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Navigating the landscape of Physical Climate risk data

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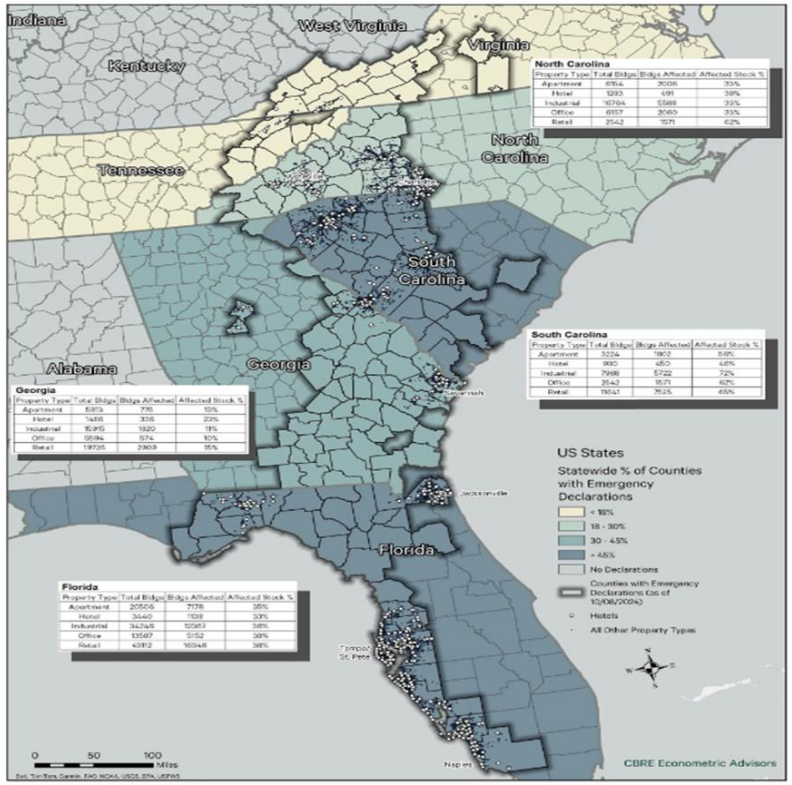
Agenda



1 Physical climate risk – data landscape

2 A use case of physical climate risk in CRE

3 Closing remarks

1 Data landscape

Provider Selection Criteria

The following data criteria was identified as most important to selecting the providers.

1. Global Coverage
2. Climate Scenarios
3. Number of Physical Hazards
4. Value at Risk
5. API
6. Geospatial Resolution

OVERVIEW OF CLIMATE DATA SOURCES

			1	2	3	4	5	6	7	8	9
SCENARIO		RCP 2.6 (<2.0°C)	✗	✓	✗	✓	✓	✗	✓	✓	✓
		RCP 4.5 (2.0°C)	✗	✓	✓	✓	✓	✓	✓	✓	✓
		RCP 6.0 (3.0°C)	✗	✓	✗	✓	✓	✗	✗	✓	✗
		RCP 8.5 (>4.0°C)	✗	✓	✓	✓	✓	✗	✓	✓	✓
		SSP1-1.9 (1.5°C)	✓	✗	✗	✗	✓	✗	✗	✓	✗
		SSP1-2.6 (1.8°C)	✓	✗	✗	✓	✓	✗	✗	✓	✓
		SSP2-4.5 (2.7°C)	✓	✗	✗	✓	✓	✓	✗	✓	✓
		SSP3-7.0 (3.6°C)	✓	✗	✗	✓	✓	✗	✗	✓	✗
		SSP5-8.5 (4.4°C)	✓	✗	✗	✓	✓	✓	✗	✓	✓
TIME HORIZONS		Baseline / historical	✓	✓	✓	✓	✓	✗	✓	✓	✓
		Near term (2025-2040)	✗	✓	✓	✓	✓	✓	✓	✓	✓
		Medium term (2050)	✗	✓	✓	✓	✓	✓	✓	✓	✓
		Long-term (2100)	✓	✓	✓	✓	✓	✗	✓	✓	✓
PHYSICAL HAZARDS		Chronic	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Acute	✓	✓	✓	✓	✓	✓	✓	✓	✓
RISK ANALYSIS	Level of analysis	Asset	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Firm	✓	✓	✓	✓	✓	✗	✗	✓	✓
		Sector	✓	✓	✓	✓	✓	✗	✗	✓	✓
		County	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Portfolio	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Impact Channel	Macroenvironment	✗	✗	✓	✓	✓	✓	✓	✓	✓
		Supply chain	✗	✓	✓	✓	✓	✗	✗	✓	✓
		Operations & assets	✗	✓	✓	✓	✓	✓	✓	✓	✓
		Markets & customers	✗	✓	✓	✓	✓	✓	✗	✓	✓
	Method	Physical Exposure	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Vulnerability indicators	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Physical impact modeling	✓	✓	✓	✓	✗	✓	✓	✓	✓
		Financial modeling	✓	✓	✓	✓	✗	✓	✓	✓	✓

