Climate Conditioned View of Severe Convective Storm Risk

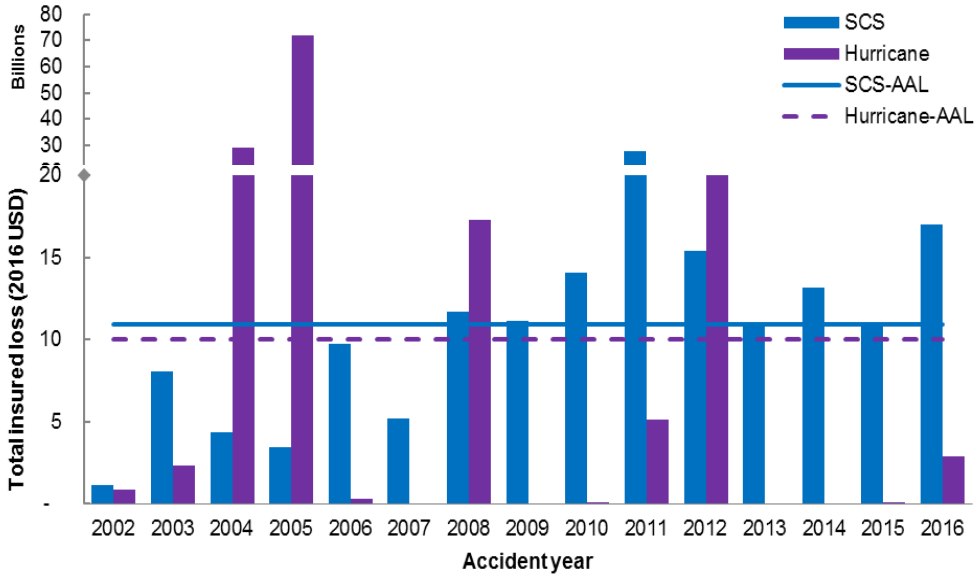
CAS Seminar on Reinsurance

Brooklyn, NY, June 4th- 5th, 2018

WillisRe

Severe convective storm (SCS) risk is as high as hurricane risk

- Annual aggregated risk to the U.S. property industry from severe convective storm (SCS) is as high as the risk from hurricanes
- Average annual loss (in 2016 USD) over 2002 to 2016 period
  - Severe convective storms - $10.94 billion
  - Hurricanes = $10.03 billion



Source: Property Claim Services (PCS), a Verisk Analytics business

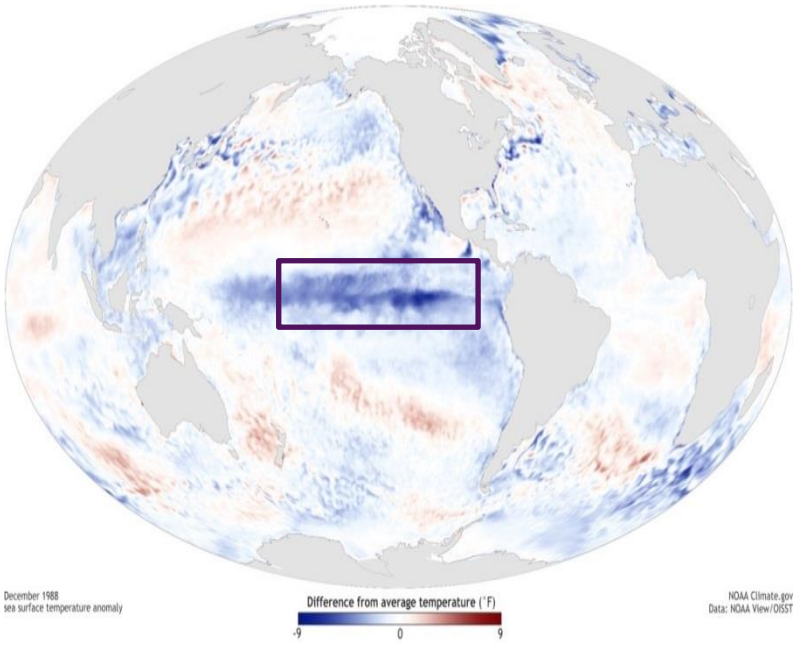
Key takeaways

- ENSO is a good indicator of spring time severe convective storm activity
- ENSO can help understand the year-to-year variability in severe convective storm risk
- ENSO conditioned view of severe convective risk estimates can help taking better informed reinsurance purchasing and underwriting decisions

