



An Introduction to Natural Catastrophe Modelling at Twelve Capital

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Hazard

- Stochastic modelling of events and their intensities
- Producing thousands of years of events with their intensities based on historic data
- Wind fields for hurricanes around tracks taking intensity, size and surface roughness into account
- Shaking at surface calculated for earthquakes taking magnitude, depth and soil properties into account

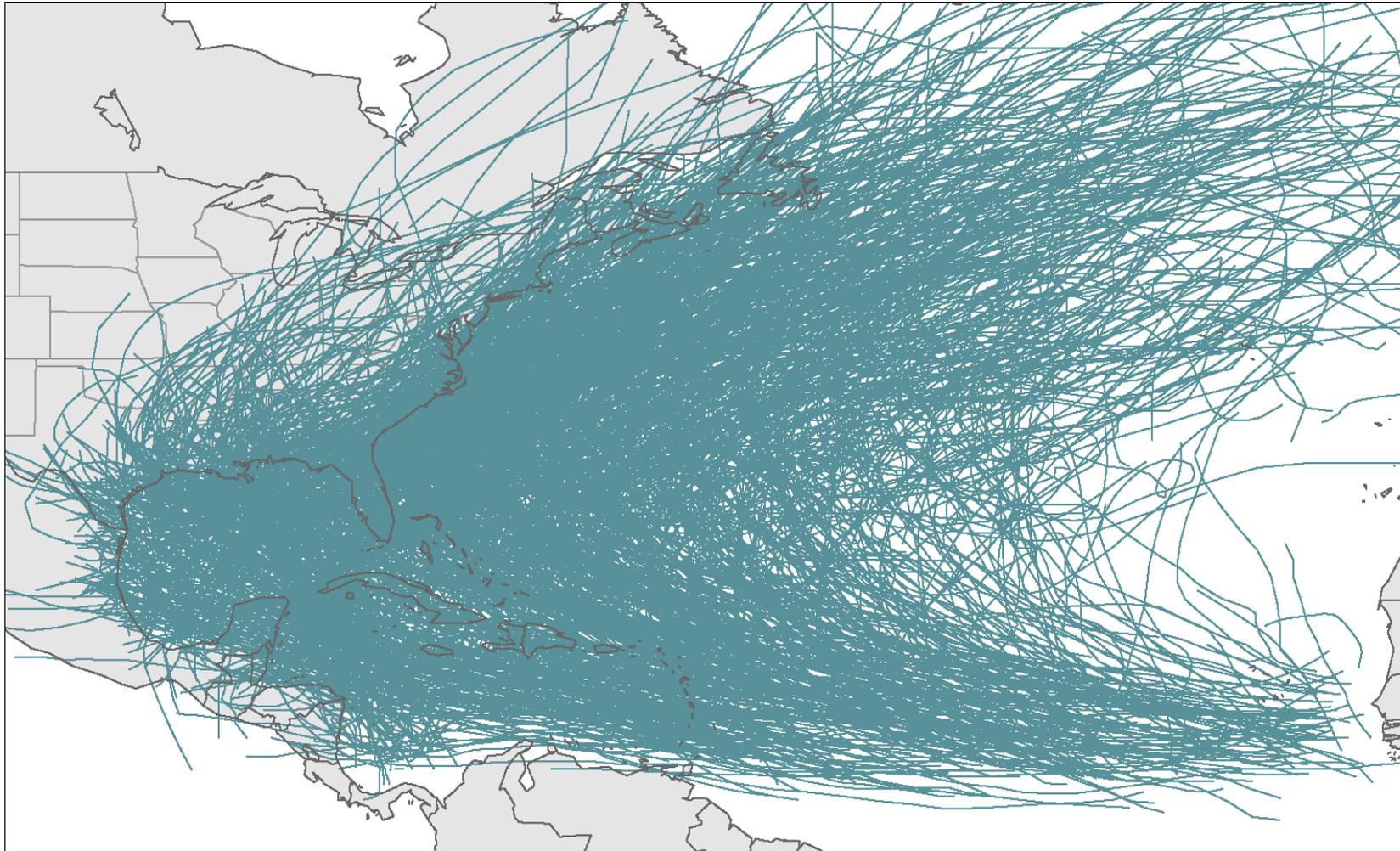
Vulnerability functions

- Calculate financial loss to buildings, contents, and business interruption, depending on hazard intensity