OVERVIEW OF CLIMATE DATA SOURCES

		1	2	3	4	5	6	7	8	9
PHYSICAL HAZARD TYPE	Flood, coast	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Flood, inland	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Extreme weather	✓	✓	✗	✓	✓	✓	✓	✓	✓
	Extreme heat	✓	✓	✓	✓	✓	✓	✗	✓	✓
	Extreme precipitation	✗	✓	✓	✓	✓	✓	✗	✓	✓
	Landslide	✗	✓	✗	✓	✓	✗	✗	✓	✓
	Drought	✗	✓	✓	✓	✓	✓	✗	✓	✓
	Water scarcity	✗	✗	✓	✓	✓	✗	✗	✓	✓
	Wildfire	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Tropical Cyclone	✓	✗	✓	✓	✓	✓	✓	✓	✓
	Hurricane	✓	✗	✓	✓	✓	✓	✓	✓	✓
	Typhoon	✗	✗	✓	✓	✓	✓	✓	✓	✓
	Tornado	✗	✗	✗	✗	✓	✗	✓	✓	✓
	Tsunami	✗	✗	✗	✗	✓	✗	✓	✓	✗
	Earthquake	✗	✗	✓	✗	✓	✗	✓	✗	✗
	Air pollution	✗	✗	✗	✗	✓	✓	✗	✗	✗
	Heating and Cooling degree days (HDD & CDD)	✓	✗	✓	✓	✓	✓	✗	✓	✗
OTHER CONSIDERATIONS	Geospatial resolution of:	1km x 1km	20m & up	30m x 30m and up	10 m & up	arc second (30n	3 m & up	1m - 3m & up	25 km	90m & up
	Value at Risk (VAR%)	✓	✓	✓	✓	✗	✓	✓	✓	✓
	If yes to VAR, what is considered when calculating losses?	✓	✓	✓	✓	✗	✓	✓	✓	✓
	Insurance replacement cost value (RCV)	✗	✗	✓	✓	✗	✓	✓	✓	✓
	Global coverage	✓	✓	✓	✓	✓	✗	✗	✓	✓
	Transition Risk	✓	✗	✓	✓	✓	✗	✗	✓	✓
	Building Energy and/or GHG intensity	✓	✗	✓	✓	✗	✓	✗	✓	✓

