] Florida and Miami-Dade County are particularly vulnerable to flooding and tropical cyclones as illustrated in Figure 3. The state has experienced 16 one billion-dollar disasters due

[13] McNatt, R., "Climate Resilience Can Protect Ratings From Sea-Level Rise and Threats To U.S. Coastal Infrastructure" Standard and Poor 22 Oct. 2015

[14] "Closing the protection gap – Disaster Risk Financing: Smart solutions for the public sector" (2015) Swiss Re. Zurich. http://media.swissre.com/documents/Closing_the_Gap_2015_FINAL.pdf citing "Storm Alert: Natural disasters can damage creditworthiness," published by Standard & Poor on September 2015 available at www.globalcreditportal.com/ratingsdirect/renderArticle.do?articleId=1449131&SctArtId=339895&from=CM&nsl_code=LIME&sourceObjectId=9327571&sourceRevId=1&fee_ind=N&exp_date=20250909-22:42:56

[15] Mrsnik, M. et al., "The Heat is On: How Climate Change Can Impact Sovereign Ratings" November 25, 2015. Standard & Poor.

to flooding or tropical storms since 1980.[16] It is therefore important to invest in preparedness in order to minimize the impact of these events locally.

- **Some flood insurance premiums are underpriced and do not fully reflect actuarial risk**

  A significant portion of the available insurance for flooding is provided by the federal government through the National Flood Insurance Program (NFIP), which subsidizes a portion of its policies.[17] The program is subsidized, meaning premiums collected are not sufficient to cover claims and because the deficit is passed on to the Treasury Department, the U.S. taxpayer is currently the primary reinsurer of the program. Because NFIP policies are often cheaper than flood insurance sold in the private market, they have come to dominate the flood risk market.[18] As a result price signals do not fully reflect the true cost of living in highly vulnerable regions.[19]

  The NFIP subsidies have been found to result in a regressive redistribution of subsidies favoring affluent homeowners and inducing development in storm-stricken and erosion-prone areas. This same study found a strong correlation between subsidy and wealth, wherein the wealthier households receive higher subsidies in the form of underpriced insurance.

  Following Hurricane Sandy, legislation was introduced to reduce many of these subsidies in the Biggert-Waters Flood Insurance Reform Act; however, there was substantial pushback after this legislation was passed and many changes were repealed. The subsequent legislation, The Homeowner Flood Insurance Affordability Act of 2014,[20] repealed many of the changes made in the Biggert-Watters legislation. The Homeowner Flood Insurance Affordability Act also addressed many affordability concerns and limited rate increases for individual premiums to 18 percent of the premium and limited increases for average rate classes to 15 percent; however, the NFIP is still pursuing mandatory increases for certain subsidized policyholders.

  The United States Government Accountability Office has noted that the NFIP revenues will likely be insufficient to repay the billions of dollars borrowed from the Treasury to cover claims from the 2005 and 2012 hurricanes. As of December 2014 FEMA still owed approximately $23 billion.[21] Because the NFIP is still not self-supported through the premiums it collects from policyholders it is reasonable to expect there may be future adjustments to the program. These changes may affect rates in Miami-Dade County.

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[16] "Billion-Dollar Weather and Climate Disasters: Mapping." National Oceanic and Atmospheric Administration. Available at www.ncdc.noaa.gov/billions/mapping

[17] Logue, K., Ben-Shahar, O., "The Perverse Effects of Subsidized Weather Insurance" Law & Economics Working Papers. Paper 111. 1 May 2015. Available at http://repository.law.umich.edu/cgi/viewcontent.cgi?article=1221&context=law_econ_current

[18] According to a RAND study published in 2006, 49 percent of all SFHs in SFHAs had NFIP policies and another 1 to 3 percent had private policies. Lloyd Dixon, Noreen Clancy, Seth A. Seabury & Adrian Overton, Rand, The National Flood Insurance Program's Market Penetration Rate: Estimates And Policy Implications (2006), available at www.rand.org/content/dam/rand/pubs/technical_reports/2006/RAND_TR300.sum.pdf

[19] Logue, K., Ben-Shahar, O., "The Perverse Effects of Subsidized Weather Insurance" Law & Economics Working Papers. Paper 111. 1 May 2015. Available at http://repository.law.umich.edu/cgi/viewcontent.cgi?article=1221&context=law_econ_current

[20] FEMA provides an overview of this legislation and expected changes at this website www.fema.gov/flood-insurance-reform-law

[21] "Preparing for Climate-Related Risks: Lessons from the Private Sector" United States Government Accountability Office. November 2015. Washington D.C.. GAO-16-126SP < www.gao.gov/products/GAO-16-126SP>

Recommended Long-Term Risk Management Practices

- **Mitigate the County's own exposure**

  The County's schedule of values is in excess of $16 billion for both real and personal property. The County currently pays approximately $19 million annually for insurance premiums to insure these assets. In the wake of a hurricane the cost of insurance would likely increase. In the long-term, if climate change continues to increase the physical vulnerability of County assets, that is likely to result in higher premiums.

  The most effective means to stabilize these costs in the long-term is to reduce the vulnerability of the County's assets. Furthermore, reducing the vulnerability of these facilities will also have a number of co-benefits, such as improving the ability of critical facilities to operate during or immediately after a hurricane or other event. Due to the interdependencies between the government and private sector, reducing the County's own exposure will also support the economic resilience of the entire community.[22] Ensuring that public infrastructure and services are resilient to disruptions will reduce losses due to business interruption and thereby support business continuity and growth.

  To reduce vulnerability of the County's assets new projects should be designed resiliently. For example, they could be built to comply with the Federal Flood Risk Management Standard,[23] Resilience STAR™,[24] or other standards. The County could also choose to incorporate an extra margin of safety into the design of key buildings such as fire stations or emergency shelters. These efforts should not be limited to only buildings in the NFIP demarcated floodplain as these boundaries can change and buildings outside of the official 100 year floodplain can still be vulnerable to flooding.

  Loss mitigation assessments, which identify ways to make buildings safer, are currently optional and focus primarily on mitigating wind and fire damage. Loss mitigation should be required for all new County projects and should incorporate flood risk. For existing properties these loss mitigation assessments should be completed in a phased manner, focusing first on critical facilities such as shelters, fire stations, medical facilities and police stations.

  Continuing to fund mitigation projects already identified in the Local Mitigation Strategy (LMS) will also help reduce the County's own exposure as well as the exposure of the community more broadly.[25] As of December 2015 the LMS contained more than 1020 projects identified as having the potential to reduce the County's exposure to known hazards.[26]

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[22] "Preparing for Climate-Related Risks: Lessons from the Private Sector" United States Government Accountability Office. Nov. 2015. Washington D.C.. GAO-16-126SP < http://www.gao.gov/products/GAO-16-126SP>

[23] More information about the Federal standard is available at http://www.fema.gov/federal-flood-risk-management-standard-ffrms

[24] More information about the standard is available at https://disastersafety.org/ibhs-news-releases/first-ever-resilience-star-homes-designated-national-preparedness-month-height-hurricane-season/

[25] More information about the Local Mitigation Strategy is available at http://www.miamidade.gov/fire/mitigation.asp

[26] The most recently published list of LMS projects is available at http://www.miamidade.gov/fire/library/OEM/local-mitigation-strategy-part-2-projects.pdf

- **Promote the Community Rating System**

  The Community Rating System (CRS) is a voluntary incentive program that is part of the National Flood Insurance Program. This program rewards communities that go beyond the minimum floodplain management requirements and proactively reduce potential flood damage. The more actively communities manage their risk and improve their rating, the deeper the discount passed onto policy holders.

  By participating in the program and achieving a high rating of Class 5, Miami-Dade County saves residents in unincorporated areas more than $19 million annually. The program has saved residents more than $295 million since the County started participating in 1994. If the County were to improve its rating to a 4, the community would receive approximately $3.8 million in additional discounts annually. Research from the University of Cambridge has demonstrated the effectiveness of strategies, such as participation in the CRS program, for mitigating the adverse impacts of flooding.[27]

  The County currently provides technical assistance to municipalities to improve their own ratings; however, dedicating additional resources to this effort would help residents in incorporated areas see further discounts to their own insurance premiums. The Local Mitigation Strategy (LMS), which is maintained by the Miami-Dade County Office of Emergency Management, actively works with the CRS communities in the County and has been working to expand the LMS to incorporate elements to support the CRS scores of communities. The LMS Working Group meets quarterly and discusses hazards, mitigation measures, and shares best practices amongst the stakeholders that includes local, state, and federal government representatives, universities, hospital and health care, private non-profit agencies, and public for profit agencies.

- **Work to address gaps in coverage, particularly for sub-groups which are more vulnerable to disasters and are least able to afford insurance coverage**

  The consequences of not carrying adequate insurance can be especially severe in low and moderate income communities, where residents have fewer personal resources to draw upon after an event. Unfortunately, it is also the case that many low and moderate-income families may be unable to maintain adequate insurance coverage due to financial constraints. Other vulnerable sub-groups include retirees who have paid off their mortgage and are therefore no longer required to carry insurance, renters who do not carry renters insurance, or homeowners who are unaware that their home insurance does not cover flood damage. Not carrying adequate insurance leaves residents dependent upon disaster aid or other government assistance, which can be delayed and is often inadequate to help a family fully recover. Again, it is often the poorest that are least able to bear the immediate short-term costs incurred before receiving disaster aid, for example, buying replacement goods, staying at a hotel, or hiring a contractor to seal a dwelling and prevent further water damage. Working to educate the

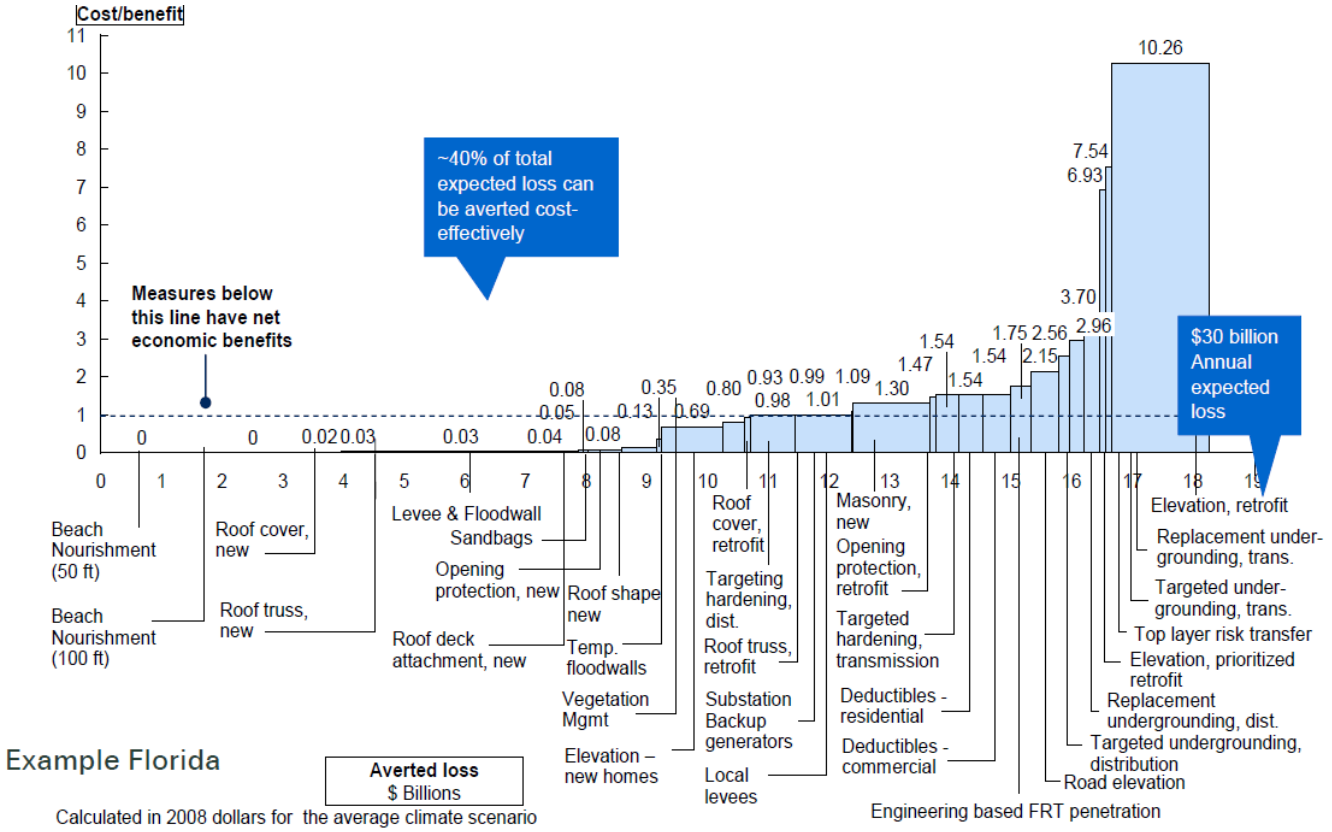
[27] Brody, S., Highfield, W., Kang, J. Rising Waters: The Causes and Consequences of Flooding in the United States (2011) Cambridge University Press.

community about the benefits of insurance, including the ability to recover more quickly after a storm, would help improve Miami-Dade County's economic resilience as a whole.

- **Work more closely with the insurance and reinsurance sector to share knowledge and expertise to identify risk and develop risk transfer solutions**

  As losses from disasters have increased over the past several decades, there has been an increased investment in developing risk management tools such as catastrophe models and risk transfer solutions such as catastrophe bonds. Continuing to engage the private sector and academia around these issues and drawing upon their technical expertise will help ensure the County is informed about the most recent developments and best available tools. The County can also follow national and international forums covering these issues such as the United Nation's 1-in-100 Initiative,[28] ClimateWise,[29] and the Association of State Floodplain Manager's Flood Insurance Committee.[30]

Figure 4: Locally specific cost /benefit analysis of different adaptation measures



Source: Swiss Re Global Partnerships, Alex Kaplan, Slide No. 11, Risk Management Roundtable Discussion, The Beacon Council, Miami, Florida, January 11, 2016

[28] More information is available at http://www.un.org/climatechange/summit/wp-content/uploads/sites/2/2014/09/RESILIENCE-1-in-100-initiative.pdf
[29] More information is available at http://www.climatewise.org.uk/
[30] More information is available at http://www.floods.org/index.asp?menuID=246

Furthermore, by working more closely with the private insurance companies the County can leverage their expertise to determine the most cost effective risk management measure. For example, SwissRe recently completed an analysis of the cost / benefit of different measures in Southeast Florida and found that approximately 40 percent of total expected losses could be cost-effectively averted with mitigation measures (Figure 4). This analysis revealed several measures that have a positive economic benefit such as beach nourishment, changing roof covers and shapes on new buildings, managing vegetation, and elevating new homes. By this same metric many measures have less favorable cost / benefit ratio and are likely less attractive as initial mitigation measures. This type of analysis can help inform the County's own response and policy choices to ensure adaptation is pursued in a strategic and sustainable manner.

- **Promote more resilient development**

Miami-Dade County is a low-lying coastal community that is vulnerable to hurricanes and flooding. As such buildings in the community should be adapted to local conditions and should be able to safely weather a typical storm or a period of heavy rain. As a recent World Bank study noted, "[N]atural disasters, despite the adjective, are not 'natural.' Although no single person or action may be to blame, death and destruction result from human acts of omission—not tying down the rafters allows a hurricane to blow away the roof—and commission—building in flood-prone areas. Those acts could be prevented, often at little additional expense."[31] Miami-Dade County should continue to promote cost-effective ways to prevent damage before the storm by incorporating best practices into codes and other planning and zoning requirements. A first priority should be working with the providers of key community services such as electricity, medical services, food distribution, and transportation to ensure their assets are resilient.

[31] "Natural Hazards, Unnatural Disasters: The Economics Of Effective Prevention" World Bank and The United Nations 2010. Available at https://www.gfdrr.org/sites/gfdrr/files/publication/NHUD-Report_Full.pdf

Conclusion and Next Steps

There was resounding consensus at this year's roundtable that hosting an annual or bi-annual discussion around these issues would be fruitful. It will be particularly helpful to continue the dialogue between the public and private sectors because the issues of climate change, risk management, and risk modeling are quickly evolving. The Office of Resilience will continue to coordinate with the Beacon Council and the British Consulate to reconvene regular discussion around this topic. In the intervening time the Office of Resilience will engage local universities, and business schools in particular, to identify opportunities to leverage their expertise and resources to further these discussions. As the dialogue progresses the stakeholders involved will undoubtedly continue to shift and expand.

Beginning immediately, smaller internal working groups will continue to meet to implement and refine recommendations discussed in this report. These groups will initially focus on four areas:

1. expediting the County's own mitigation efforts,
2. effectively communicating these efforts to the industry,
3. engaging the industry and others to stay abreast of the most current data and tools, and
4. addressing issues of affordability and public education for the uninsured and underinsured.

These work groups will report back and provide the Mayor with specific recommendations for how Miami-Dade County can stay ahead of these issues and be a leader in this field. These workgroups will collaborate with local academic institutions and community-based organizations to the greatest extent possible. These focus areas will be refined and adjusted to meet the evolving needs of the community.