Financial model

- Include insurance conditions for each building / location
- Calculate loss to the entire portfolio
- Include reinsurance conditions

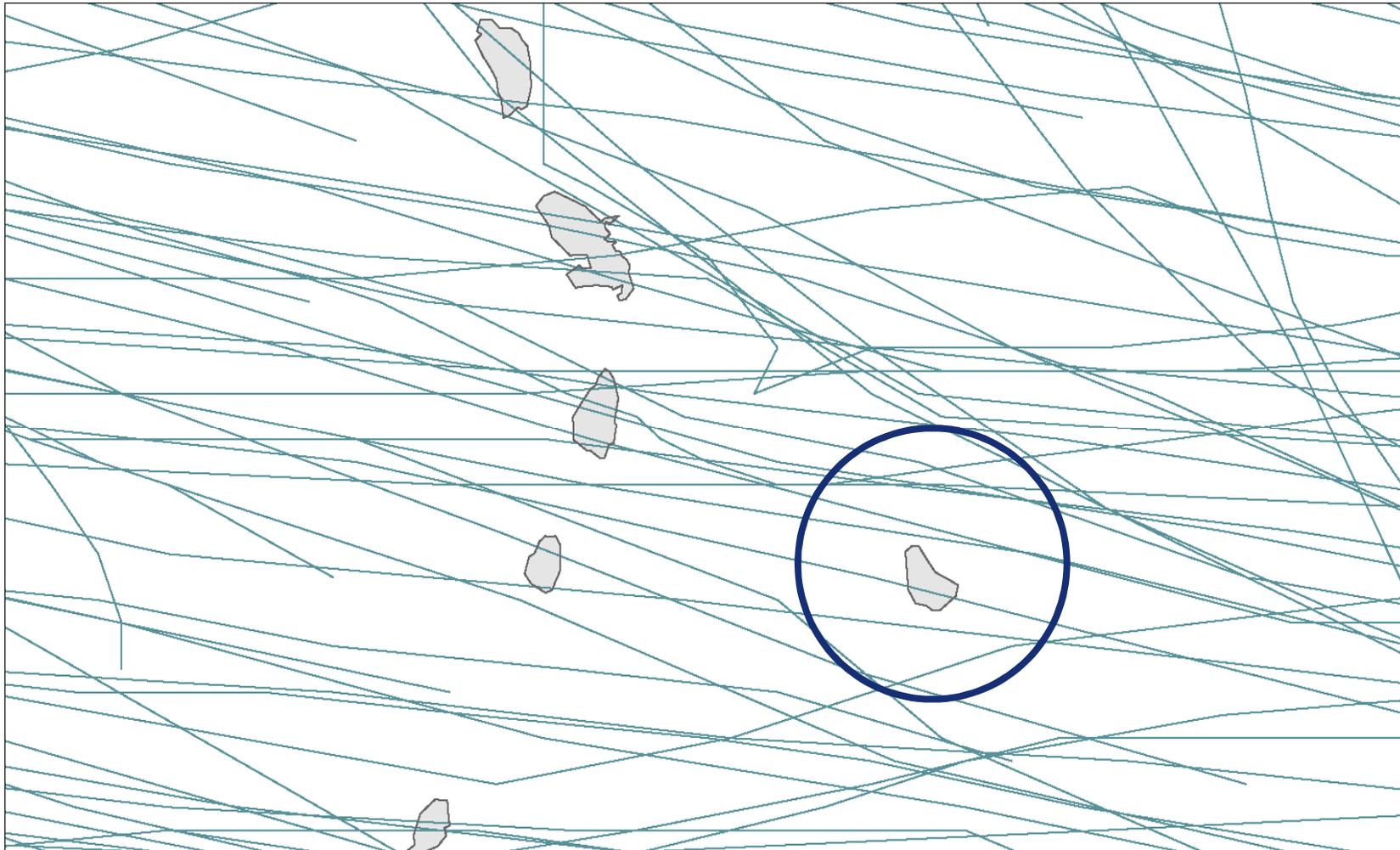
All Atlantic Storms Tracks from HURDAT* since 1851