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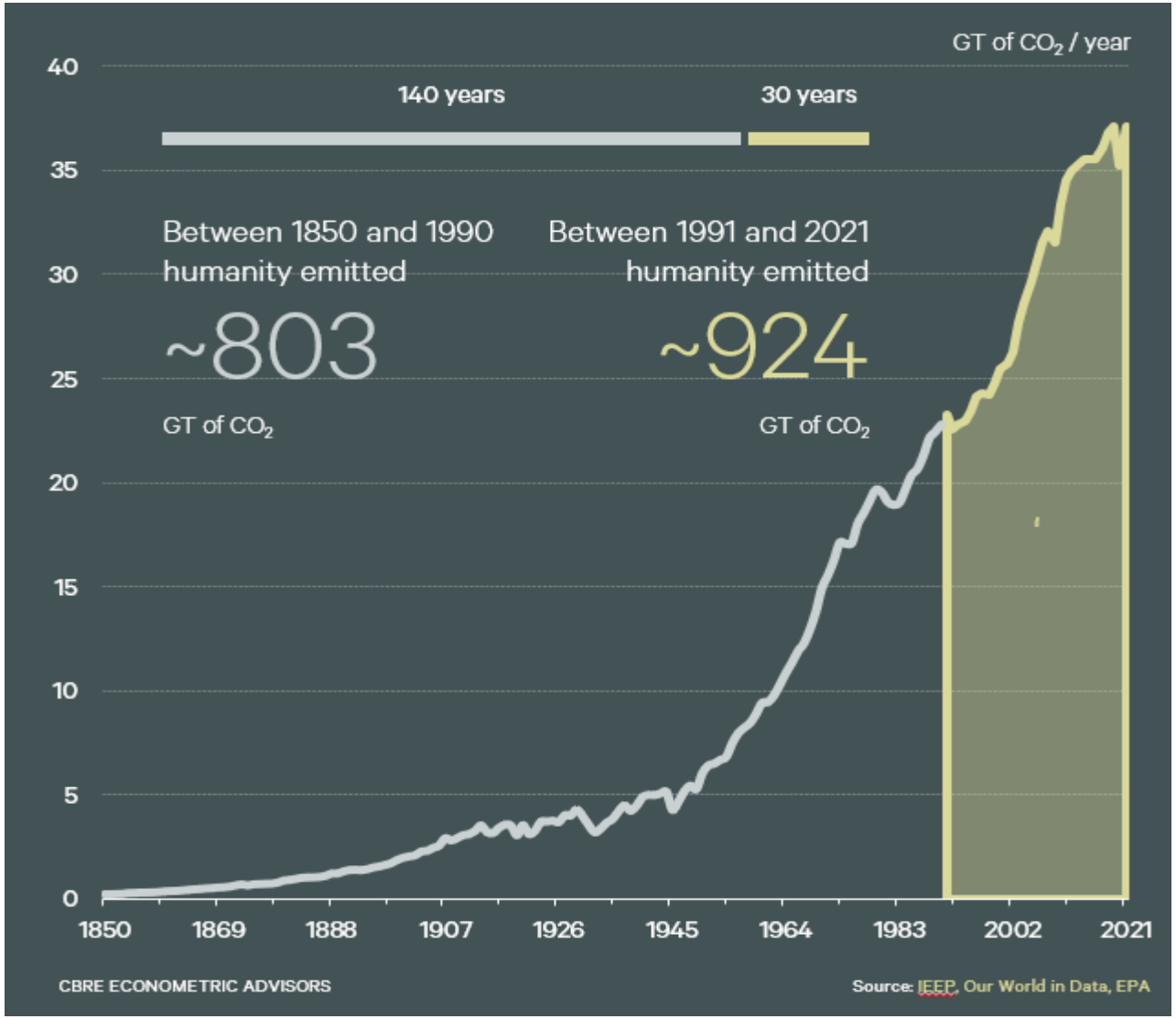