Appendix 1: Roundtable Participants

Sector	Affiliation	Individual
Insurance & Reinsurance	Willis Re, Inc	Antony Phillips, Managing Director, Willis Latin America & Caribbean Adam J. Canning, Senior Vice President Pete Thomas
	SwissRe	Alex Kaplan, Senior Client Manager, Vice President, Global Partnerships
	Llyod's	Rodney Smith, CIC, CRM, Regional Director, Southeast US
	Arthur J. Gallagher & Co.	Tony Abella, Jr.
Economists	University of Miami	Professor David Letson, Ph.D., Natural Resource Economist
Academia	University of Miami	Dr. Ben Kirkman, Professor and Associate Dean for Research Program Director: Physical Sciences and Engineering, Center for Computational Science
Commercial real-estate	Colliers International	John K. Scott, RPA, Senior Executive Managing Director
	CBRE	Tim Gifford, FRICS, Senior Vice President Quinn W. Eddins, Director, Research and Analysis
	Mitig8 Risk Management LLC	David S. G. Baxter, BSc (Hons) MRICS, SIIRSM, President
	Florida East Coast Industries	Fancois Illas, Vice President – Corporate Development Jose Gonzalez, Senior Vice President – Corporate Development
Local business community	Greater Miami Chamber of Commerce	Barry Johnson, President/CEO
	The Beacon Council	Larry K. Williams, President and CEO Steve Beatus, Executive Vice President, Economic Development Marc S. Schlag, Manager, Public Relations and Events Stanley Rigaud, Manager, International Economic Development Programs
Non-profit community	Catalyst Miami	Kamalah Fletcher, Senior Director of Community Engagement
	Miami Foundation	Stuart Kennedy, Director of Program Strategy and Innovation
	The Nature Conservancy	Kathy Baughman McLeod, Director, Climate Risk & Resilience
British Consulate		Dave Prodger, HM Consul General Alexander Close, Head of Politics, Press, and Public Affairs Cynthia Conner Chonchol Gupta, Vice Consul, Trade and Investment Officer
SE FL Regional Climate Change Compact	Institute for Sustainable Communities	Nancy Schnieder, Senior Program Officer
	City of Miami Beach	Amy Knowles, Deputy Resiliency Officer
	City of Miami	Matthew S. Haber, Assistant City Attorney
	Broward County	Samantha Danchuk, Assistant Director, Environmental Protection and Growth Management Department

	Palm Beach County	Natalie Schneider, Climate Change & Sustainability Coordinator
	Monroe County	Kevin Madok, Senior Director of Strategic Planning
County government	Office of the Mayor	Hon. Carols A. Gimenez Ed Marquez , Deputy Mayor
	Internal Services Department, Risk Management	Tara Smith, Director, Internal Services Department Barbara Dunlap, Property and Casualty Manager Baunie McConnell, Director, Risk Management Division
	Office of Emergency Management	Curtis Sommerhoff, Director Cathie Perkins, Emergency Management Planner
	Office of Management and Budget	Jennifer Moon, Director
	Office of Intergovernmental Affairs	Joe Rasco, Director, Office of Intergovernmental Affairs
	Regulatory and Economic Resources	Lee Hefty, Assistant Director, Environmental Resources Management, Regulatory and Economic Resources Department Nichole Hefty, Deputy Resilience Officer, Office of Resilience, Regulatory and Economic Resources Department Katie Hagemann, Sustainability Initiatives Coordinator, Office of Resilience, Regulatory and Economic Resources Department Jim Murley, Chief Resilience Officer, Office of Resilience, Regulatory and Economic Resources Department Tere Florin, Communications Manager, Regulatory and Economic Resources Department
	Miami-Dade County Water and Sewer	Bertha Goldenberg, Assistant Director, Regulatory and Compliance Division

Appendix 2: Roundtable Agenda

Date: Monday January 11, 2016

Location: The Beacon Council, 80 SW 8th St #2400, Miami

9:00 Welcoming remarks

- Larry Williams (Beacon Council)
- Dave Prodger (British Consul General)
- Carlos A. Gimenez & Jim Murley (Miami-Dade County)

9:15 – 10:15 Introduction to Key Issues

- Jim Murley (Miami-Dade County)
- Antony Phillips & Adam Canning (Willis Re) *Modelling Climate Risk and A Holistic Approach to Financial Mitigation*
- Alex Kaplan (Swiss Re) *Resilience and the Economics of Risk*
- David Baxter & Tim Gifford (RICS) *Driving Responsible Solutions Across the Built Environment*
- Rodney Smith (Lloyd's America, Inc.) *Lloyds: Climate Change*

10:15 – 10:30 Coffee Break

10: 30 – noon Facilitated Discussion

- How do we better understand the physical and economic risks posed by climate change to Miami-Dade County?
- What can we learn from existing best practice?
- How do we ensure future insurability?
- What strategies for adaptation/mitigation would be most suitable for Miami-Dade?

12.00 Adjourn

Appendix 3: Roundtable Discussion Questions

The following questions served as a framework for initiating discussion and to spark a broader conversation.

How do we better understand the physical and economic risks posed by climate change to Miami-Dade County?

1. How do we best model and evaluate climate risk and the balance of risk between catastrophic and long-term effects as well as wind versus flood?
2. How could catastrophe models be better used to help understand the impacts of different climate change scenarios? How do we evaluate Miami-Dade's economic exposure and over what timeframes?
3. Are there opportunities to leverage the insurance industry's expertise to help Miami-Dade County determine the most cost-effective flood planning levels? For example, understanding the economic benefits of requiring additional free board or strengthening building codes?
4. How could catastrophe models be better used to determine the effects of various adaptation measures and determine which measures would be most cost effective?
5. Are there other innovative risk management tools that could help Miami-Dade County better manage our exposure?
6. Are there tools that could be better utilized to help private property owners understand their exposure?

What can we learn from existing best practice?

7. What steps could be taken to better encourage property owners to take actions to mitigate their risks to flooding and hurricanes (wind damage) before an event?
8. What programs exist to reward policyholders who take steps to reduce their vulnerability to hurricanes and flooding? What are the barriers to these programs being more fully utilized?
9. How could communications be improved between insurance companies who are aware of steps that can be taken to mitigate risks and policyholders who are less aware?
10. Do programs exist to increase up-front funding for adaptation retrofits?
11. How do we ensure public property stock and building codes reflect adaptation/mitigation?

How do we ensure future insurability?

12. Given that sea level rise is increasing the risks of flooding annually and climate change may also impact the intensity of future hurricanes, what steps can Miami-Dade County take as a government to improve the insurability of our own assets and private assets within the County?
13. Given that backstop insurance programs, such as the National Flood Insurance Program and Florida Citizens, are serving as the primary insurers for many, how could climate change affect these programs and policyholders in Miami-Dade County? What steps could be taken to limit these risks?
14. Given that insurance policies are typically written for one to three years future risks from climate change, such as sea level rise may not be incorporated into the insurance rates policyholders are paying today. How could policyholders, such as Miami-Dade County, get a clearer picture for how insurance rates are likely to change over the medium and long-term?

15. Should we encourage a longer-term view of climate risk mitigation to match financing/mortgage cycle?

What strategies for adaptation/mitigation would be most suitable for Miami-Dade County?

16. What steps could Miami Dade County take to finance needed adaptation measures?
17. How can we provide adequate but accessible contingency and how should this be balanced between Federal and State?

Appendix 4: Quarterly Reports

First Quarter Update (January 31, 2015- April 30, 2015)

Background

In July 2013, the Board created the Miami-Dade Sea Level Rise Task Force (SLRTF) for the purpose of reviewing current and relevant data, science and reports, and to assess the likely and potential impacts of sea level rise and storm surge to Miami-Dade County over time. On July 1st, 2014, the Task Force presented a report to the Board entitled, "Miami-Dade Sea Level Rise Task Force Report and Recommendations," providing the requested assessment along with recommendations of how Miami-Dade County may more specifically begin planning and preparing for projected sea level rise impacts. In addition, Resolution R-451-14 and Ordinance 14-79 were adopted in 2014, requiring that planning, design and construction of County infrastructure consider potential sea level rise impacts. On January 21st, 2015, the Board passed seven separate resolutions, each supporting the implementation of one of the seven recommendations included in the Sea Level Rise Task Force's Report. Resolution R-49-15 directs the Mayor to initiate discussions related to climate change with the insurance sector and other key stakeholders to develop long term risk management solutions.

On September 29, 2014, the Mayor and the Beacon Council co-hosted a meeting with the UK Ambassador, the UK Consul General, and key leaders in the business and insurance sectors of Miami-Dade to discuss issues and opportunities associated with climate change and sea level rise in Southeast Florida. In addition, the Mayor announced in his opening remarks at the Sixth Annual Southeast Florida Climate Leadership Summit on October 1st, 2014, that he will convene a group of business, financial and insurance leaders to begin a dialogue around these critical business and financial issues.

Quarter 1 Progress (January 31, 2015 – April 30, 2015)

The following steps have been taken during the first quarter towards implementation of this Resolution:

The Nature Conservancy contacted Miami-Dade County in March 2015 with information regarding their collaborative work with Swiss Re to demonstrate the cost effectiveness of coastal ecosystems in adaptation and risk reduction. They have developed "a set of tools and approaches for quantifying risks from coastal hazards and climate change," and provided a Project Note (see attached), summarizing the methodologies used and tools and models developed. They are proposing consideration of parametric insurance policy based on their existing model. Staff from the Regulatory and Economic Resources Department and Internal Services Department's Risk Management Division are currently evaluating the information provided for applicability and use by Miami-Dade County.

In addition, RER staff are working with the Office of Intergovernmental Affairs to identify appropriate stakeholders and candidates to include in an initial meeting, which will occur during the next Quarter.

If you have questions concerning the above, please contact Mark R. Woerner, AICP, Assistant Director for Planning, Department of Regulatory and Economic Resources, at (305) 375-2835 or mwoerner@miamidade.gov.

Second Quarter Update (May 1, 2015- July 30, 2015)

The following work has taken place during the Second Quarter in order to prepare the report referenced in this resolution:

- RER staff have developed a list of appropriate stakeholders and candidates to include in meetings to discuss insurance and long term risk management solutions. These stakeholders are drawn from several key sectors including commercial and residential real estate, insurance, reinsurance, and finance. Several risk management experts in the public sector will also be invited to participate. These meetings will serve as listening sessions to understand the concerns and questions of private sector partners and to introduce the work underway within Miami-Dade County and regionally. This will be followed by discussions throughout the fall which will work through the potential for direct assistance and collaboration between the public and private sectors to minimize the uncertainty and potential impact of flooding and severe storms.

- These meetings will also explore the potential impact of a changing insurance market and its implications for the larger economy and development within Miami-Dade County. The intention is that this group can begin to outline the information, stakeholders, and working relationships that will be needed to create more formal public-private partnerships to work to identify financing options for needed investments for adaptation and minimizing flooding risks and economic disruption.

- Staff from RER and Internal Services Department's (ISD) Risk Management Division have evaluated the information provided by The Nature Conservancy regarding their collaborative work with Swiss Re to demonstrate the cost effectiveness of coastal ecosystems in risk reduction. Given the wealth of natural buffer areas throughout Miami-Dade County, this research is very relevant to our long-term adaptation and will be considered as part of a holistic adaptation approach.

Third Quarter Update (July 31, 2015- October 15, 2015)

The following discussions have been taken during the third quarter in order to prepare the report referenced in this resolution:

- During this quarter, RER staff continued several initiatives including conversations with The Nature Conservancy regarding their collaborative work with Swiss Re to demonstrate the cost effectiveness of coastal ecosystems in risk reduction. Staff also continued to contact the list of key stakeholders drawn from commercial and residential real estate, insurance, reinsurance, and finance. In addition RER has continued to work closely with the Risk Management Division within the Internal Services Department (ISD) to identify additional contacts.

- On July 29, 2015, staff spoke with regional Compact partners and the Chambers of Commerce from Miami-Dade and Broward counties to determine how the Compact could more directly engage the business community. Through this discussion a number of opportunities were identified to present to different business groups. For example, in January 2016, the Miami-Dade Chamber of Commerce will be hosting a panel discussion on climate change. RER staff are working directly with the Chamber to identify potential speakers and will continue to help with shaping the content of the event.

- On August 21, 2015 RER staff also met with the Beacon Council to discuss how best to approach and engage the business community regarding the issues of sea level rise and climate change. At this

meeting the staff outlined a work plan to hold a series of small focus group meetings with key business leaders which represent several key industries within Miami-Dade County. These initial conversations are intended to serve as the foundation for a broader engagement strategy once the appropriate messaging has been developed.

- On August 31, 2015, Miami-Dade County hosted a delegation of 35 representatives from Lloyd's of London, one of the largest reinsurance agencies in the world. The Lloyd's delegation came to Miami to learn of our challenges associated with sea level rise and climate change, and what the County is doing at a local and regional level to plan and prepare for impacts. The meeting was also an opportunity to learn more about how Lloyd's is approaching these challenges from their perspective. During the discussion Lloyds raised a number of questions about the County's current floodplain regulations and how the County was going to integrate sea level rise considerations into future land use planning. They discussed how, in the United Kingdom, the insurance industry has effectively negotiated with the government to increase overall insurability. In the United Kingdom, it is the responsibility of the government to put adequate regulations in place which reduce the riskiest forms of development, and in exchange, the insurance industry agrees to continue to offer insurance. Recently, as flood risks and losses have increased, the insurance industry has renegotiated that agreement and has pushed the government to do more in terms of flood defenses. This meeting with the Lloyd's representatives also provided new insights into the potential for the County to use catastrophe models (which are already utilized) to better inform our risk mitigation investments, reduce the County's exposure to extreme events, and reduce insurance premiums. The Lloyd's delegation also raised important considerations about how climate change and the associated increase in risk moving forward will impact insurance premiums and the ability to purchase insurance.

- On September 25, 2015, the British Consulate of Miami facilitated a meeting at their office between RER staff and representatives from CBRE Real Estate Services and Royal Institution of Chartered Surveyors (RICS). RICS promotes and enforces the highest professional qualifications and standards in the development and management of land, real estate, construction and infrastructure. CBRE provides a broad range of professional services with a particular emphasis on the real estate market. This meeting focused on professional standards relating to construction, insurance, and climate change. The discussion also revolved around the future effect of sea-level rise, exacerbated by natural catastrophe, on the economic and environmental resilience in Florida.

- On September 25, 2015, staff drawn from ISD, Planning, Sustainability, and Emergency Management, sat down with representatives from AJG and AIR Worldwide to discuss how the County could make better use of the outputs of the annual catastrophe models that are conducted for the Risk Management Division of ISD. The secondary goals of the meeting were to discuss how the use and scope of the catastrophe models could be expanded in the future to better guide the County's mitigation efforts. Given Miami-Dade County currently uses its annual catastrophe analysis primarily to determine the Average Annual Loss (AAL), the discussion focused on how these tools could also be used to help the County reduce the exposure of its own assets. The discussion centered on how these risk mitigation tools, used primarily for insurance purposes, could be fed more directly to Emergency Management to prioritize mitigation strategies, which will in turn increase the County's resilience to sea level rise and potentially reduce insurance premiums. The potential to broaden the current scope of this work to incorporate sea level rise was also discussed.

- On September 25, 2015, staff drawn from the ISD, RER Planning, the Office of Sustainability, and the Office of Emergency Management, held a separate discussion with Swiss Re, a global reinsurance

company, regarding work they completed for New York City as part of the city's *Stronger, More Resilient New York* initiative. Swiss Re supported the development of the coastal protection plan for New York using an iterative process examining the cost effectiveness of different adaptation measures. This process also utilized catastrophe models. This meeting focused on the potential to draw upon the reinsurance industry's risk management expertise to help expedite the development of a comprehensive plan to increase Miami-Dade County's resilience to sea level rise.

Appendix 5: Roundtable Presentations

RISK MANAGEMENT ROUNDTABLE DISCUSSION

January 11, 2016

The Beacon Council, Miami Florida

British Consulate-General Miami

MIAMI-DADE COUNTY

The Beacon Council
Miami-Dade County's Official Economic Development Partnership

WELCOME

Larry K. Williams, President & CEO, The Beacon Council
Dave Prodger, British Consul General in Miami
Carlos A. Giménez, Mayor Miami-Dade County

AGENDA

9	Welcoming remarks
9:15 – 10:15	Introduction to Key Issues • Antony Phillips & Adam Canning (Willis) • Alex Kaplan (Swiss Re) • David Baxter & Tim Gifford (RICS) • Rodney Smith (Lloyds)
	Break
10: 30 – 12	Facilitated Discussion
Noon	Adjourn

AGENDA

9:15 – 10:15 Introduction to Key Issues

- **Jim Murley** (Miami-Dade County)
- **Antony Phillips & Adam Canning** (Willis) *Modelling Climate Risk and a holistic approach to financial mitigation*
- **Alex Kaplan** (Swiss Re) *Resilience and the Economics of Risk*
- **David Baxter** (RICS) *Driving Responsible Solutions Across the Built Environment*
- **Rodney Smith** (Lloyd's) *Lloyds: Climate Change*

CONTEXT

Jim Murley (Miami-Dade County)

MODELLING CLIMATE RISK & A HOLISTIC APPROACH TO FINANCIAL MITIGATION

Antony Phillips & Adam Canning (Willis Towers Watson)