* HURDAT: North Atlantic Hurricane Database.

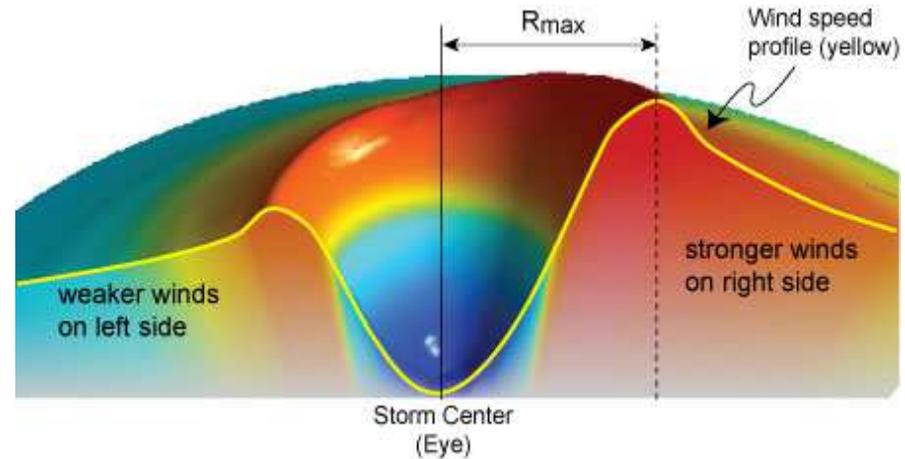
Source: National Hurricane Center (NHC) / National Oceanic and Atmospheric Administration (NOAA).

160 years of Data is not enough for certain Regions!



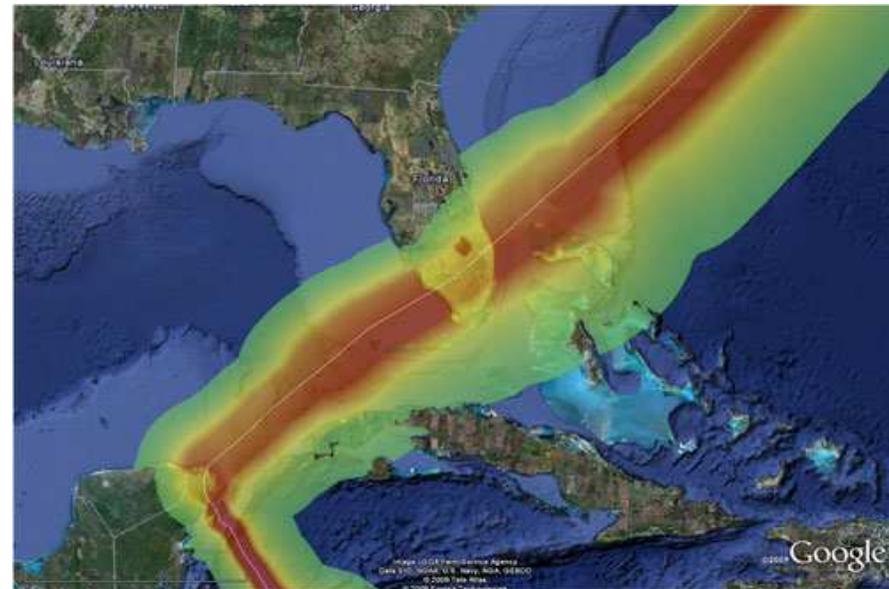
Hurricane Cross-Section

- Hurricane wind fields are stronger to the right of the centre (in the northern hemisphere) due to the combination of rotation and forward movement