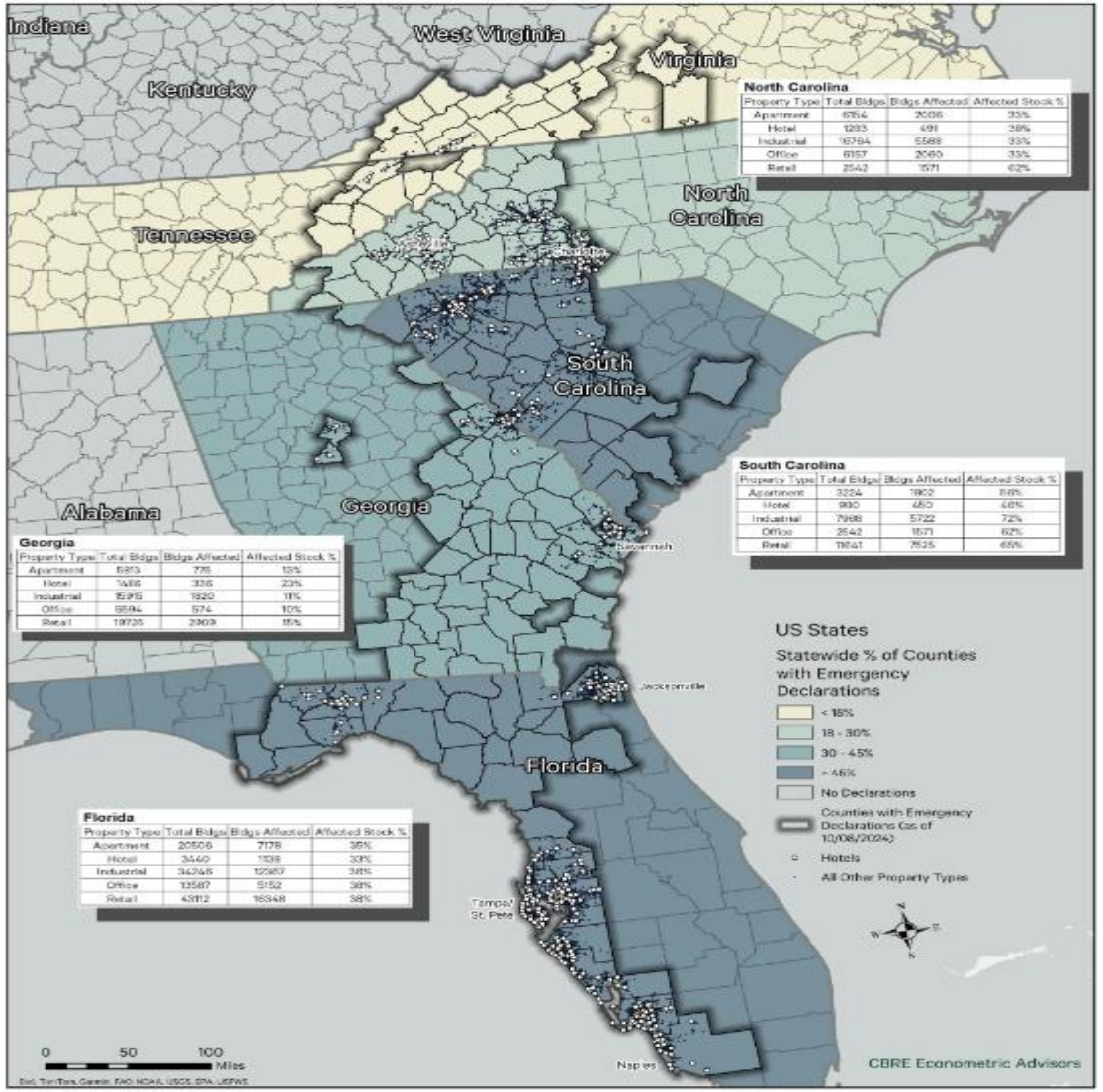
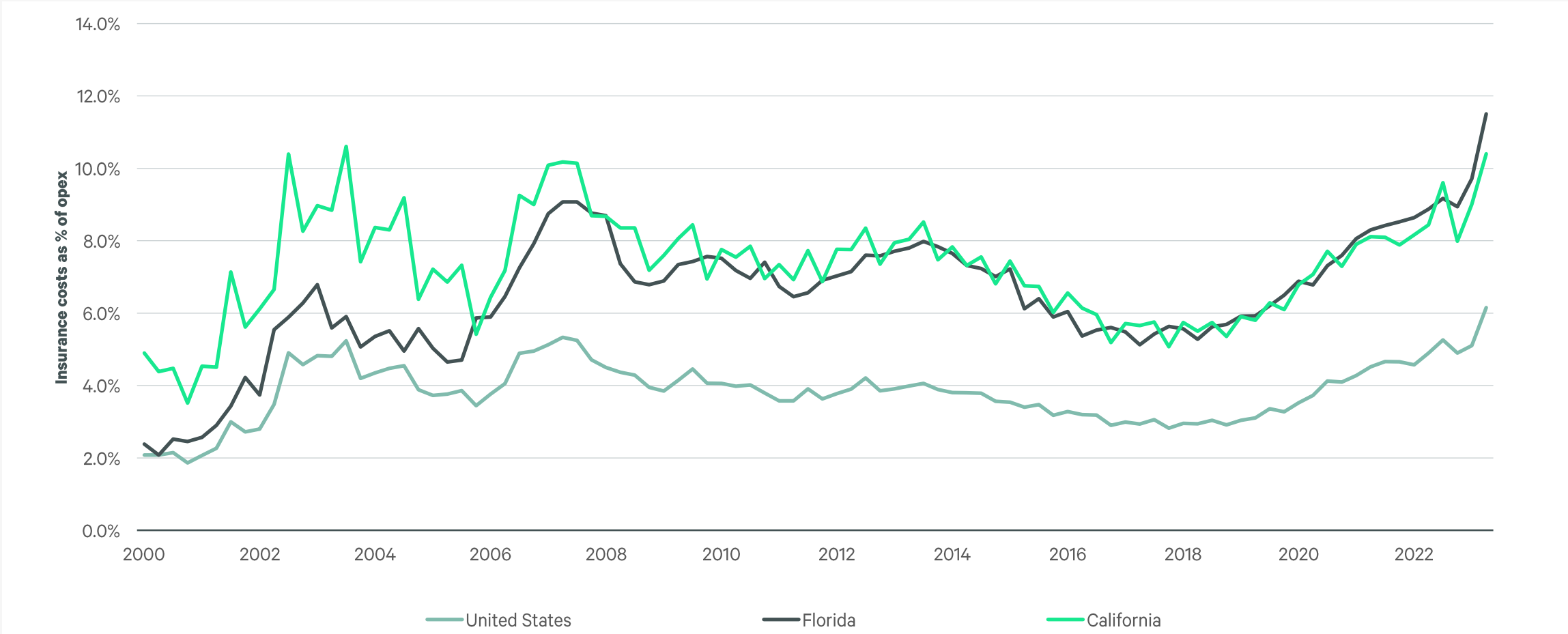
2. Using Physical climate risk data