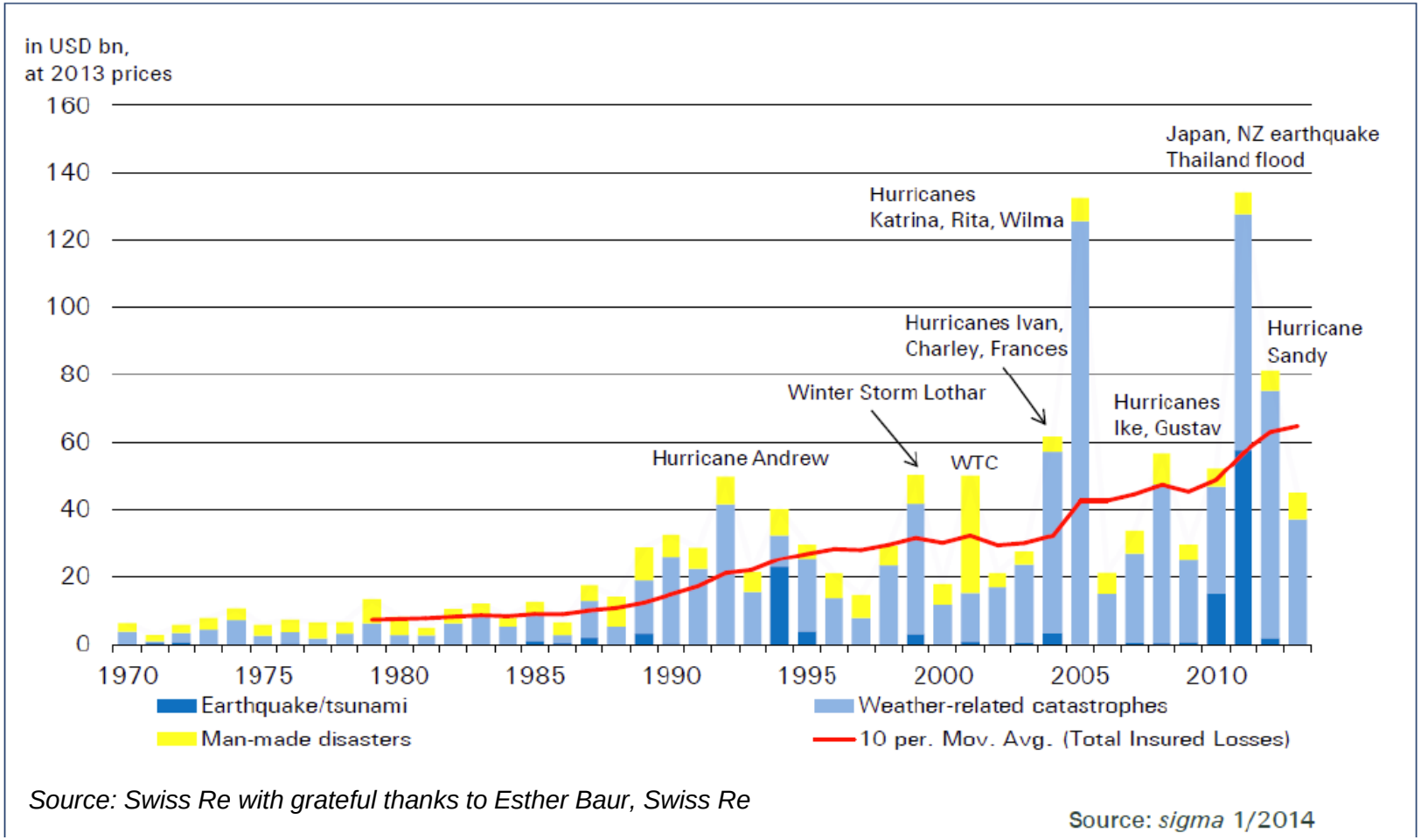
Long-Term Risk Management and Insurance

Modelling climate risk & a holistic approach to financial mitigation

WillisRe

Global Re/insurance Sector 1992 – 2015: from Ruin to Resilience

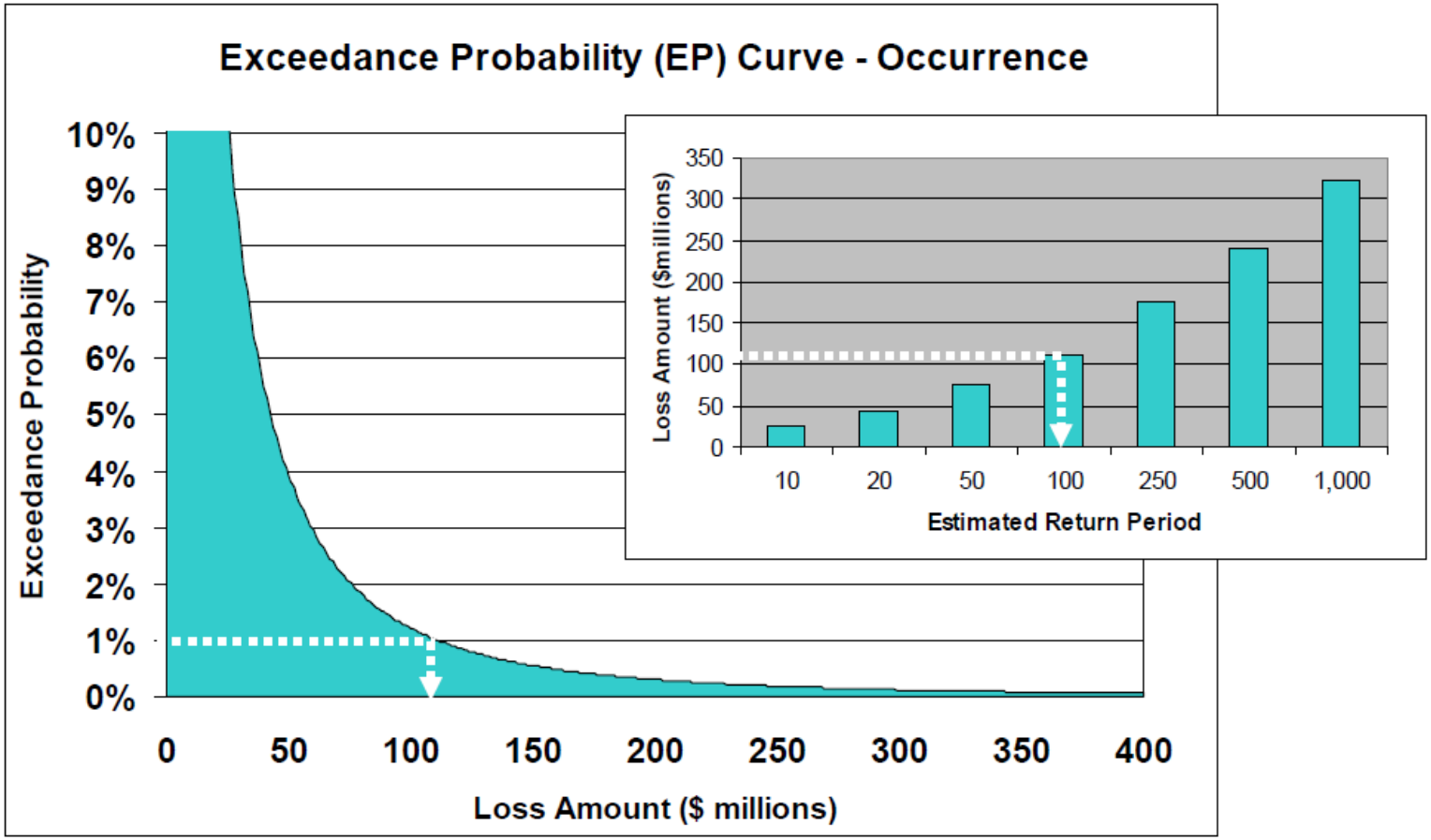
The story of climate risk stress tests and industry reform



Source: Swiss Re with grateful thanks to Esther Baur, Swiss Re

The Output that Transformed a Market

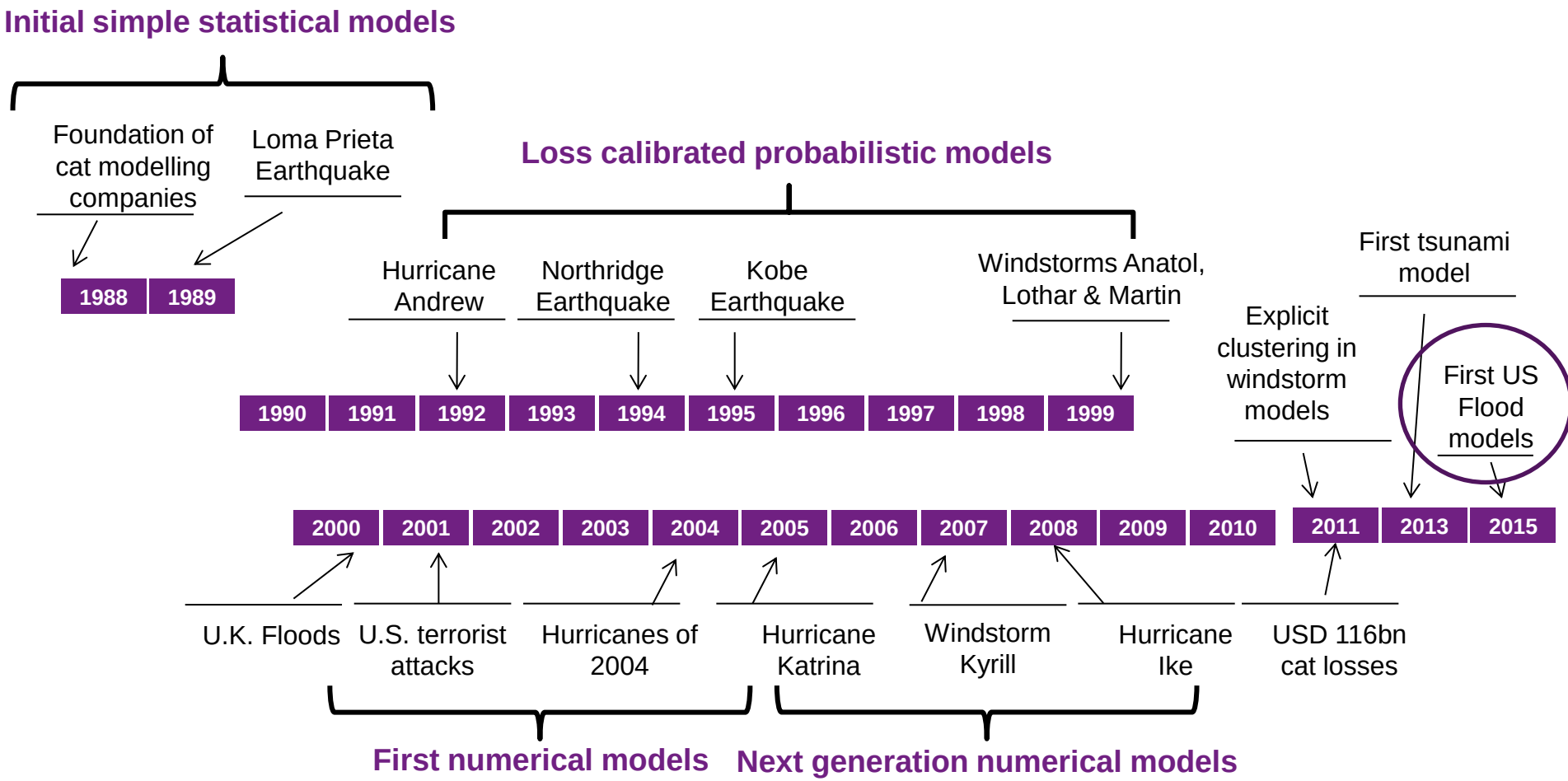
The Loss Exceedence Probability Curve



Source: AIR Worldwide

Quantifying risk through Catastrophe risk models

A brief history



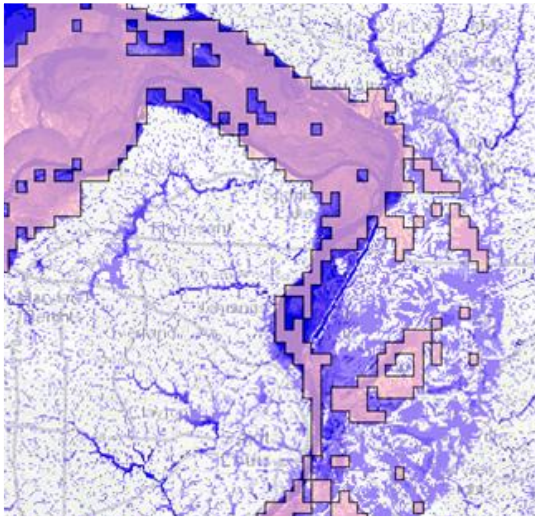
Quantifying the Risk

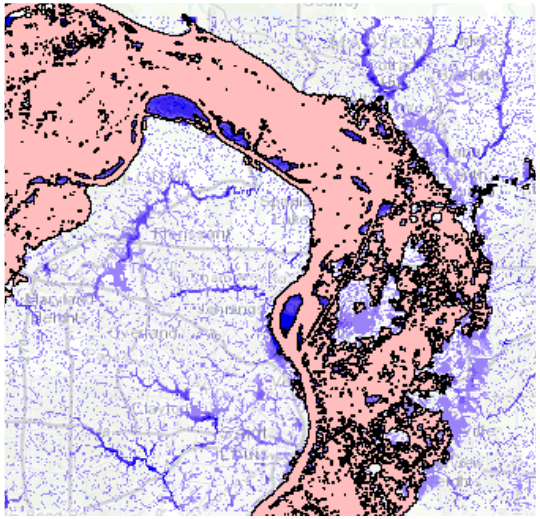
Flood Catastrophe Modeling

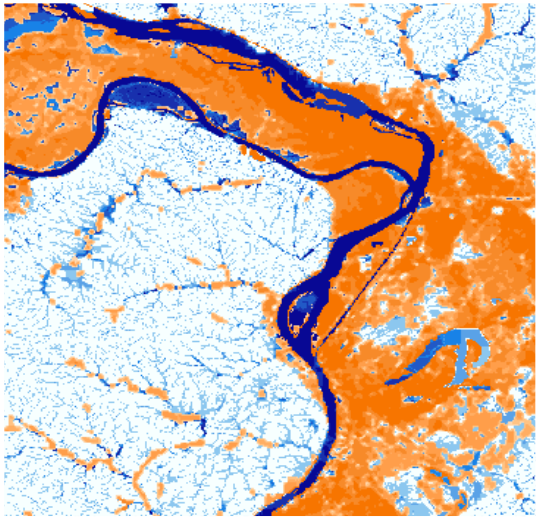
Ability to model flood exposure has developed slower than models for Hurricane or Earthquake, however the past few years has seen a marked increase in the availability of commercial models and hazard maps for risk quantification.

Willis Re has evaluated the large majority of those and assessed:

- Coverage (e.g. pluvial)
- Scientific methodology (e.g. 2D modelling)
- Resolution