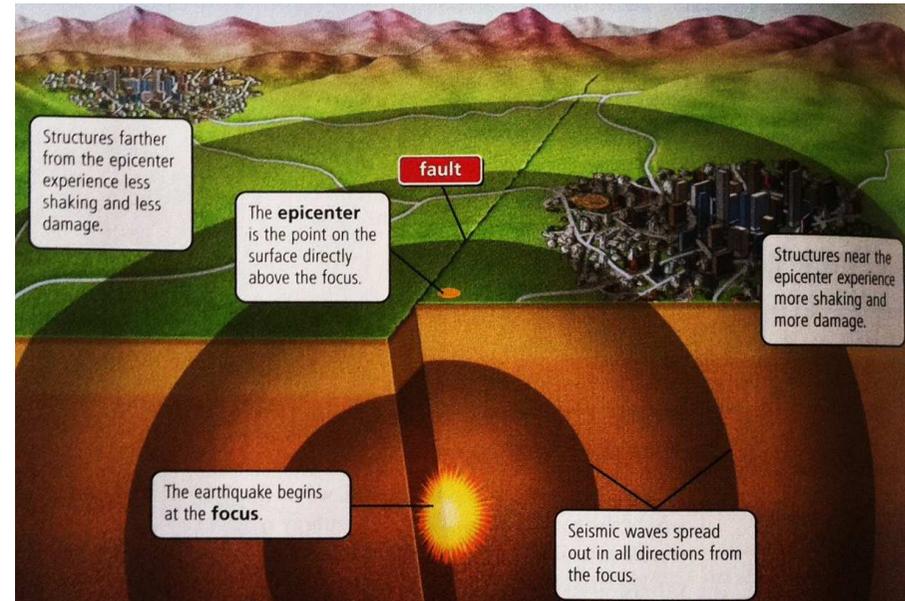
Resulting Wind Field for Wilma

- Includes asymmetry of wind field
- Includes surface roughness due to land use



Earthquake shaking is calculated taking into Account

- Magnitude
- Depth
- Fault structure
- Soil properties between source and surface: attenuation and site amplification
- Similar to what is used by USGS for US earthquake hazard assessment



Current Earthquake Models also include

- Fire following earthquakes
- Tsunami
- Soil liquefaction

Combining Exposure Data with Hazard

- Damage to building calculated depending on
 - Hazard intensity, e.g. wind speed or shaking,
 - Line of business and occupancy (residential, commercial, industrial, ...),
 - Building type (masonry, concrete, wood frame, ...),
 - Further building properties as number of stories, roof structures, year of construction, ...