Frequency and severity of weather-related events intensify as emissions grow





Insurance cost on the rise as severity of climate change increases



Source: NCREIF, CBRE Research

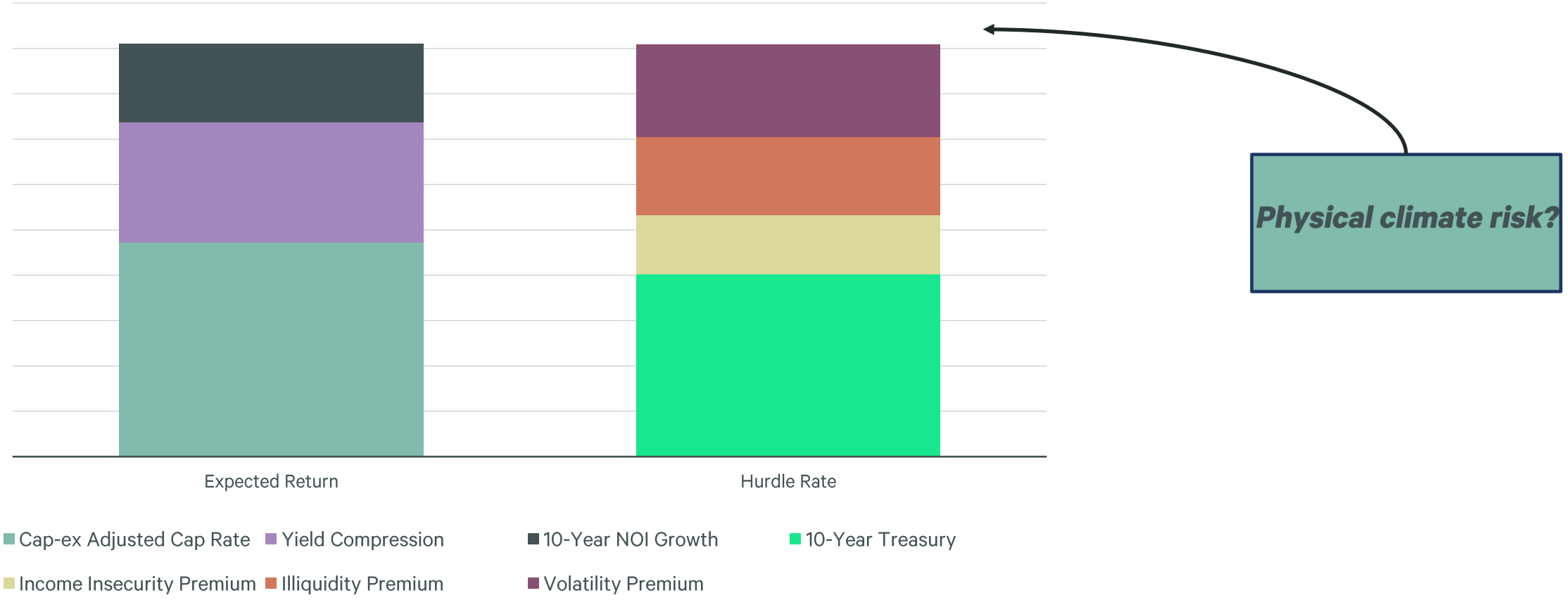
Climate risk scenarios & transitional / physical risk implications

	GREEN SCENARIO		HIGH-CARBON SCENARIO	
	PARIS ALIGNMENT	TWO +/- DEGREE	BUSINESS AS INTENDED	FAILED TRANSITION / BUSINESS AS USUAL
TRANSITION RESPONSE	Very strong	Strong	Substantial	Limited
CHANGE IN TEMPERATURE VS. PRE-INDUSTRIAL ERA (2100)	1.5˚C	2.4˚C	2.8˚C	4.3˚C
RCP SCENARIO	2.6	4.5	6.0	8.5

Source: CFTC 2929 (page 75), CBRE Research, February 2022.