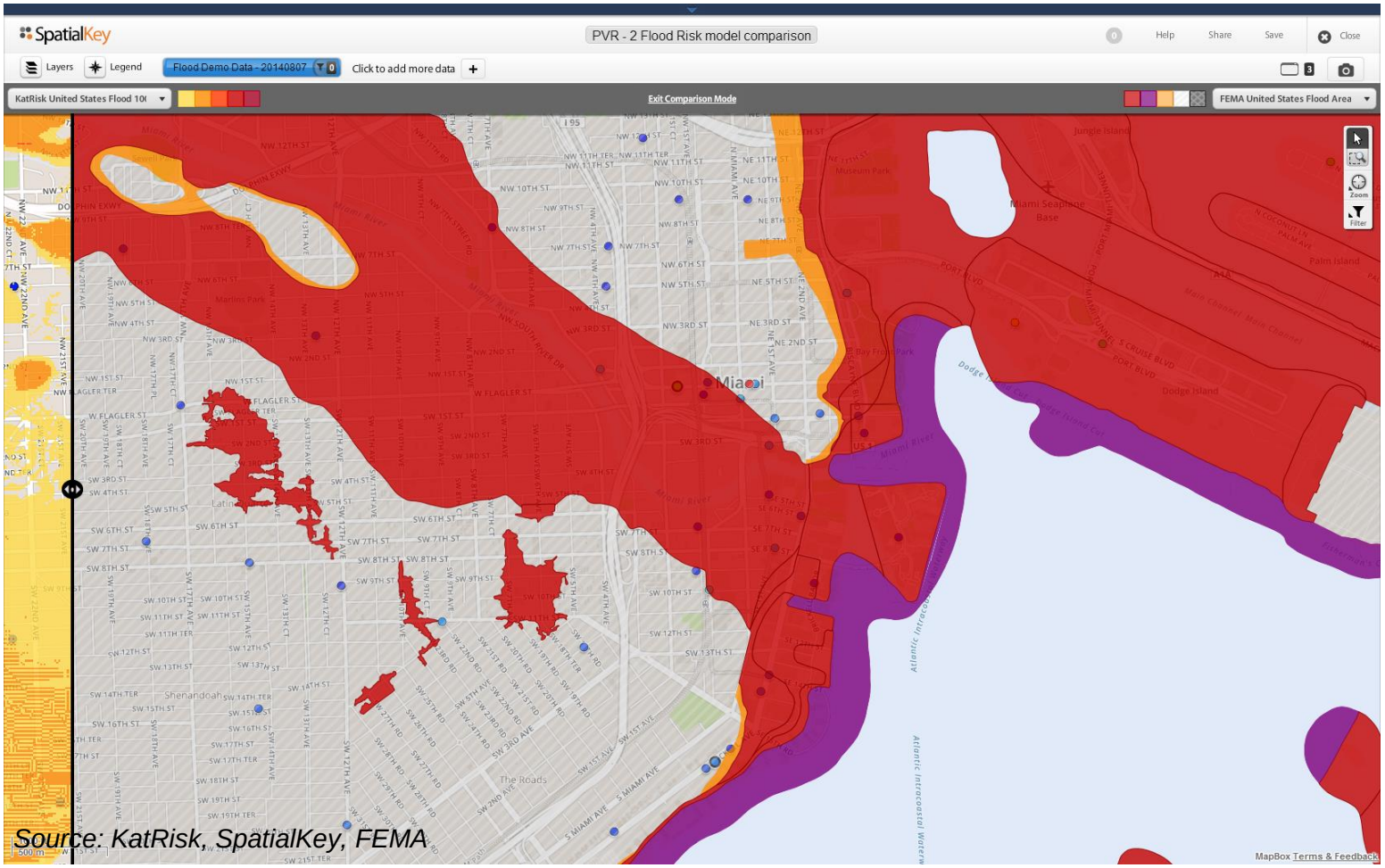






Supplementing the NFIP View of Risk

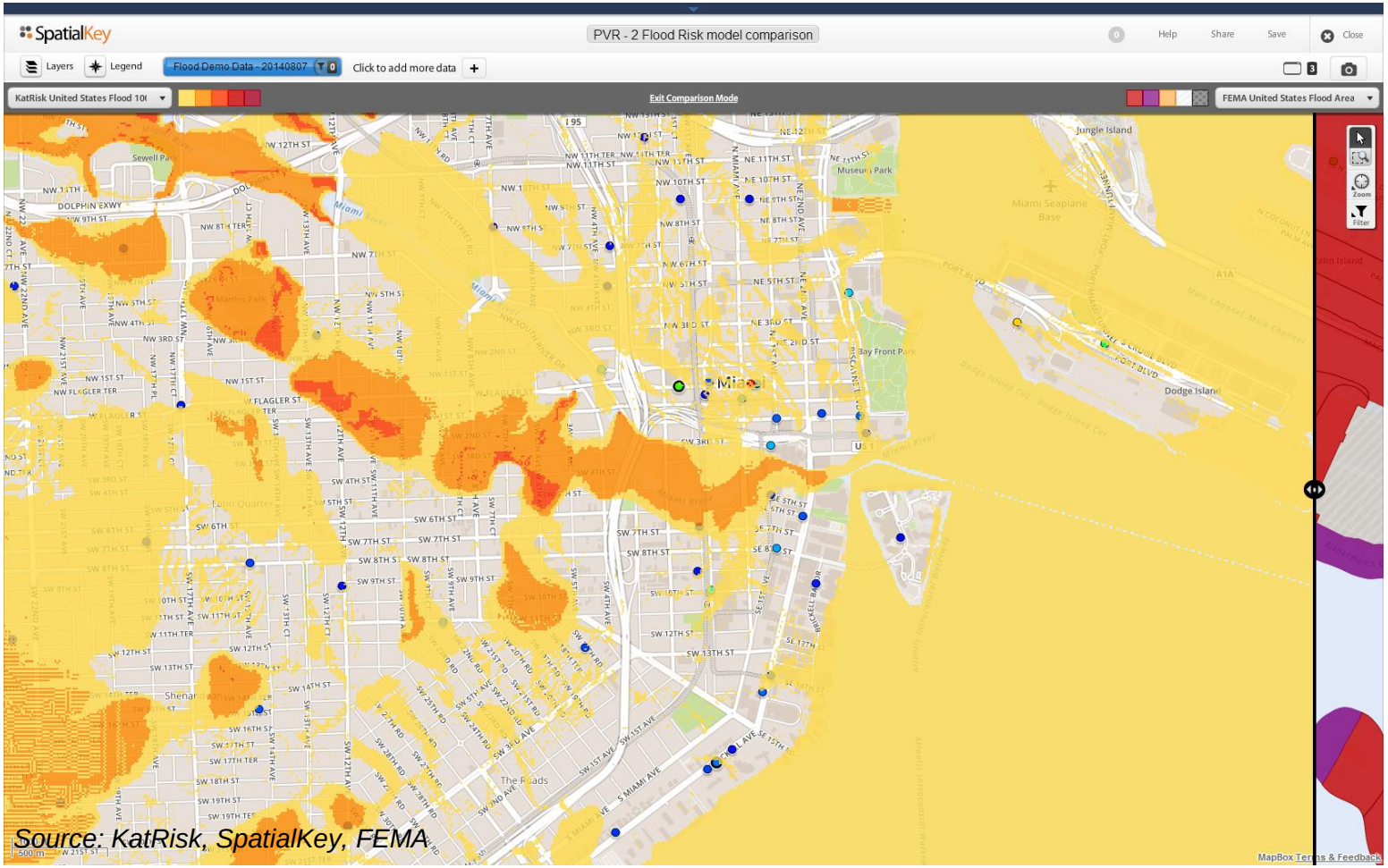
US flood hazard layer comparisons



Source: KatRisk, SpatialKey, FEMA

Supplementing the NFIP View of Risk

US flood hazard layer comparisons



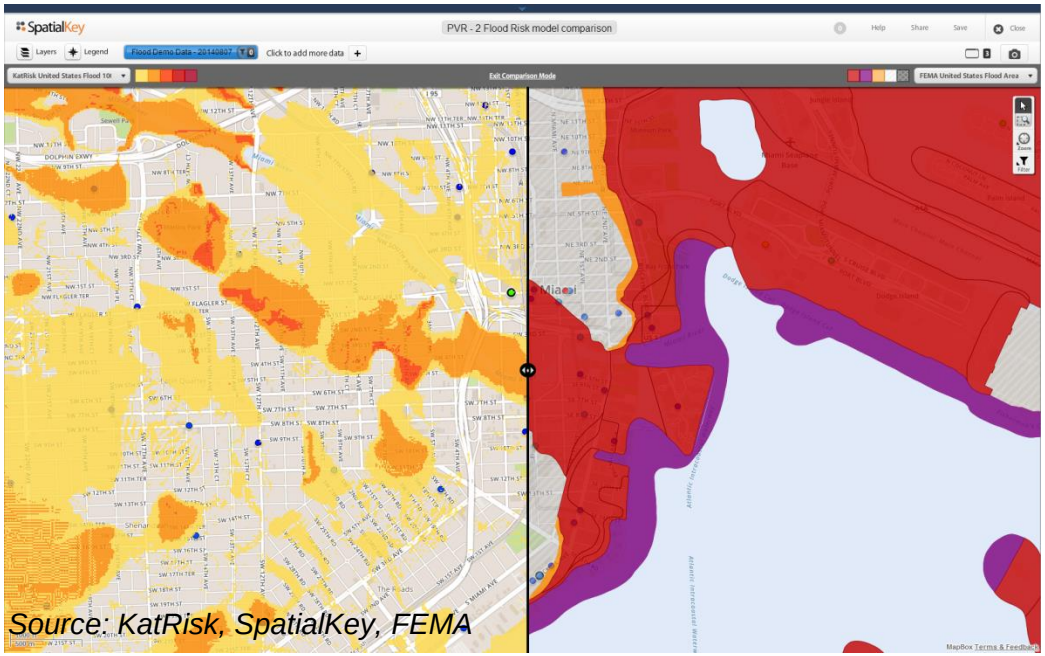
Source: KatRisk, SpatialKey, FEMA

Supplementing the NFIP View of Risk

US flood hazard layer comparisons

‘Tying Flood Insurance to Flood Risk for Low-Lying Structures in the Floodplain’
(National Academy of Science)

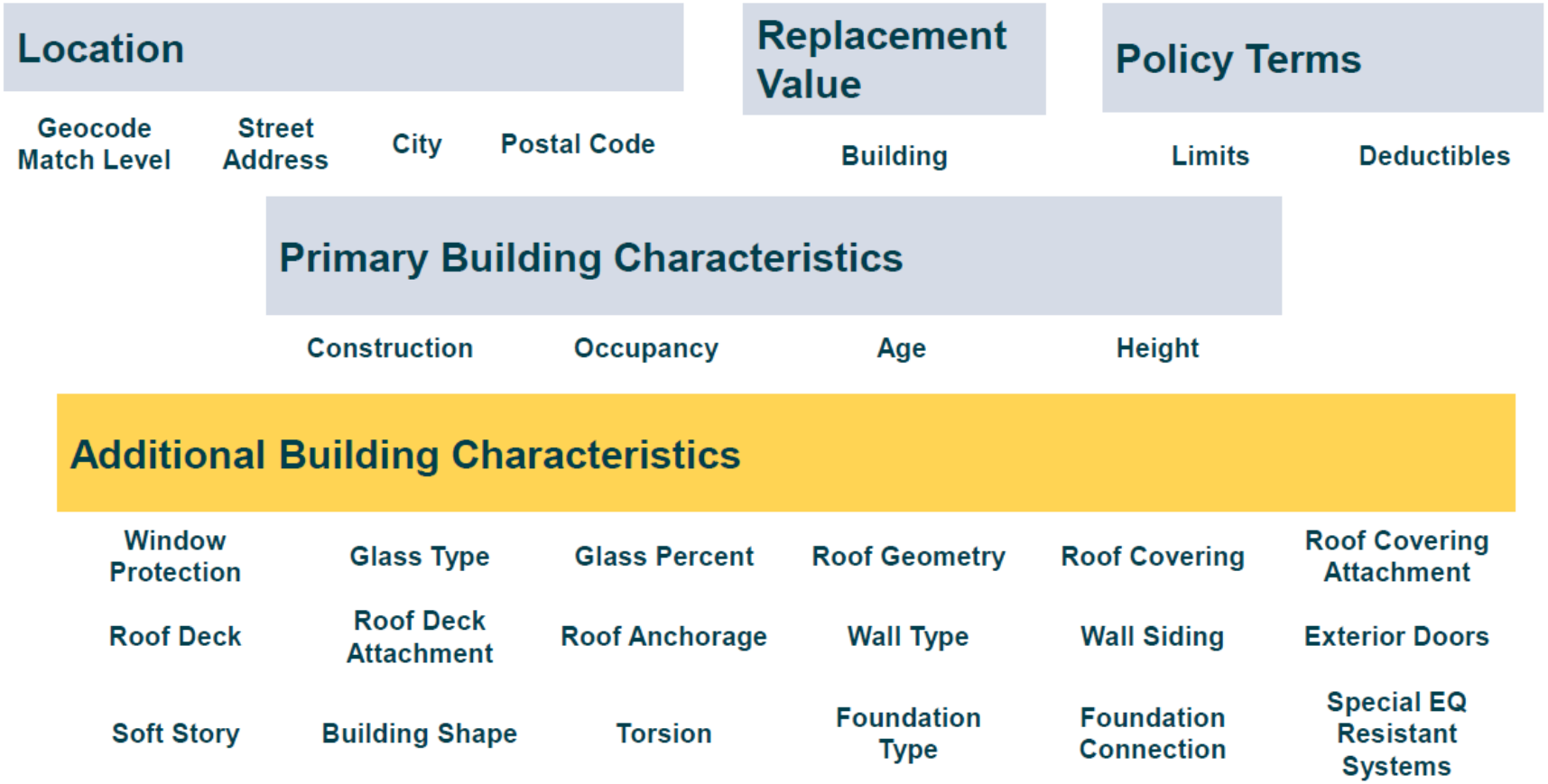
“Modern technologies, including analysis tools and improved data collection and management capabilities, enable the development and use of comprehensive risk assessment methods, which could improve NFIP estimates of flood loss”



Source: KatRisk, SpatialKey, FEMA

Exposure data relevant for Climate Risk Modelling

Understanding the underlying risk attributes



Post-Andrew, Miami-Dade Construction Codes improved, wind-driven reasons but will also help improve resilience to flood

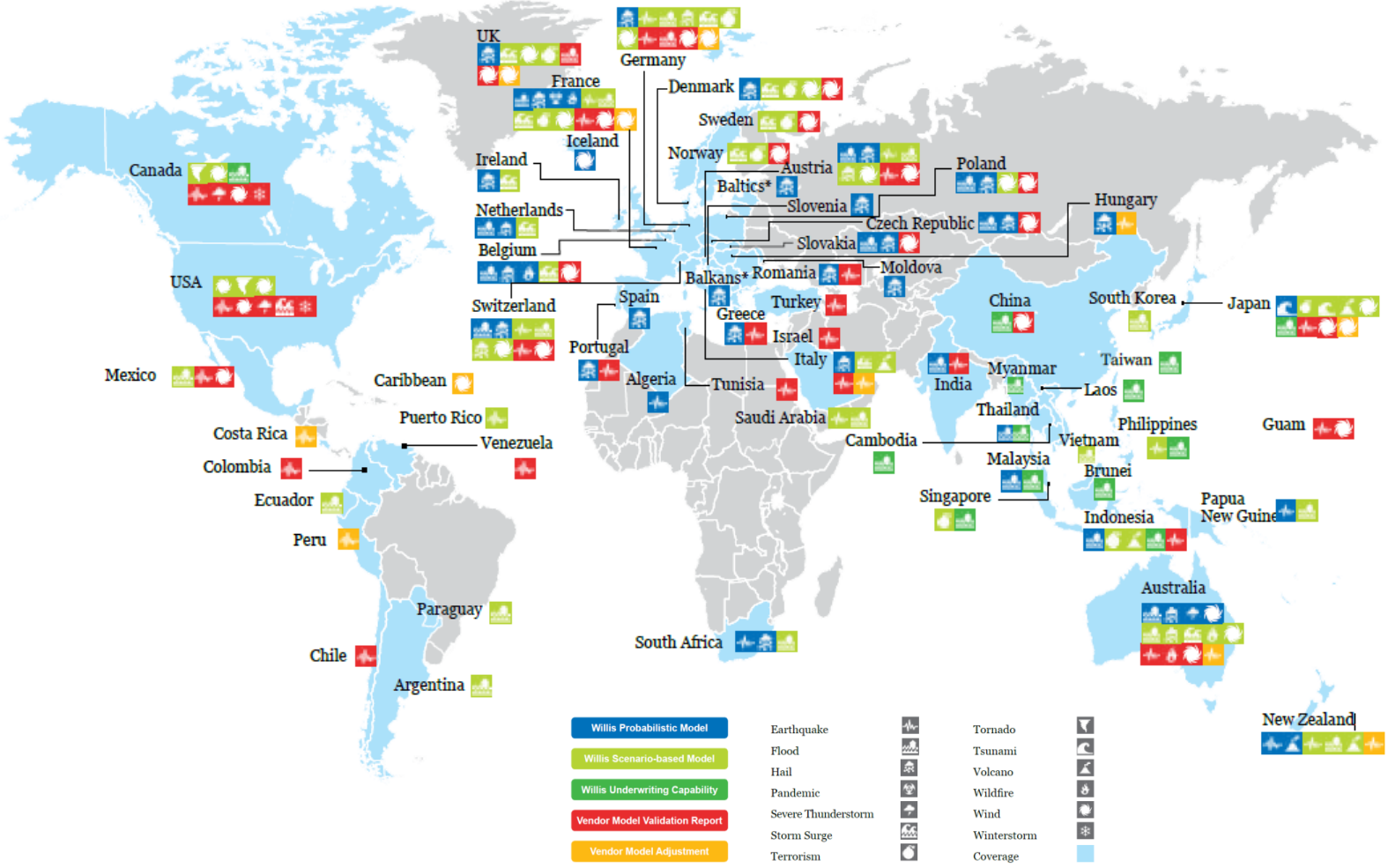
‘Re/Insurance Style’ Climate Risk Stress Tests

Benefits & Implications

- A tried and tested approach, 25 years in re/insurance risk trading, management and regulation.
- Same framework, tools and methodologies can be used to evaluate future risks and wider risk factors, including public policy.
- By placing a tractable and proportionate price on risk we provide a reasoned and proportionate value on risk reduction and resilience and a mechanism for enabling that equation to be integrated into financial decisions.
- Using insurance style assessment approaches, feasible to undertake trial/research stress tests on Cities to physical climate risk – now and in the future.
- Groups of interested parties are already emerging, such as the ‘1 in 100 Initiative’ and ‘Insuring Resilient America’.

Willis Re supporting flood quantification globally

The Willis Re View of Risk

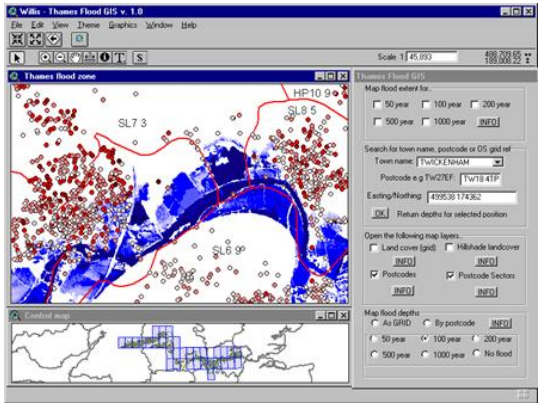


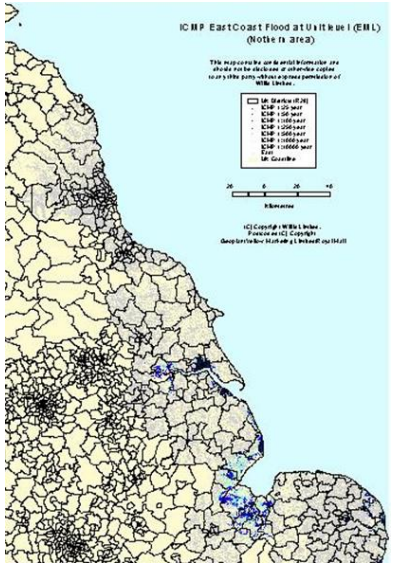
Flood quantification at the forefront of WTW analytics

A history of managing flood risk

A few examples of our flood modelling pedigree:

- UK River Thames and Coastal Surge models
- Australia flood mapping, quantifying the risk and enabling flood insurance for the market
- Latin America Mega-cities
- Pan-European flood and regional / catchment correlation
- South-East Asia comprehensive flood analytics
- Developing rates to assist in first-to-market Personal Lines flood policy in Canada





Willis Towers Watson academic partners and research

Capital Science & Policy / WRN

- Investment in our future
- Climate change
- Strategic advisor to the U.N.
- Willis Research Network (WRN) is the world's largest collaboration of industry & academia

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Long-Term Risk Management and Insurance