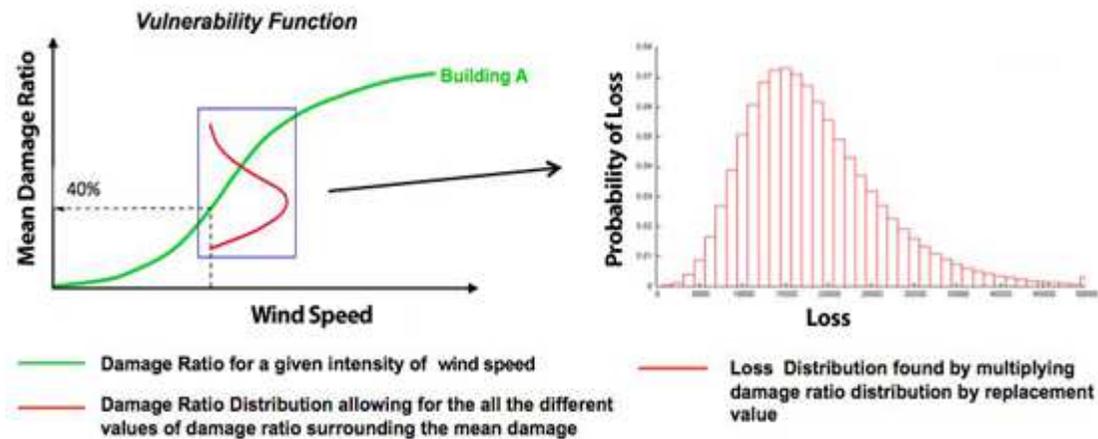
Hurricane Sandy, NJ, 2012



Northridge, CA, 1994

Calculating the Loss to the Portfolio

- Ground-up loss to each building
- Including the insurance conditions of each building
- Loss to the entire portfolio
- Including the reinsurance conditions



Advantages of current Catastrophe Models

- Spatial correlation of events is taken into account, portfolio view is therefore possible
- Losses beyond historic data can be taken into account
- Current portfolio of exposure is considered in the modelling
- Losses of historic events to current portfolio can be calculated

Perils currently covered

- Tropical cyclones (hurricanes, typhoons, cyclones, ...)
- Extra tropical storms (US and Canada winter storms, European storms)
- Severe convective storms (tornadoes, hail, straight-line wind)
- Earthquakes including fire-following and tsunami
- Floods
- Terrorism

AIR Worldwide, licensed by Twelve Capital

- Applied Insurance Research
- Founded in 1987 in Boston, US
- Member of the Verisk Insurance Solutions Group at Verisk Analytics

RMS, licensed by Twelve Capital

- Risk Management Solutions
- Founded in 1988 at Stanford University, US

EQECAT

- EQE founded in 1981 in San Francisco, US
- Part of CoreLogic since December 2013

Conclusion

- These models are around since more than 30 years.
- These models are widely used in the insurance and re-insurance industry, their use is standard.

Niche by Region

- Risk Frontiers
 - Models for Australia
 - Earthquake, tropical cyclones, floods, hail, bushfire
- Evaluación de Riesgos Naturales (ERN)
 - Based in Mexico, specialised in Latin America
 - Earthquake, hurricanes, floods

Niche by Peril

- JBA Group
 - UK based
 - Specialised in flood modelling
- Applied Research Associates, Inc. (ARA)
 - US based
 - Specialised in hurricane modelling