Leveraging CBRE EA's 'Hurdle Rate' framework to include climate risk

Non-climate informed Hurdle Rate Model



Source: CBRE Econometric Advisors

Including nine Hazards to Quantify Physical Climate Risk

River Flooding

Surface Flooding

Coastal Flooding

Subsidence

Landslide

Wildfire

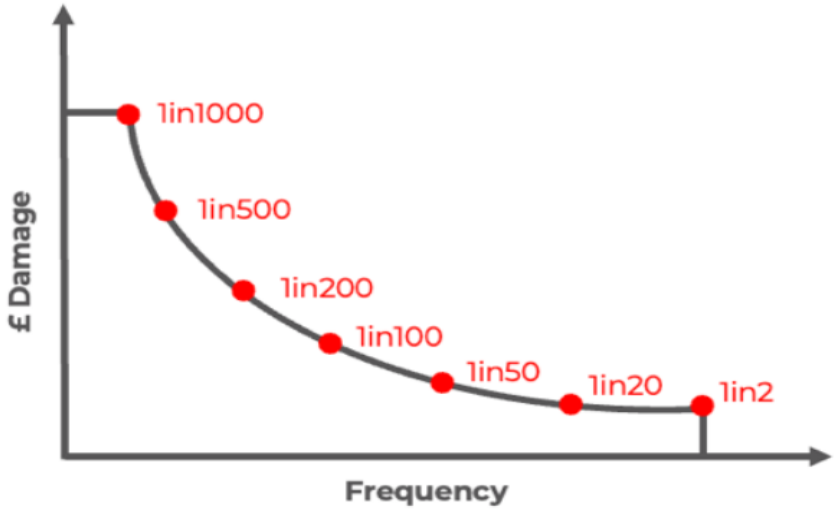
Storm

Tropical Cyclone

Storm Surge

Demystifying the Expected Annual Loss for Physical Climate risk

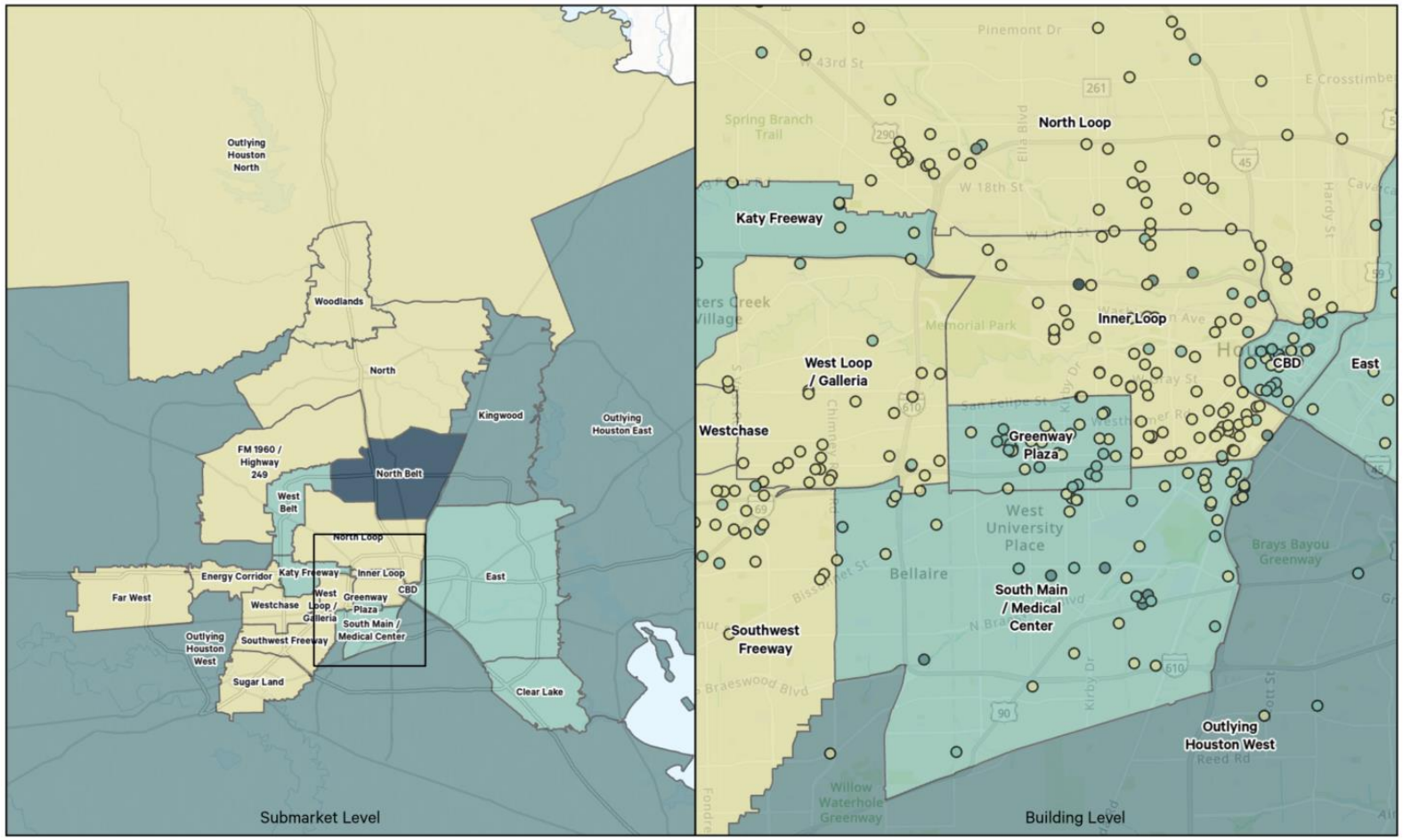
Expected Annual Loss (EAL): the loss that can be expected on average each year by weighting the probability of different hazard magnitudes (e.g. different flood depths) against the likelihood of the hazard occurring.