Modelling climate risk & a holistic approach to financial mitigation

Willis Re

RESILIENCE AND THE ECONOMICS OF RISK

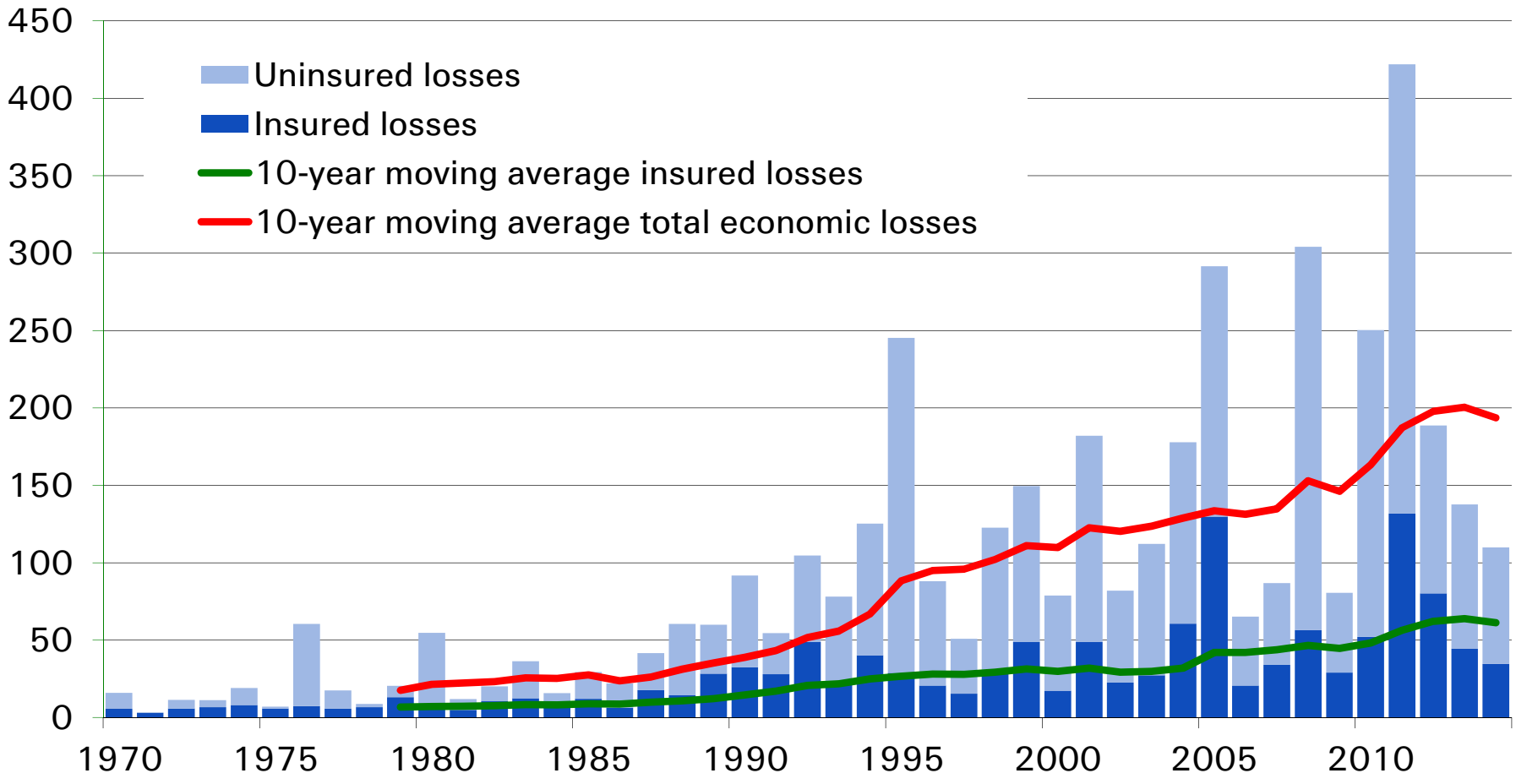
Alex Kaplan (Swiss Re)

Resilience and the Economics of Risk

Miami-Dade County Mayor's Discussion on Long-Term Risk Management and Insurance
January 2016

The growing burden of uninsured losses

Natural catastrophe losses 1970 – 2014 (in 2014 USD)



Source: Swiss Re Economic Research & Consulting and Cat Perils.

Climate change is not the main driver for rising natural catastrophe losses in recent decades

Ocean Drive, FL, 1926

Ocean Drive, FL, 2013

Drivers

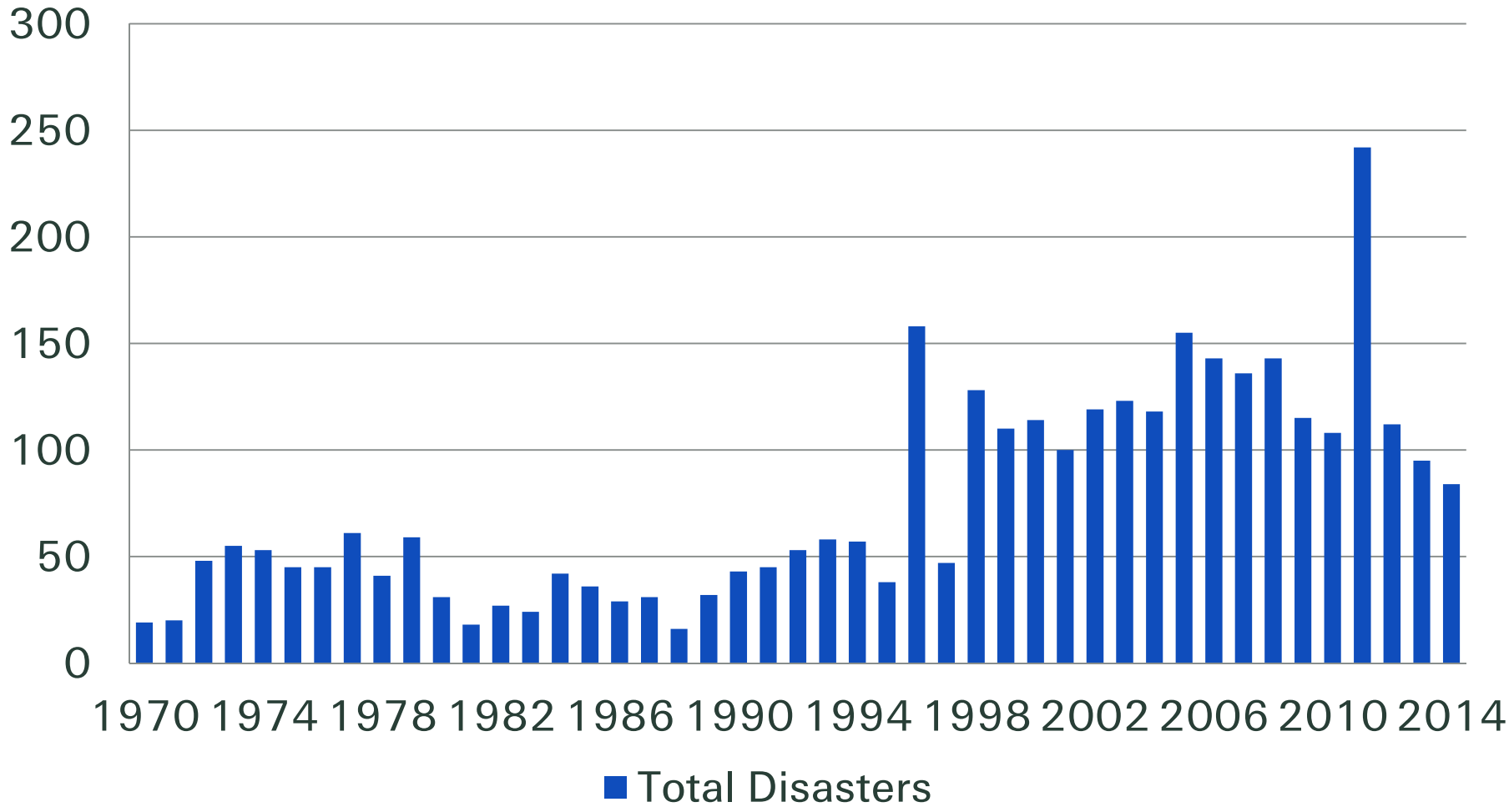
Growth of wealth

Concentration of values in exposed areas (e.g. coasts)

Increasing vulnerability

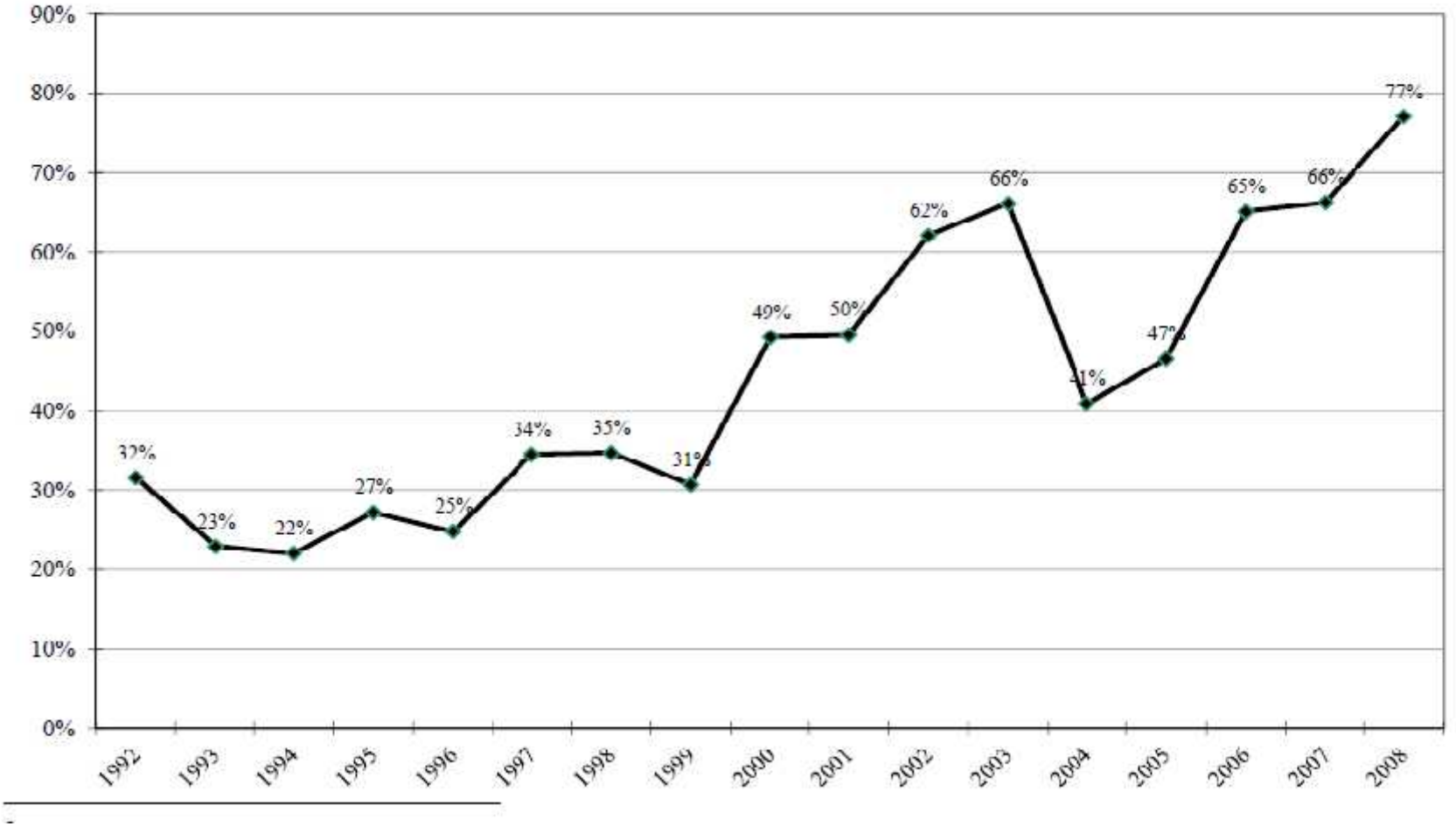
Climate change as a potential new driver in future (storms, floods, droughts)

FEMA Disaster Declarations – 1970-2014
Disasters Have Tripled Since in the 1970s



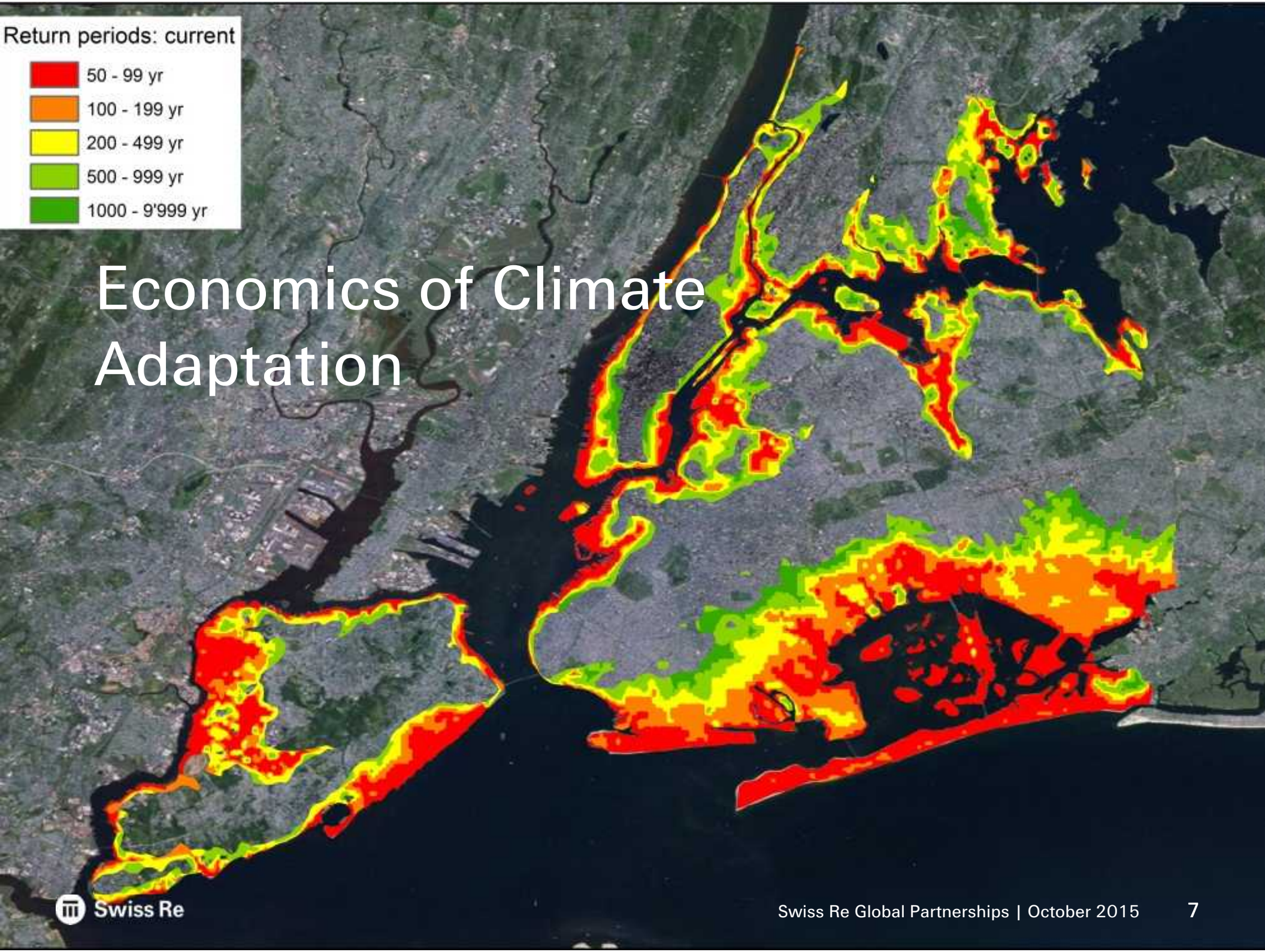
The proportion of economic losses absorbed by the USG: Is this sustainable?

Figure 4: Ratio of Total Federal Government Disaster Expenditures to Measured Losses
Source: Cummins, Suher, and Zanjani (2010)[2]



In the US, the price tag is large and growing.

- Since 2005, the US taxpayer has spent over **$300 billion on direct costs** of extreme weather and fire alone.
- Firefighting expenses have **tripled in 20 years**.
- In 1991, firefighting made up **13%** of the Forest Service budget. In 2013, it was **50%**
- Natural catastrophes (earthquake and weather related) cause average economic losses of **$60-100 billion** annually. (Hurricane Sandy = ~$70 billion)
- The US Government spent **$96b** in 2012 to pay for climate-related events
  - If this so-called "Climate Disruption Budget" were included in the actual budget, it would be the largest non-defense discretionary budget item.
  - The Government paid more for climate-related losses than it did for transportation or education.



Economics of Climate Adaptation

Climate adaptation is an urgent priority

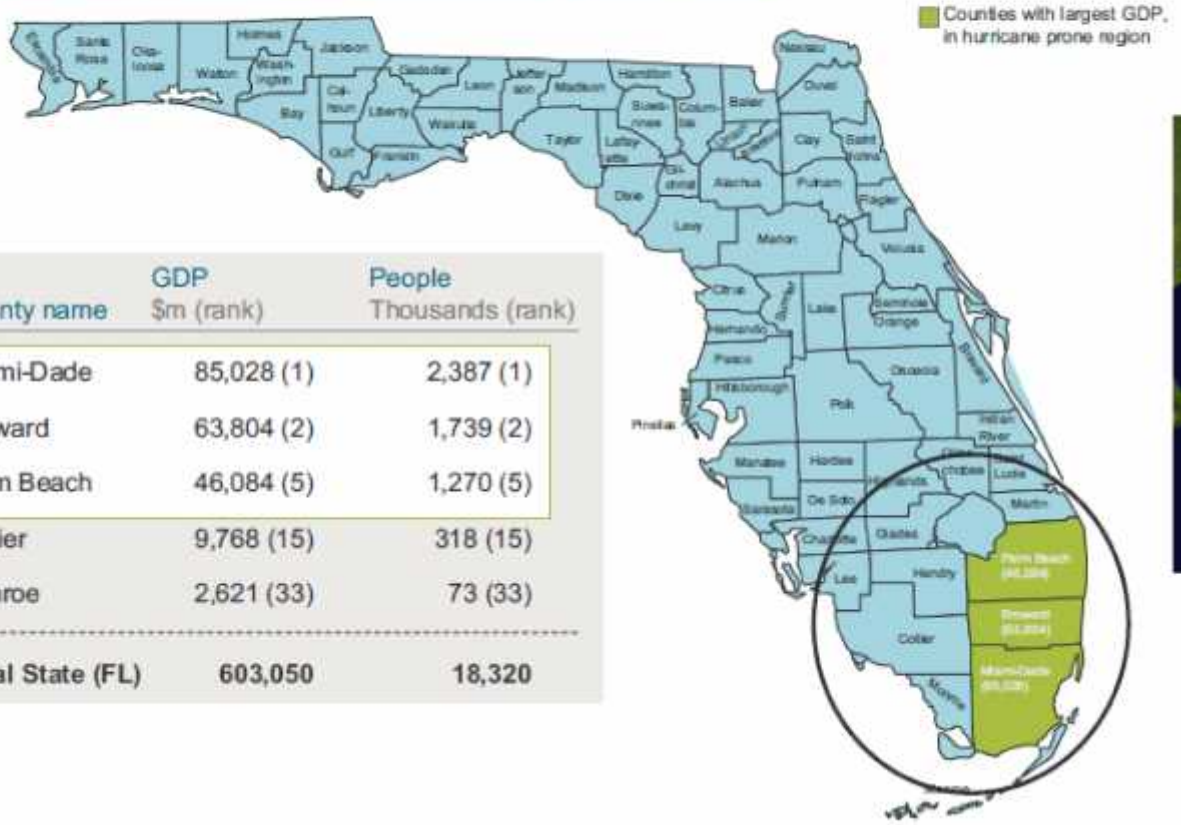
Decision makers ask

- What is the potential climate-related damage over the coming decades?
- How much of that damage can we avert, with what measures?
- What investments will be required to fund those measures and will the benefits of that investment outweigh the costs?