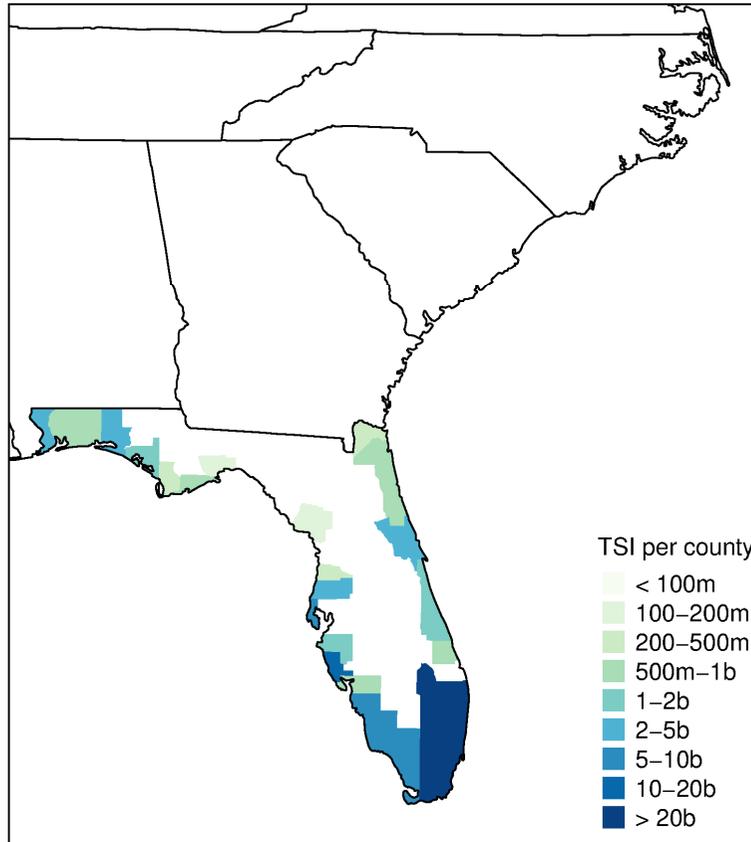
Current Status

- License for AIR Worldwide
 - Modelling of Cat Bonds and private ILS
 - Portfolio roll-up and analytics
- License for RMS
 - Modelling of US risks and terrorism
- In-house model development for non-Cat perils
 - Aviation
 - Fire per risk
- Active observation of weather and climate pattern with public and proprietary information
 - Licensing of forecasts by Planalytics

Plans for the Future

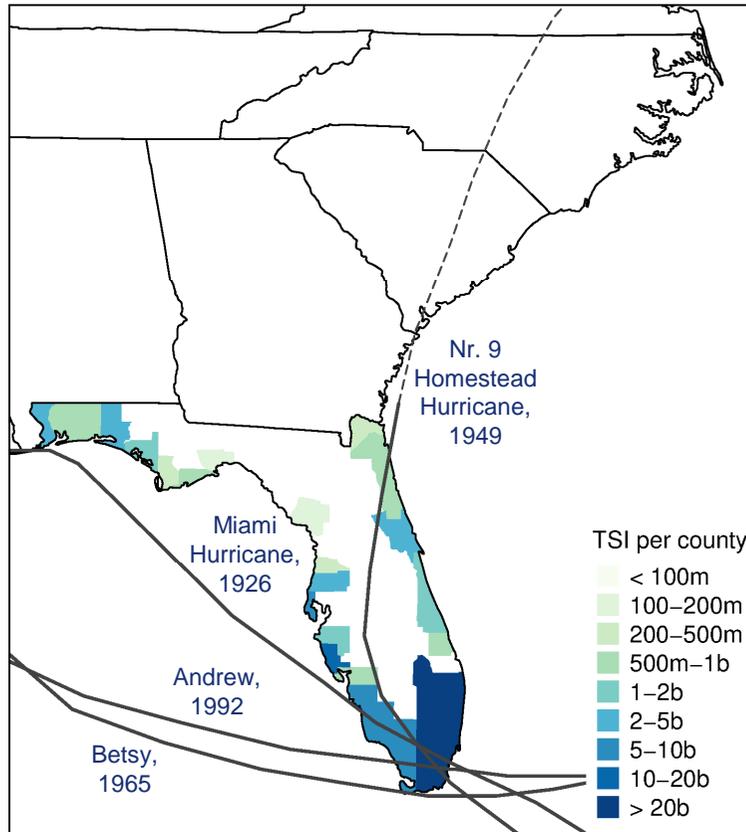
- In-depth model evaluation and if needed, model adjustment
- In-house development of further models and/or model components
- Actively following new developments of modelling companies

Everglades Re Ltd. Series 2014-1 Class A



- Map depicts total sums insured per county, heavy concentration around Miami
- Attachment Probability (AP): 2.89%
- Expected Loss (EL): 2.30%
- Exhaustion Probability (EP): 1.72%

Everglades Re Ltd. Series 2014-1 Class A



- Historic hurricanes which would cause a loss to this bond
- 1926 Miami Hurricane (100% loss)
- 1945 Homestead Hurricane (100% loss)
- 1965 Betsy (18% loss)
- 1992 Andrew (100% loss)

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