The process:

- Develop representative sample of EA building inventory per submarket;
- Run buildings into the Climate-X Spectra API;
- Return Annual Percentage Loss for all risk categories and buildings
- Average EAL = $((EAL_{2025} * 5) + (EAL_{2030} * 5) + (EAL_{2035} * 5) + (EAL_{2040} * 5)) / 20$
- Discounted NPV at 8% discount rate

Physical climate risk leveraging Houston as a use case

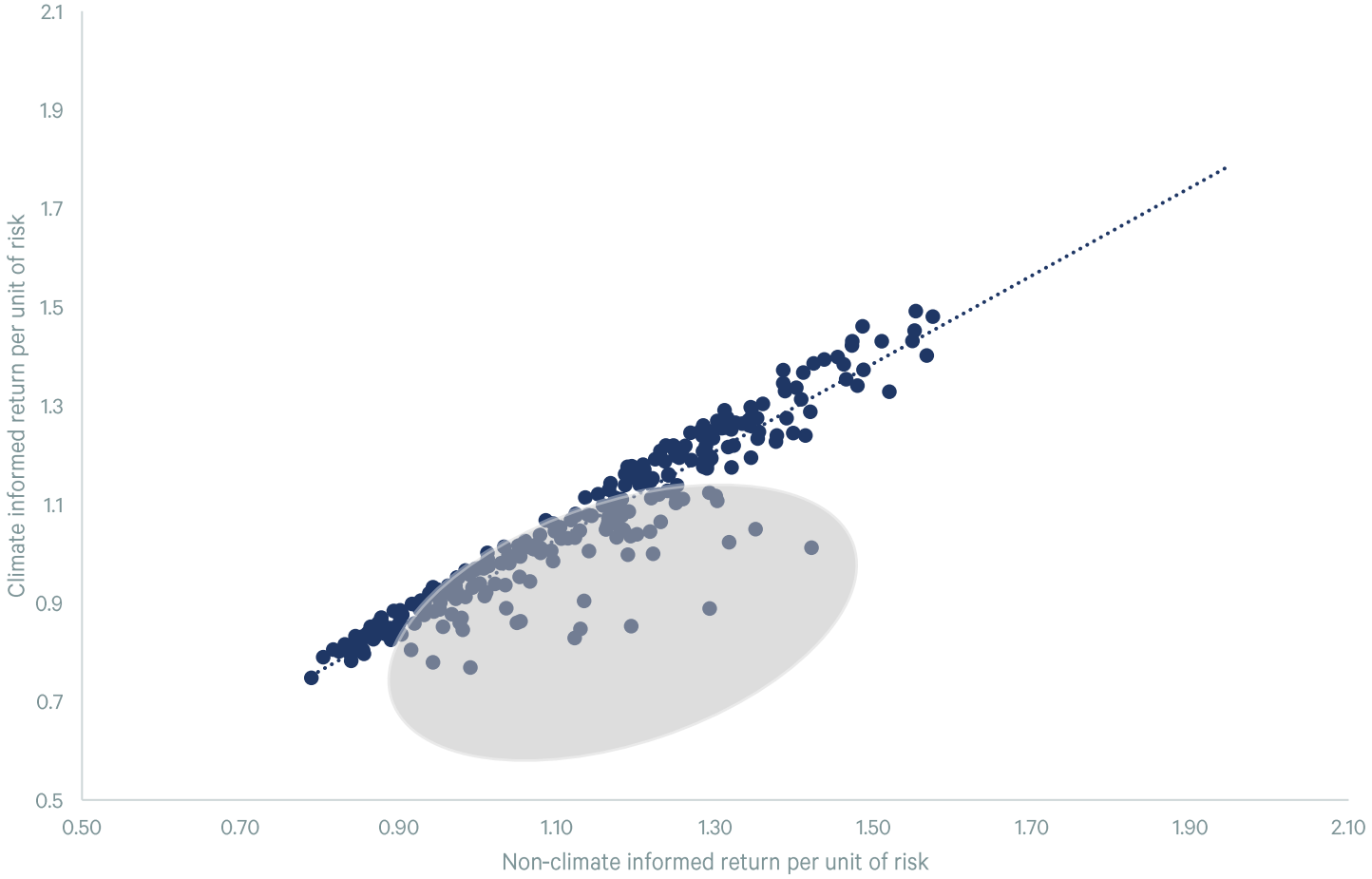


Expected Annual Loss
Houston, TX

Annual % Loss ○ < 2% ● 2- 5% ● 5 - 10% ● > 10%

- Building level expected annual loss based on 9 hazards;
- Aggregated by representative sample by submarket
- Aggregated stock weighted by submarket to market