South Florida Case Study:
Focus on Risk from Hurricanes

02

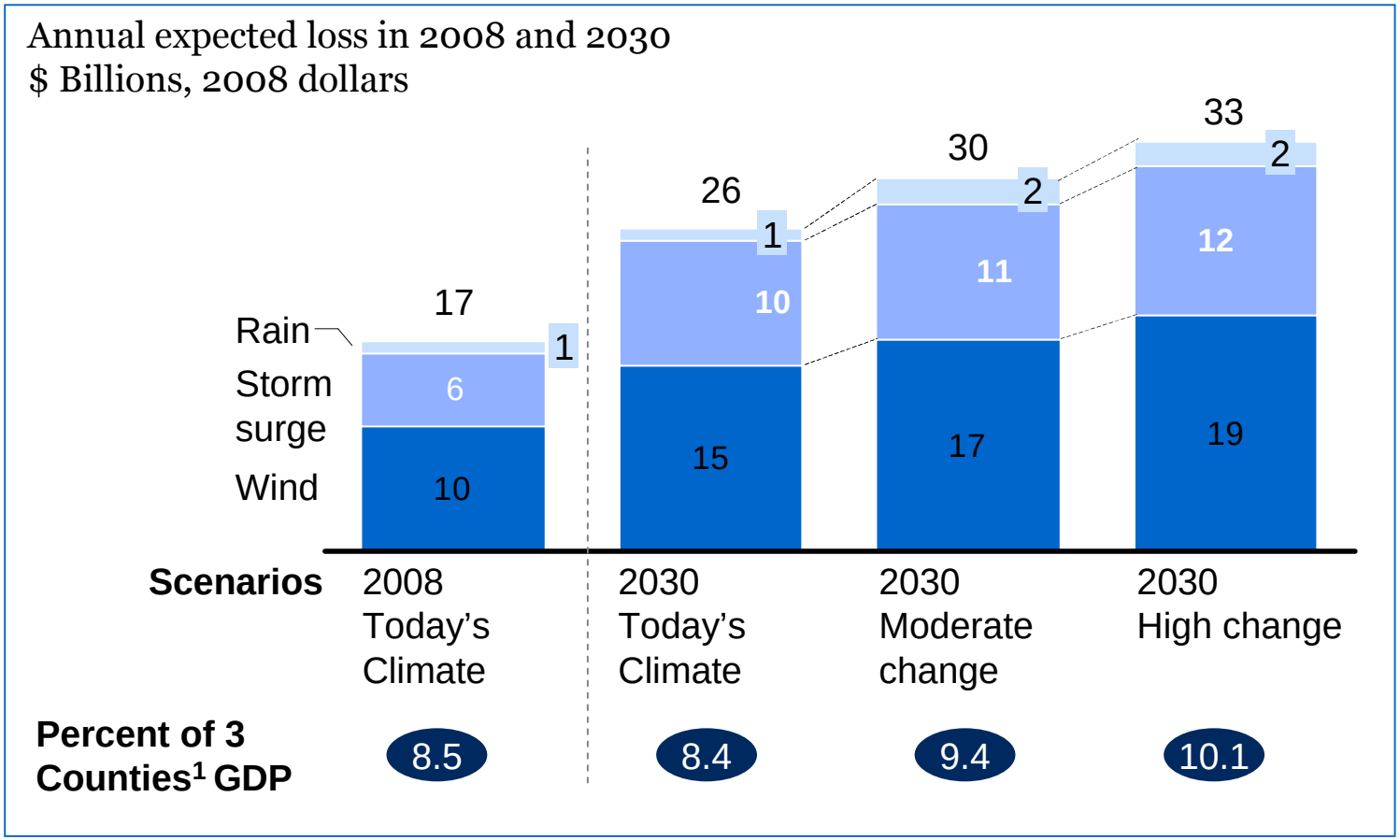
The case study area is home to some of the most populated and economically successful counties in the State



County name	GDP $m (rank)	People Thousands (rank)
Miami-Dade	85,028 (1)	2,387 (1)
Broward	63,804 (2)	1,739 (2)
Palm Beach	46,084 (5)	1,270 (5)
Collier	9,768 (15)	318 (15)
Monroe	2,621 (33)	73 (33)
Total State (FL)	**603,050**	**18,320**

Result: Expected losses by scenarios and by hazard

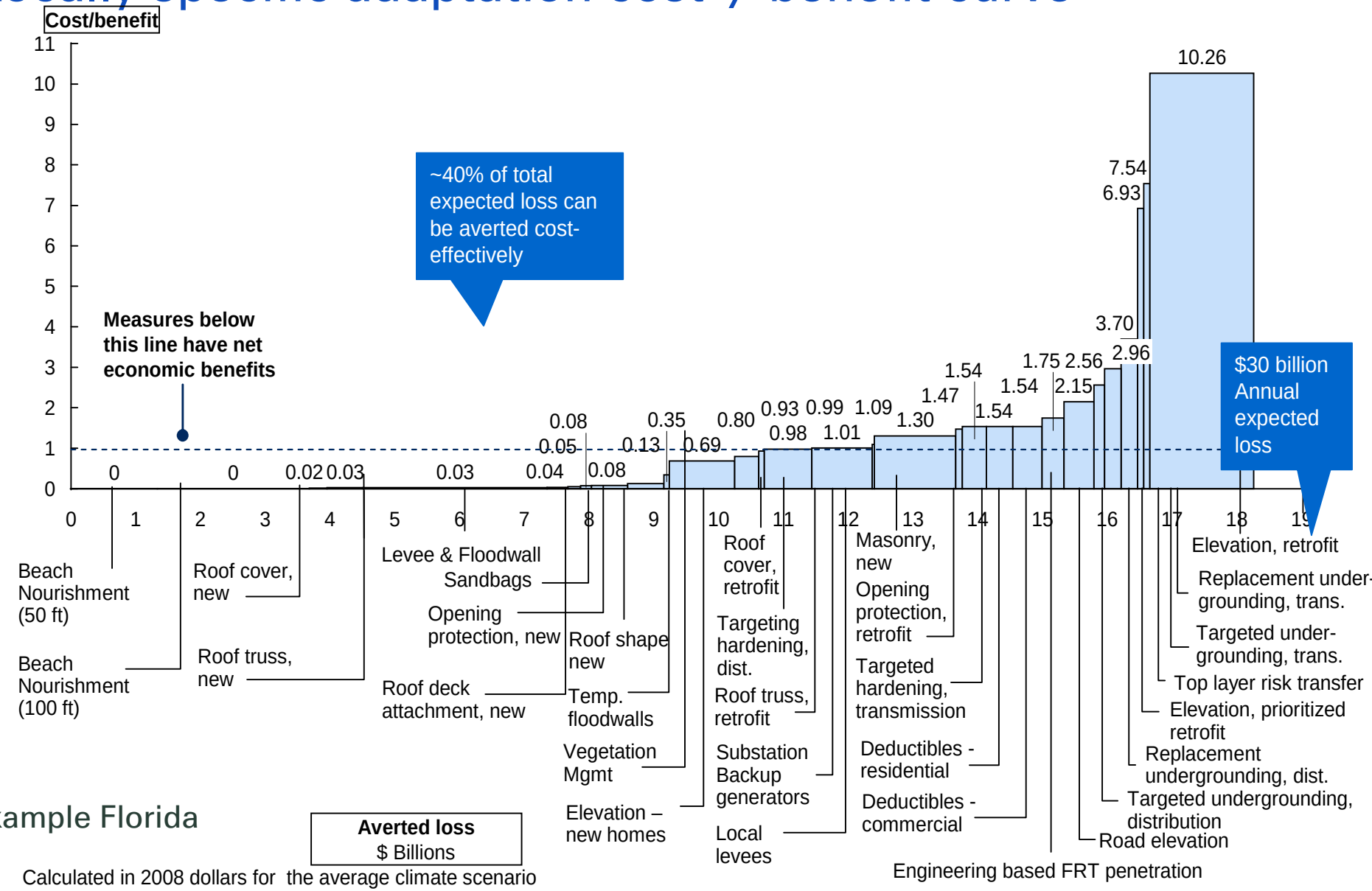
Example Florida



1 2008 Moody's

SOURCE: Swiss Re; team analysis

Locally specific adaptation cost / benefit curve

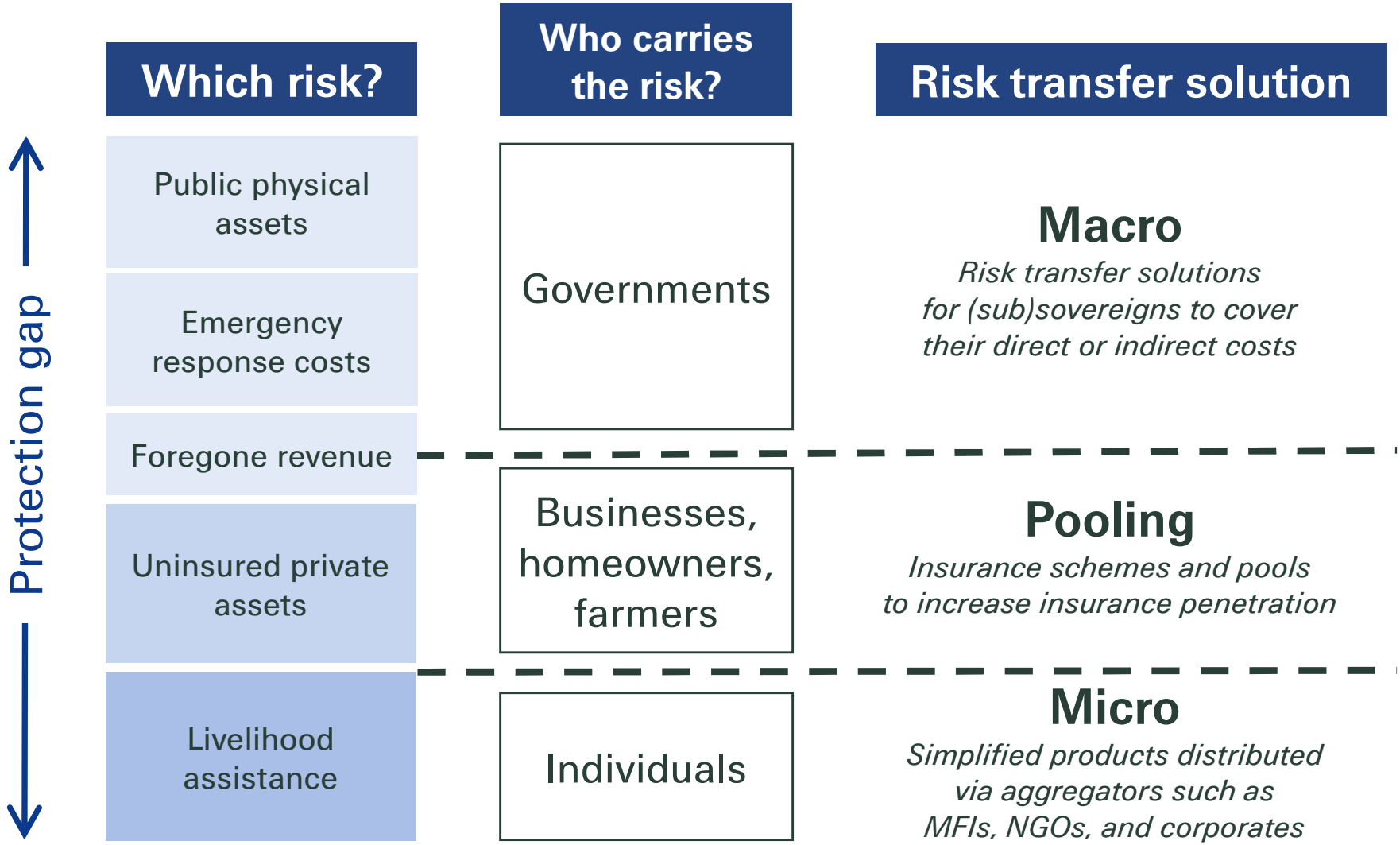


Example Florida

Calculated in 2008 dollars for the average climate scenario

Closing the gap

How to close the protection gap



Financing is a pillar of integrated disaster risk management

1 Identification

What risks do we **face**?

- Systematic
- Cross-sectoral

2 Assessment

Can we **quantify** it?

- Frequency
- Severity

3 Prevention & mitigation

How can we **minimize** it?

- Improve quality
- Build new protection

4 Adaptation

How can we manage the **residual risk**?

- Change behavior
- Pre-finance
- Risk transfer

Disaster Risk Financing: Case Studies

Case study Caribbean:
Caribbean Catastrophe Risk Insurance Facility (CCRIF)

Solution features

- The CCRIF offers parametric hurricane and earthquake insurance policies to 16 CARICOM governments
- The policies provide immediate liquidity to participating governments when affected by events with a probability of 1 in 15 years or over
- Member governments choose how much coverage they need up to an aggregate limit of USD 100 m
- The mechanism will be triggered by the intensity of the event (modelled loss triggers)
- The facility responded to events and made payments:

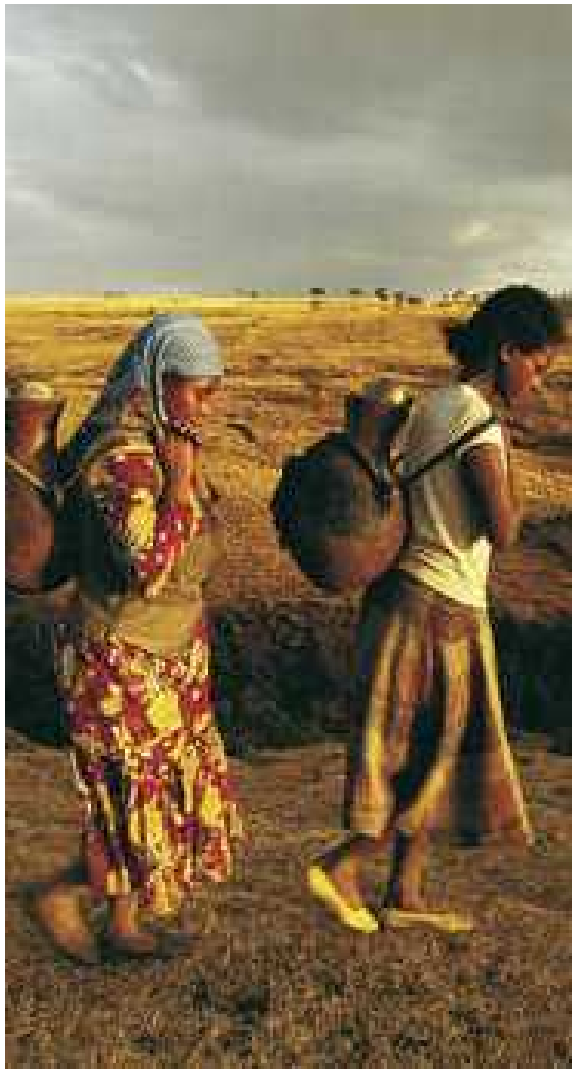
Involved parties

- Reinsurers: Swiss Re and other overseas reinsurers
- Reinsurance program placed by Guy Carpenter
- Derivative placed by World Bank Treasury

Payouts to date

- 2010: Haiti USD7.7m (earthquake), Barbados USD 8.5m (hurricane), St. Lucia USD 3.2m (hurricane), St. Vincent & The Grenadines USD 1.1 (hurricane), Anguilla USD 4.2m (hurricane).
- 2008: Turks & Caicos USD 6.3m (hurricane)
- 2007: St. Lucia USD 418k (hurricane), Dominica USD 528k (hurricane).

Case study African Risk Capacity: Insuring governments' drought response costs



Solution features

- African Risk Capacity (ARC), through its insurance subsidiary ARC Insurance Ltd., is a sovereign insurance pool, which provides African governments with index-based macro drought cover (in a later stage also flood).
- It incepted in May 2014 with five countries and will expand over the next years to cover more countries. The pool is capitalized with USD 200 million to offer maximum cover of USD 30 million per country.
- To establish the payout rules, ARC has developed a software application, Africa Risk View (ARV), which translates satellite-based rainfall information into near real-time response cost estimates.
- Each country is required to customize and define its own insurance parameters and to submit a contingency plan, addressing the distribution of potential payouts to the affected population to ensure fast response.
- Certificate of good standing issued by ARC agency is a pre-requisite to participate in the insurance pool.

Involved parties

- Set up as Special Agency of the African Union with support from WFP, DfID, SIDA, SDC, Rockefeller Foundation, IFAD;
- Insurance entitiy ARC Insurance Ltd capitalized by DfID and KfW.
- Risk transfer to international insurers and reinsurers through broker.

Payouts to date

For 2014, Niger, Senegal and Mauritania received a combined payout of USD 26m, of which USD 16.5m to Senegal.