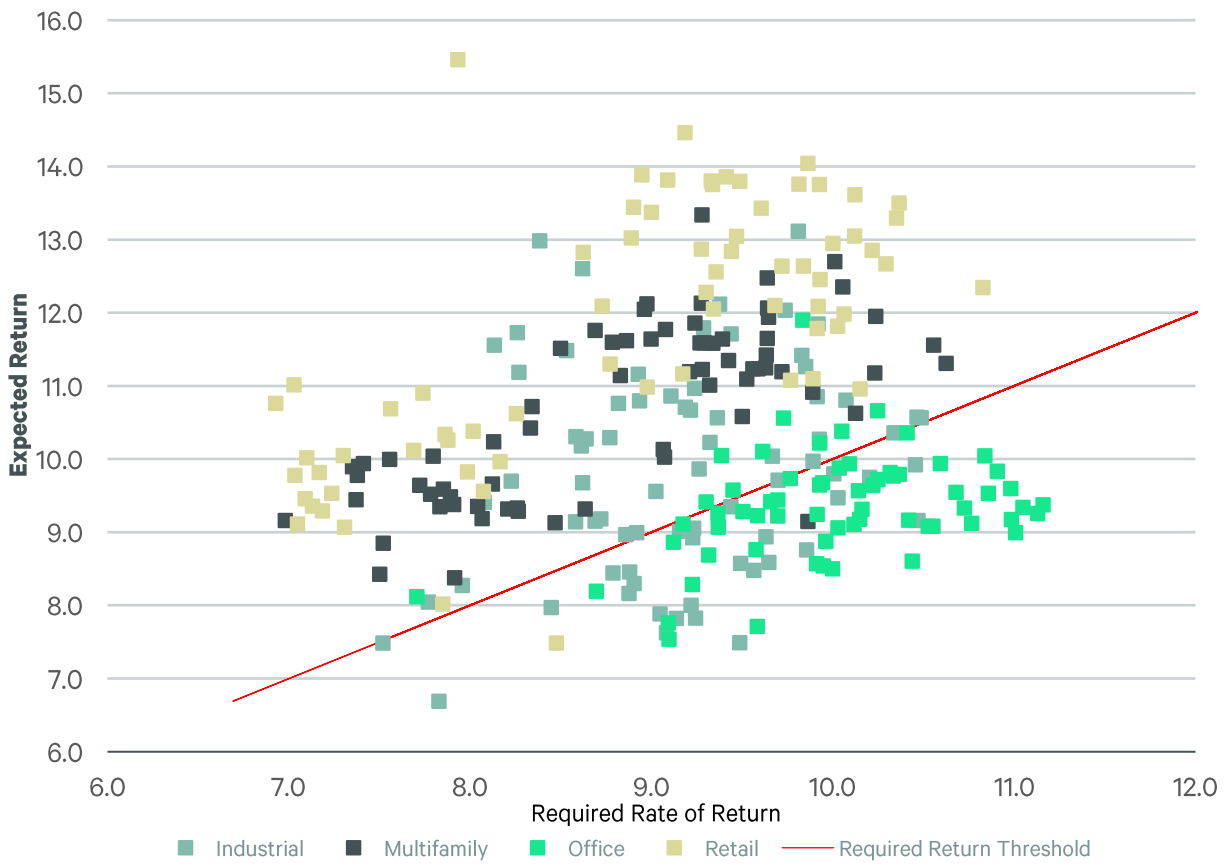
Physical Climate Risk Premium Highest for Retail and Coastal Cities



Sector	Physical Climate risk premium
Industrial	71
Multifamily	69
Office	41
Retail	80

Climate informed hurdle rate shuffles risk-adjusted returns

10-Year Expected Return and Required Rate of Return, Baseline Scenario



Source: CBRE Econometric Advisors

Climate informed, 10-Year Expected Return and Required Rate of Return

Source: CBRE Econometric Advisors

Thank you

Gracias ধন্যবাদ Salamat Asante धन्यवाद Obrigado Tack 謝謝 O Se Спасибо 감사합니다

Bedankt Grazi ਧੰਨਵਾਦ Merci תודה شكريہ Teşekkürler Danke ありがとう Dziękuję Terima Kasih شکرا

FOR MORE INFORMATION

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