Case study:
Miami Dade County Public Schools–
Custom multi-year structured cover

Solution features

- Insured peril: Named Windstorm and associated flood
- Multi-year structured cover: USD 100m
- Covering indemnified losses from NWS to soften impact to broader school system
  - 3 year coverage with unlimited reinstatements
  - Term Aggregate Deductible
  - Fixed premium over term
  - No claims bonus
- Time horizon: May 2013– May 2016
- Customized multi-year structured risk transfer for major school district

Involved parties

- Insured: Miami-Dade County Public Schools
- Swiss Re: Lead structurer and sole underwriter
- Broker: AJ Gallagher

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DRIVING RESPONSIBLE SOLUTIONS ACROSS THE BUILT ENVIRONMENT

David Baxter & Tim Gifford (RICS)

Driving Responsible Solutions Across the Built Environment

David Baxter, BSc (Hons) MRICS
Director, Mitig8 Risk Management LLC
RICS Chapter Member and Past Chair RICS (West Midlands UK)

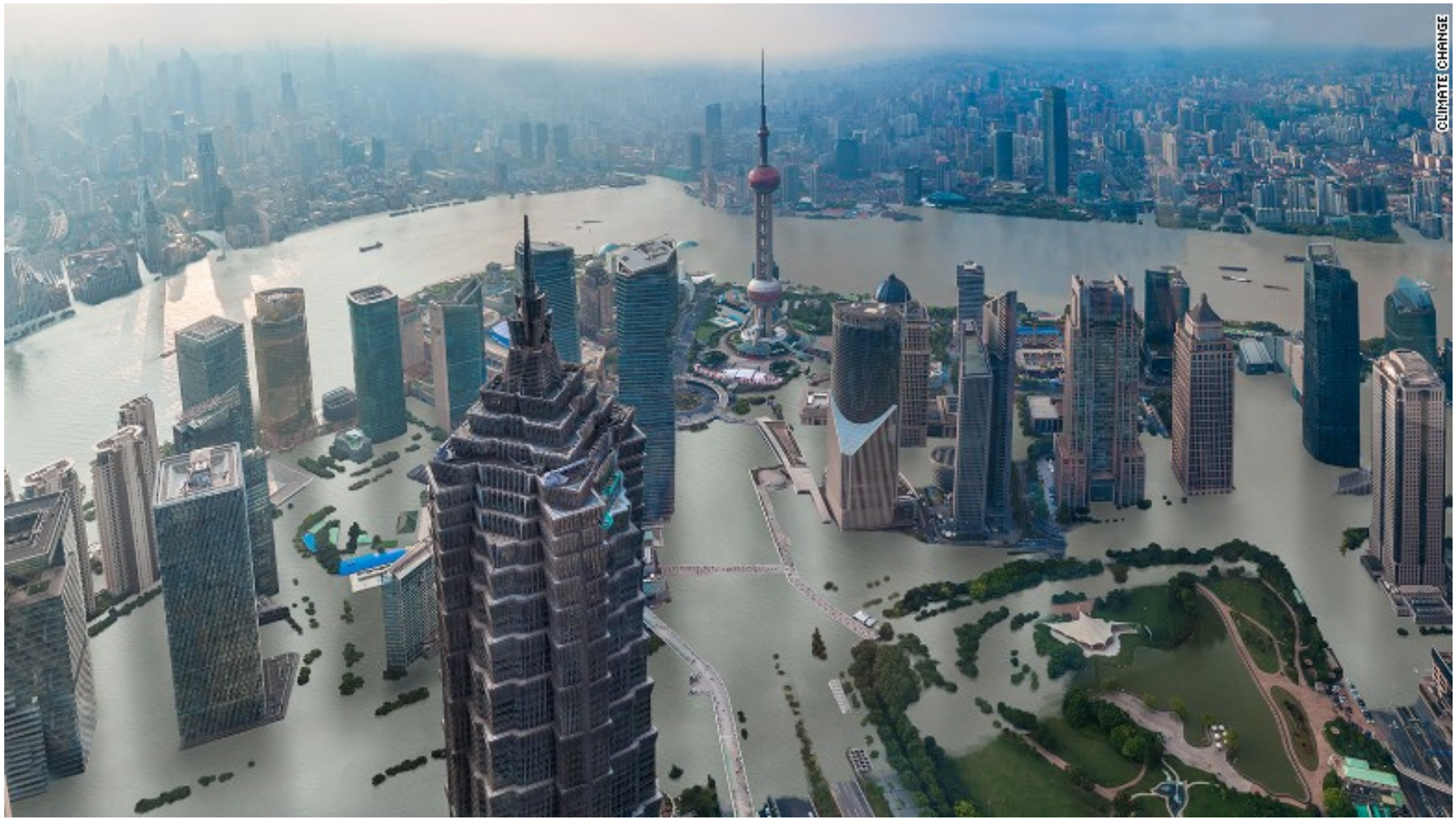
Tim Gifford, FRICS
Senior Vice President, CBRE
RICS Florida Chapter Chair

Driving Responsible Solutions Across the Built Environment

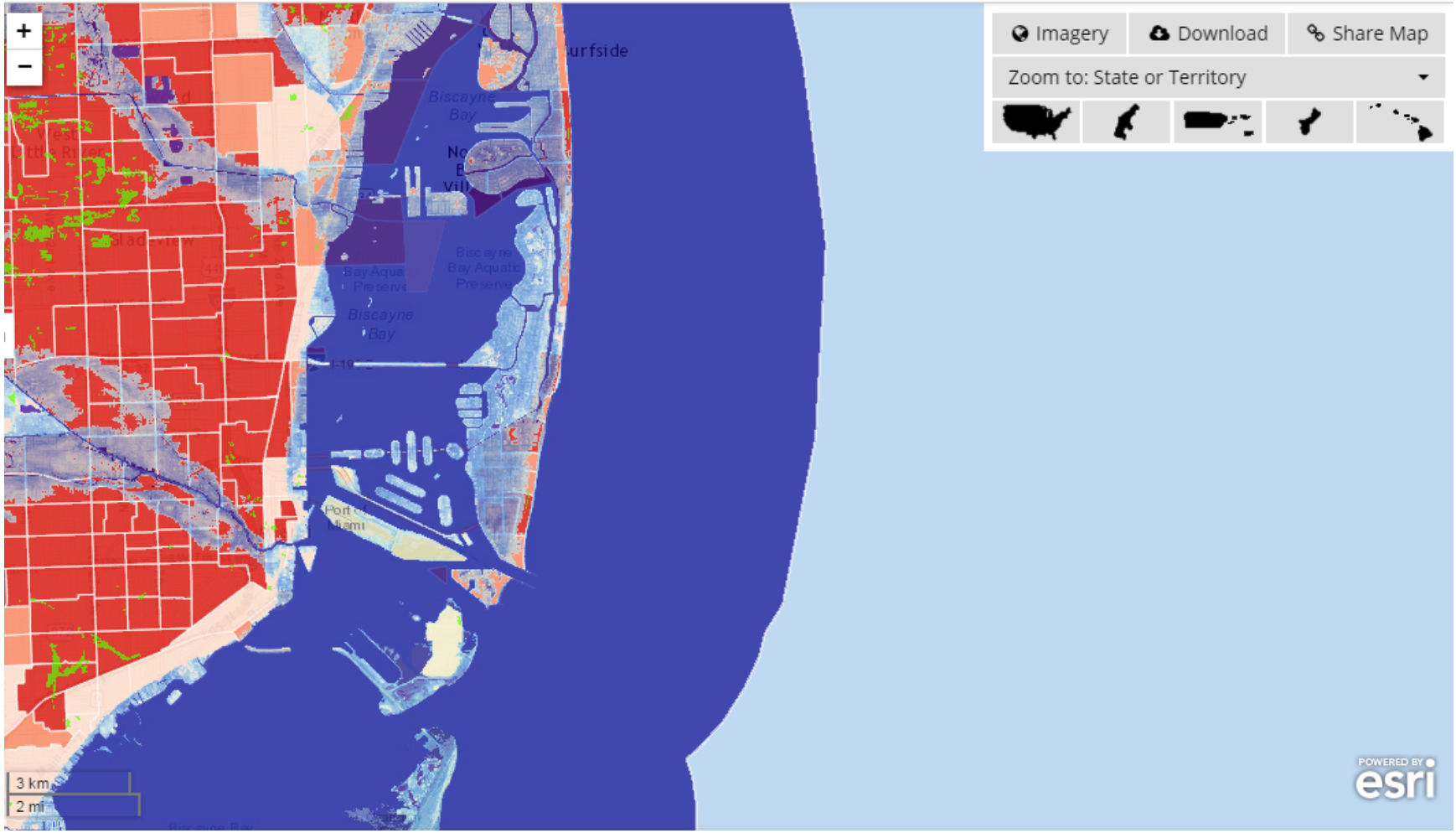
Agenda

- COP21 Video (2.30 mins)
- The Built Environment (1 min)
- Demand for Low-energy Buildings (1.30 min)
- RICS Professionals and Low-energy Assets (2 min)
- RICS Commitments (2 mins)
- Conclusion (1 min)

Shanghai – 2-degree Celsius



Miami Beach – 6 feet SLR



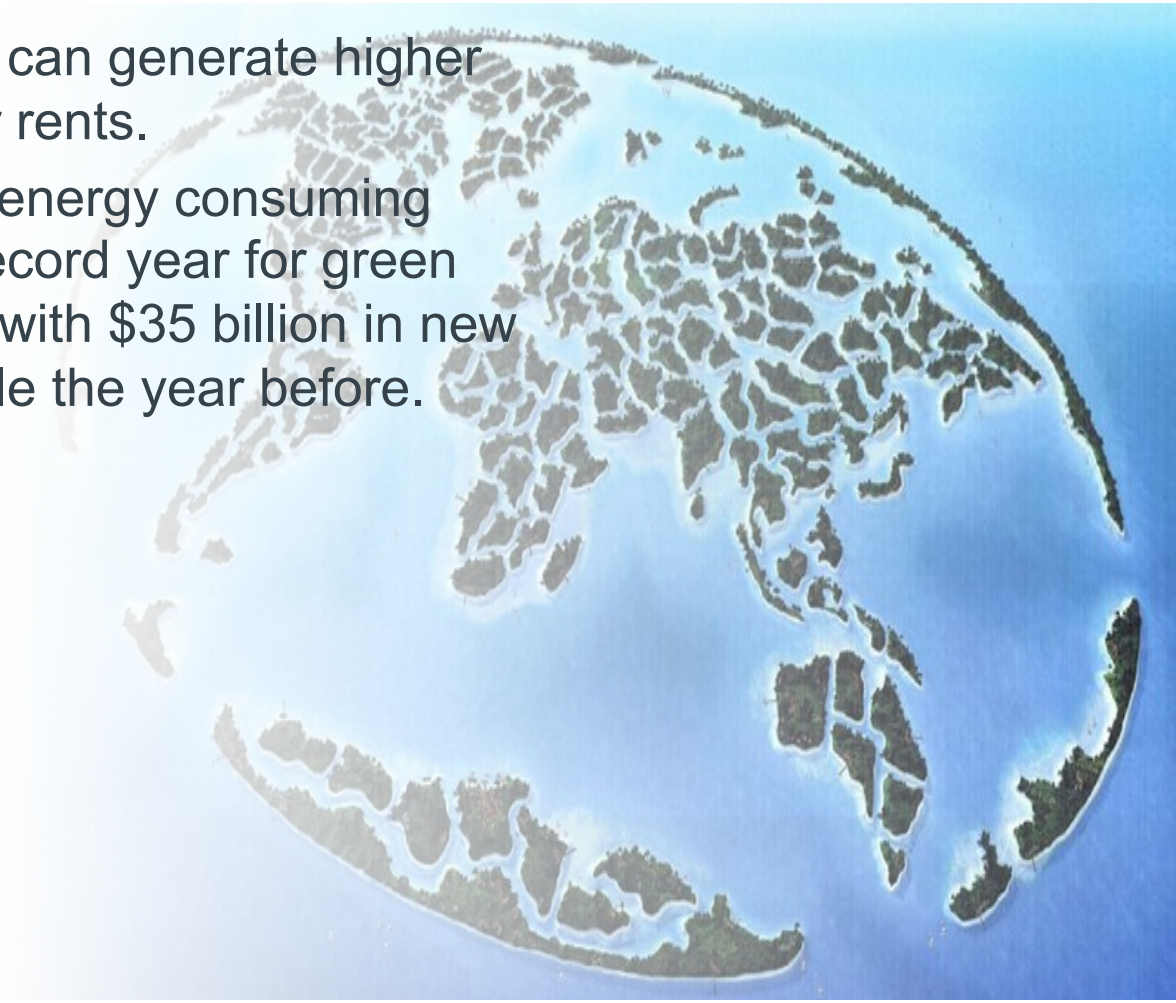
The Built Environment

RICS COP21

- 40% of the worlds energy is consumed by the built environment.
- Emits up to 30% of global greenhouse emissions.
- Carbon emissions could triple by 2050 if we do no ACT.
- Property sector is global
- Occupied by multinational corporate tenants
- Financed by international investors
- Developed and managed by global firms
- Our population is heading toward 9 Billion People
- 66% of future population will live in urban cities
- Land and Real Estate accounts for 70% of the worlds wealth

The Demand of for Low-Energy Buildings

- Energy efficient buildings can generate higher yields and achieve higher rents.
- Growing demand for low-energy consuming buildings - 2014 was a record year for green buildings internationally , with $35 billion in new issuances, more than triple the year before.



RICS Professionals and Low-energy assets

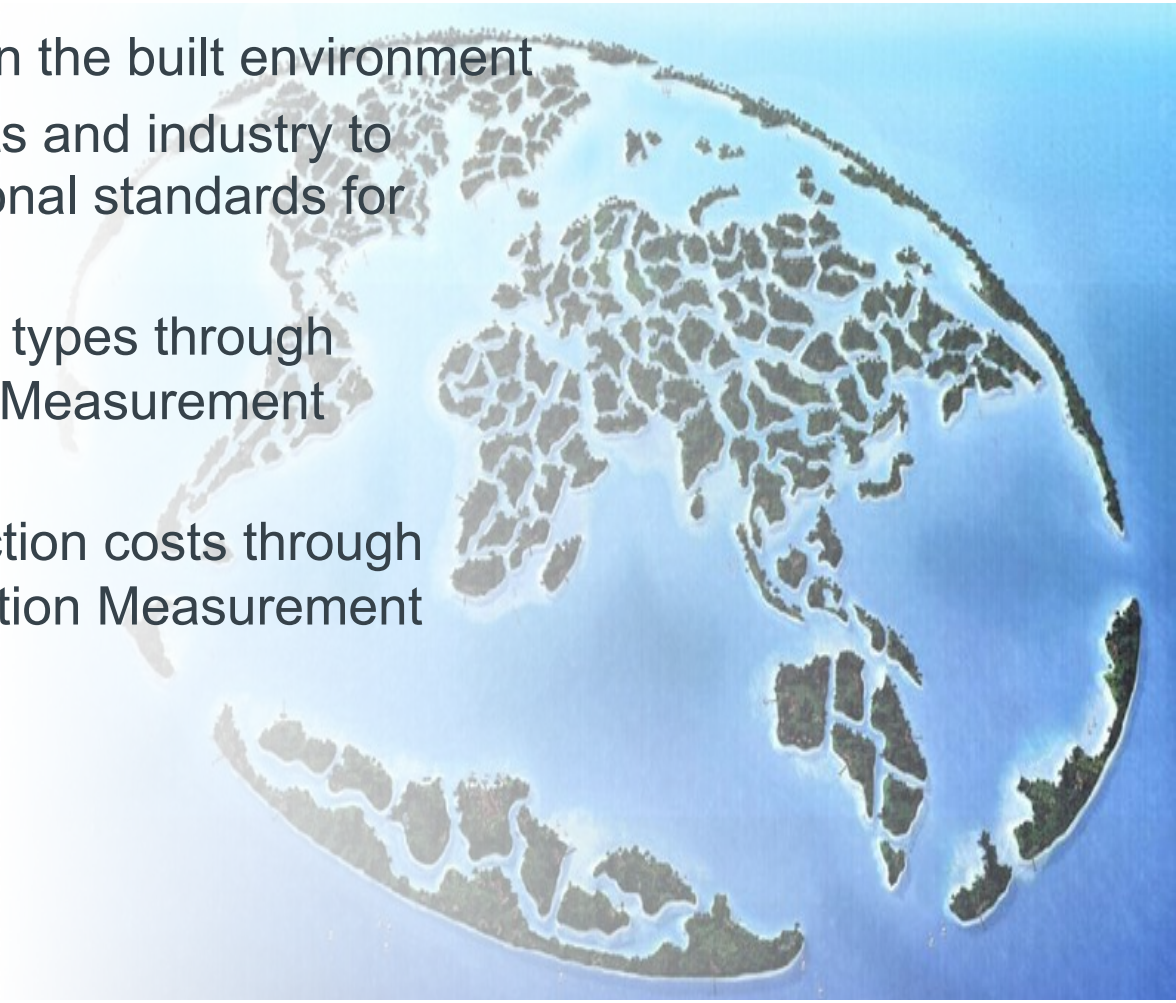
- As professionals, how do we deploy our expertise and professional standards to make a difference?
  - Transparency and comparability underpin investment decisions
  - If a deal lacks transparency, it is considered more risky
  - Investments need to be compared on a like-for-like basis
  - Measurements in buildings around the world can vary by 24% - reducing transparency and risk
  - Distorts how we measure and benchmark energy consumption and carbon emissions from buildings

RICS Commitment

- Strengthen business case for energy efficiency measures and Green Buildings.
- RICS already made sustainability an integral part of the Red Book professional valuation guidance.
- Developing “RenoValue” sustainability training programmes and e-learning.

RICS Commitment

- Promoting transparency in the built environment
- Working with governments and industry to devise common international standards for measuring:
  - the size of all property types through International Property Measurement Standards (IPMS)
  - all aspects of construction costs through International Construction Measurement Standards (ICMS)



RICS Commitment – South Florida

- Promoting discussion and thought leadership amongst RICS Florida members and other industry professional bodies.
- Influencing industry leaders through RICS Florida sponsored member events.
  - RICS holds member and non-member Round Table events to drive discussion
- Educating members and non-members on subject matter through research reports and courses.

Conclusion

- **Buildings have a major impact** on our environment; they are key to achieving our climate commitments.
- The Built Environment is **significant in underpinning investment** into the financial Eco-system of the world
- **We need to ensure** the way we deal with urbanization is in a sustainable way, maximizing our use of limited resources.
- Building energy **performance measures can help us monitor** and assess progress towards our targets and drive behaviour change.
- Meaningful progress requires a **common standard** for measuring buildings.
- **IPMS offers a solution** which is becoming established in the property industry. Governments should get behind this solution too.
- Need to **drive dialogue** on topic matter to broad audience of professional real estate practitioners.

Thank you.

www.rics.org

www.ipmsc.org

LLOYD'S: CLIMATE CHANGE

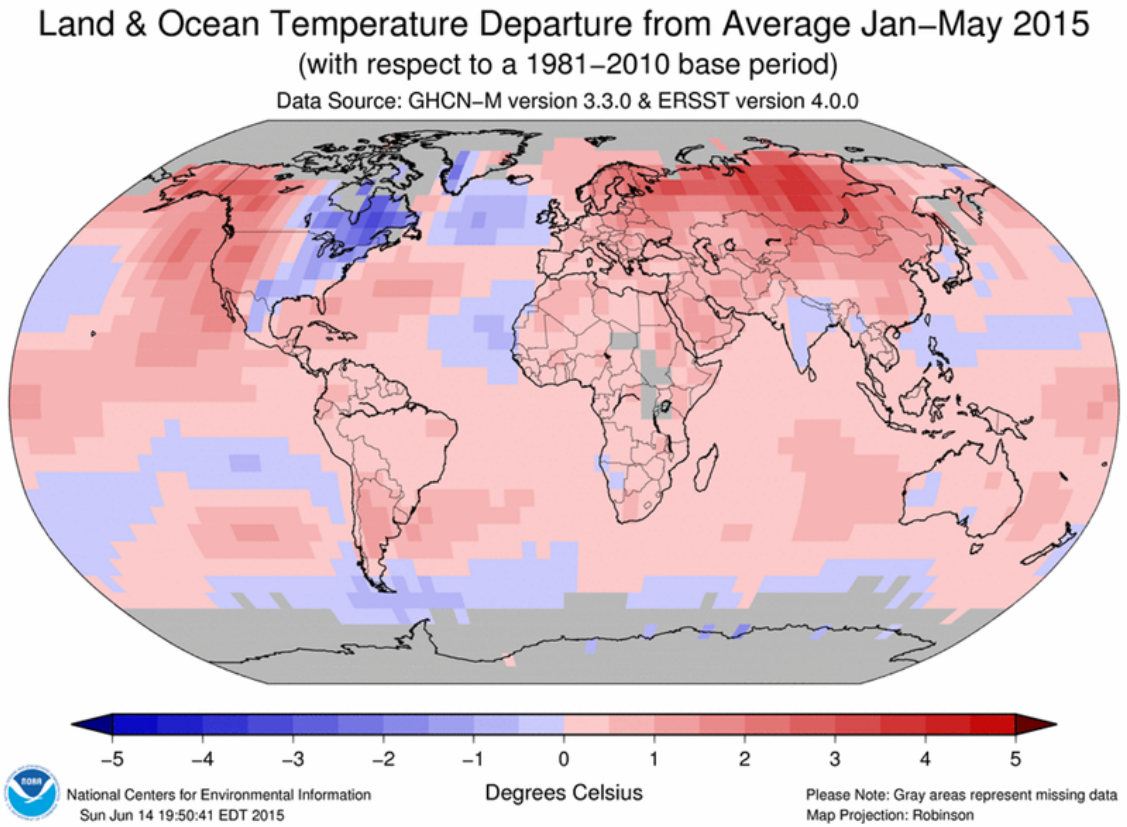
Rodney Smith (Lloyd's America, Inc.)

Lloyd's: Climate Change

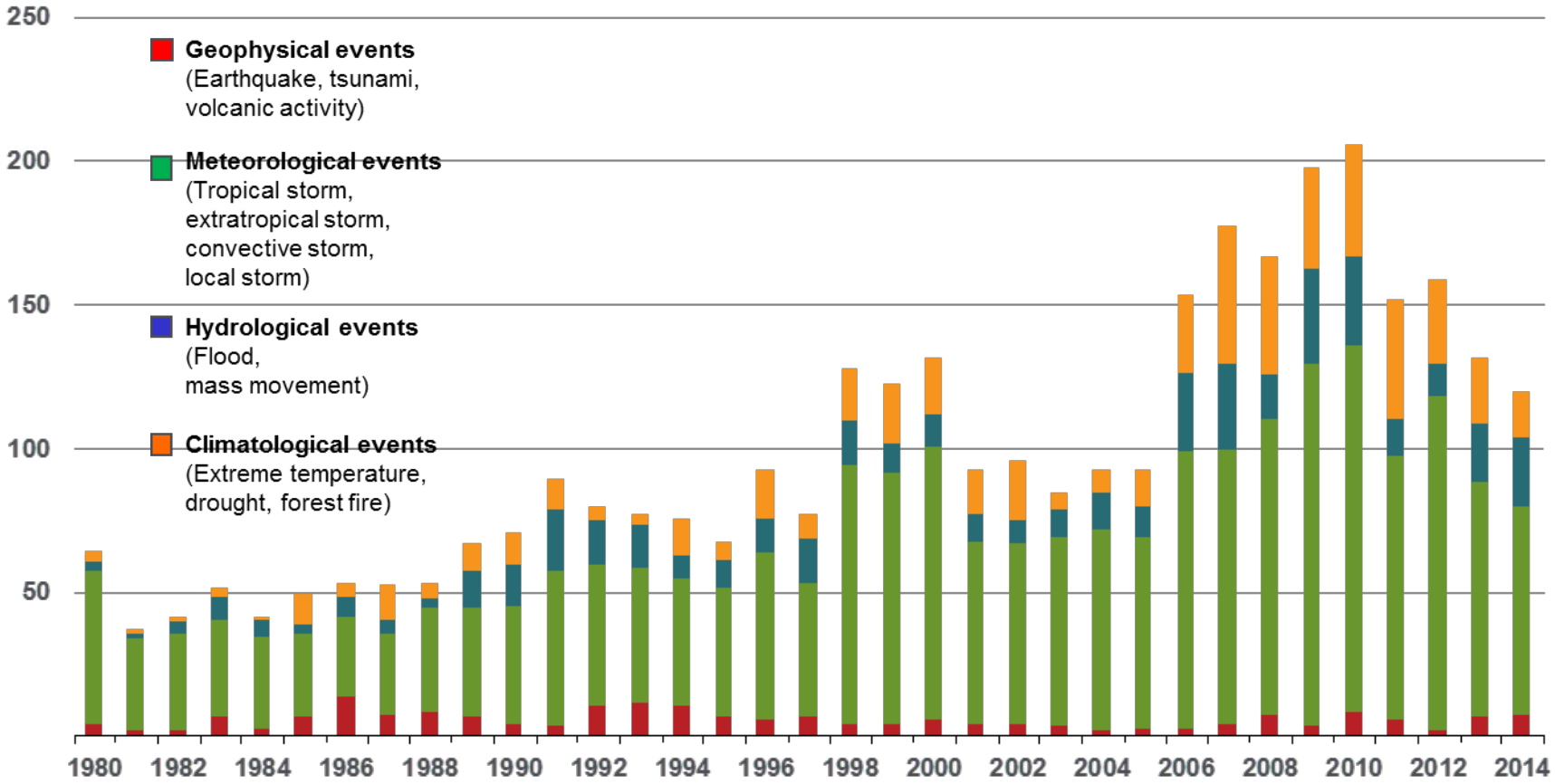
Rodney Smith, Director, Lloyd's America

The World is Warmer...With An Exception

- 2014 was the warmest year across global land and ocean surfaces since records began in 1880.
- 9 of the 10 warmest years in the 135-year period of record have occurred in the 21st century. 1998 currently ranks as the fourth warmest year on record.
- January to May 2015 warmest first five months on record!

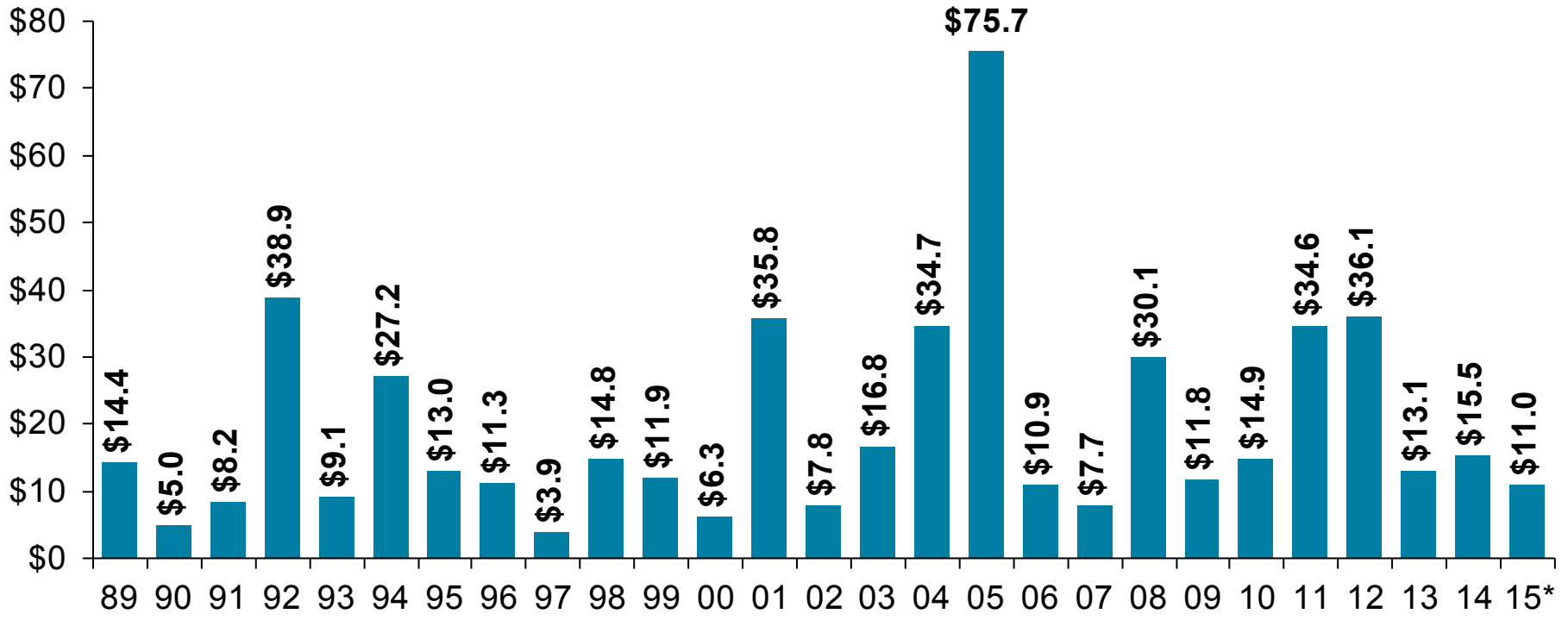


Loss events in the US, 1980 – 2014



Source: Geo Risks Research, NatCatSERVICE

U.S. Insured Catastrophe Losses



*Through 9/30/15 in 2015 dollars.

Note: 2001 figure includes $20.3B for 9/11 losses reported through 12/31/01 ($25.9B 2011 dollars). Includes only business and personal property claims, business interruption and auto claims. Non-prop/BI losses = $12.2B ($15.6B in 2011 dollars.)

Sources: Property Claims Service/ISO; Insurance Information Institute.

Managing the escalating risks of natural catastrophes in the US

1 The first step in protecting US property owners from natural catastrophe losses is ensuring there is a healthy, private insurance market

2 Government intervention in private insurance markets should be kept to a minimum

3 Risk-based pricing is the fairest and most sustainable solution

4 Specialist international insurers and reinsurers add value to the US natural catastrophe market through additional capacity and expertise

5 Government and insurers must respond to changing trends in the frequency and severity of losses

Managing the escalating risks of natural catastrophes in the US

6 Government has an important role to play in helping develop risk mitigation measures and rewarding adaptation to reduce the overall costs to the economy

7 The insurance industry has a key role to play in helping build more resilient communities

8 Good quality data and hazard mapping is critical to robust underwriting

9 We believe in encouraging a responsible approach to risk in society

Florida Citizens Exposure to Loss, 2002 – 2015* ($ Billions)

*As of October 6, 2015.

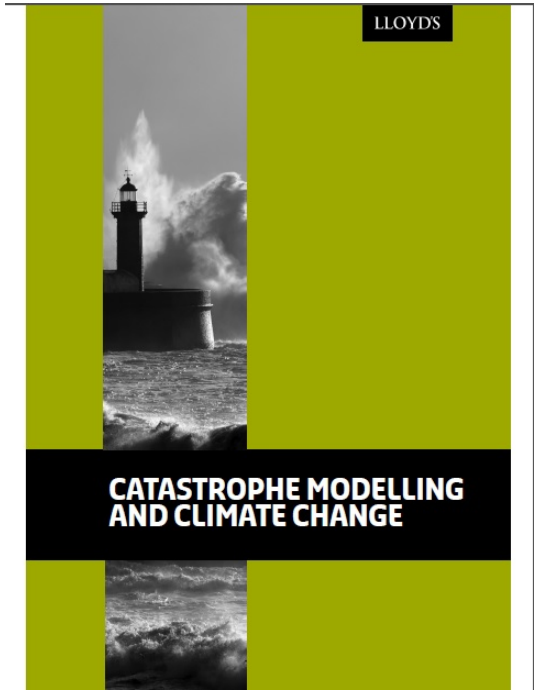
Source: PIPSO; Florida Citizens https://www.citizensfla.com/about/bookofbusiness/; Insurance Information Institute (I.I.I.).

Climate Change and Catastrophic Modeling

Increasing magnitudes of warming is increasing the likelihood of severe and pervasive impacts

Peak river flows from 10% to 15% over the period between 2015 and 2039, rising to a range of 20% to 30% by 2080

Rising sea levels around the world could have significant implications for insurers in the context of storm surge



The ClimateWise principles:

- Lead in risk analysis
- Inform public policymaking
- Support climate awareness
- Investment strategies
- Reduce environmental impact
- Report and be accountable

ClimateWise

Thank you! Stay in touch.

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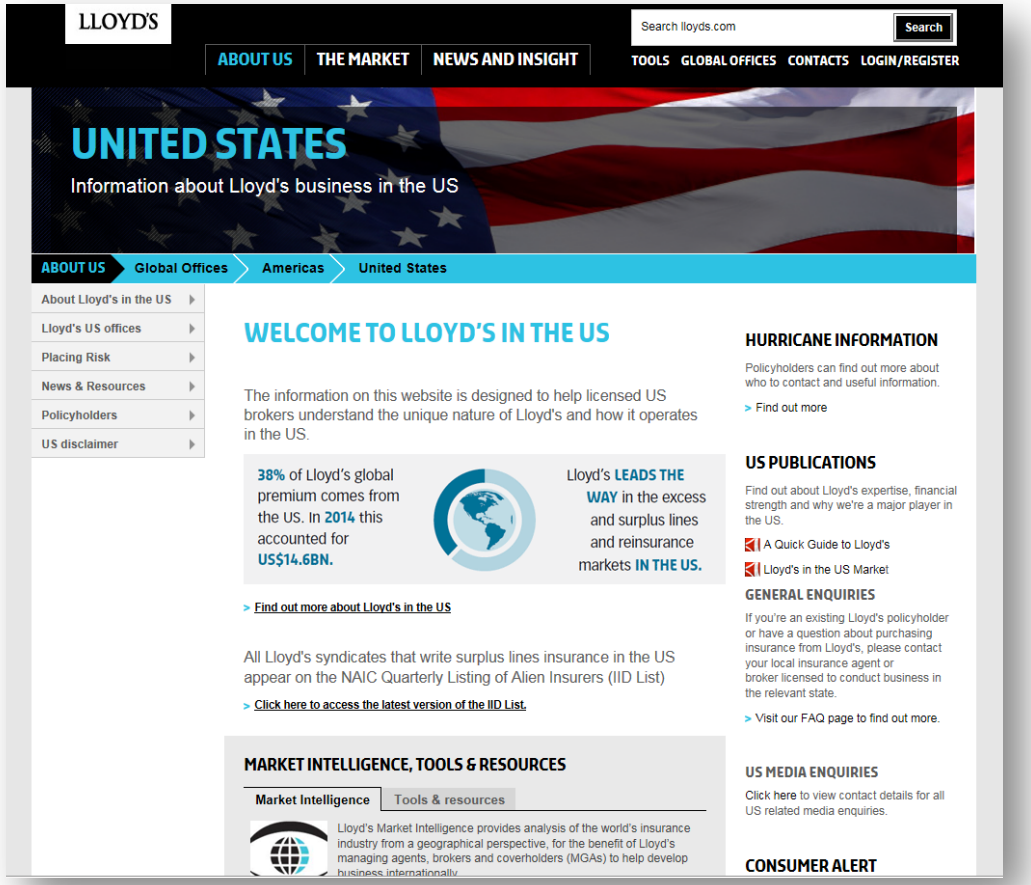

COFFEE BREAK

10:15 - 10:30

FACILITATED DISCUSSION

10:30 - Noon

DISCUSSION QUESTIONS

- How do we better understand the physical and economic risks posed by climate change to Miami-Dade County?
- What can we learn from existing best practice?
- How do we ensure future insurability?
- What strategies for adaptation/mitigation would be most suitable for Miami-Dade?

ADJOURN

Noon