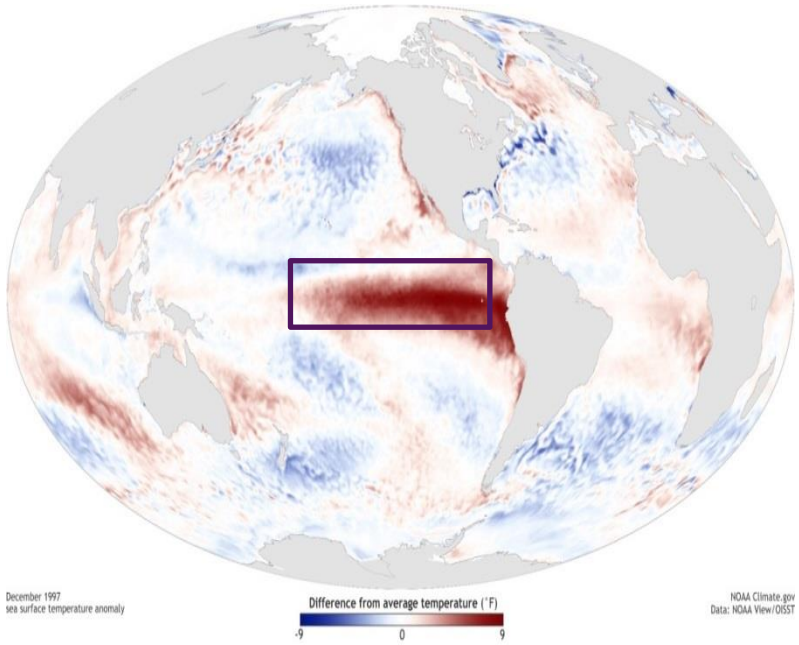
El Nino-Southern Oscillation (ENSO)

Unusual warming or cooling of tropical Pacific sea surface temperature, usually peaking in winter

La Niña



El Niño

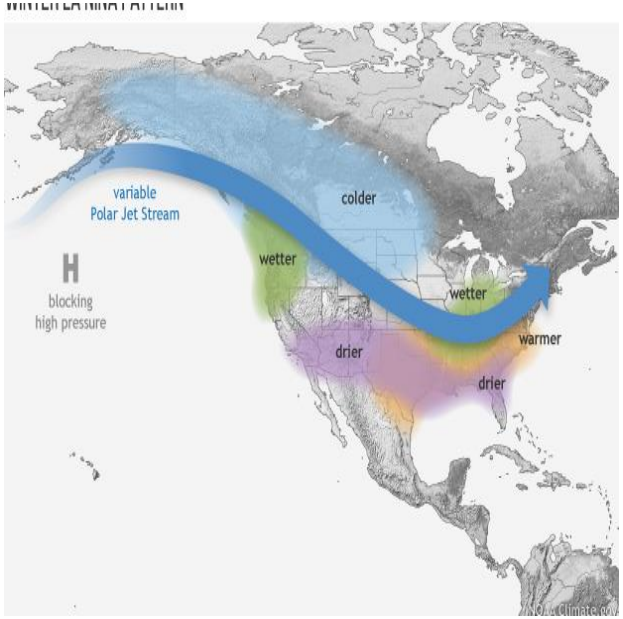


www.climate.gov

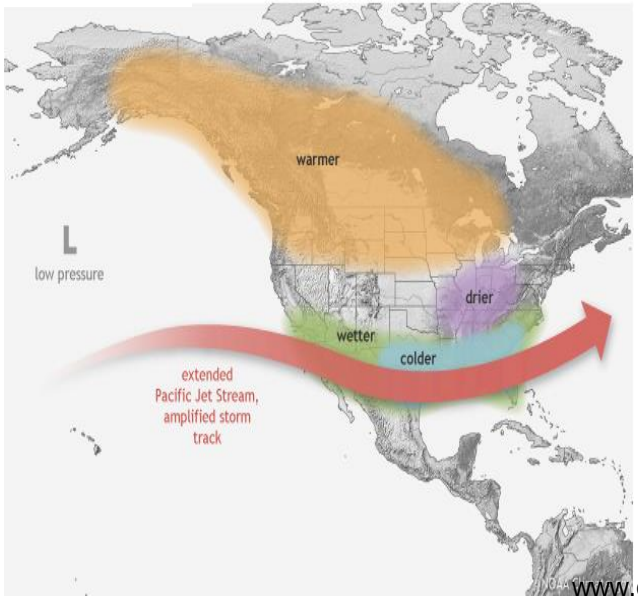
El Nino-Southern Oscillation (ENSO)

Jet stream shifts are a source of predictability for forecasts of seasonal averages of U.S. precipitation and temperature

La Niña



El Niño



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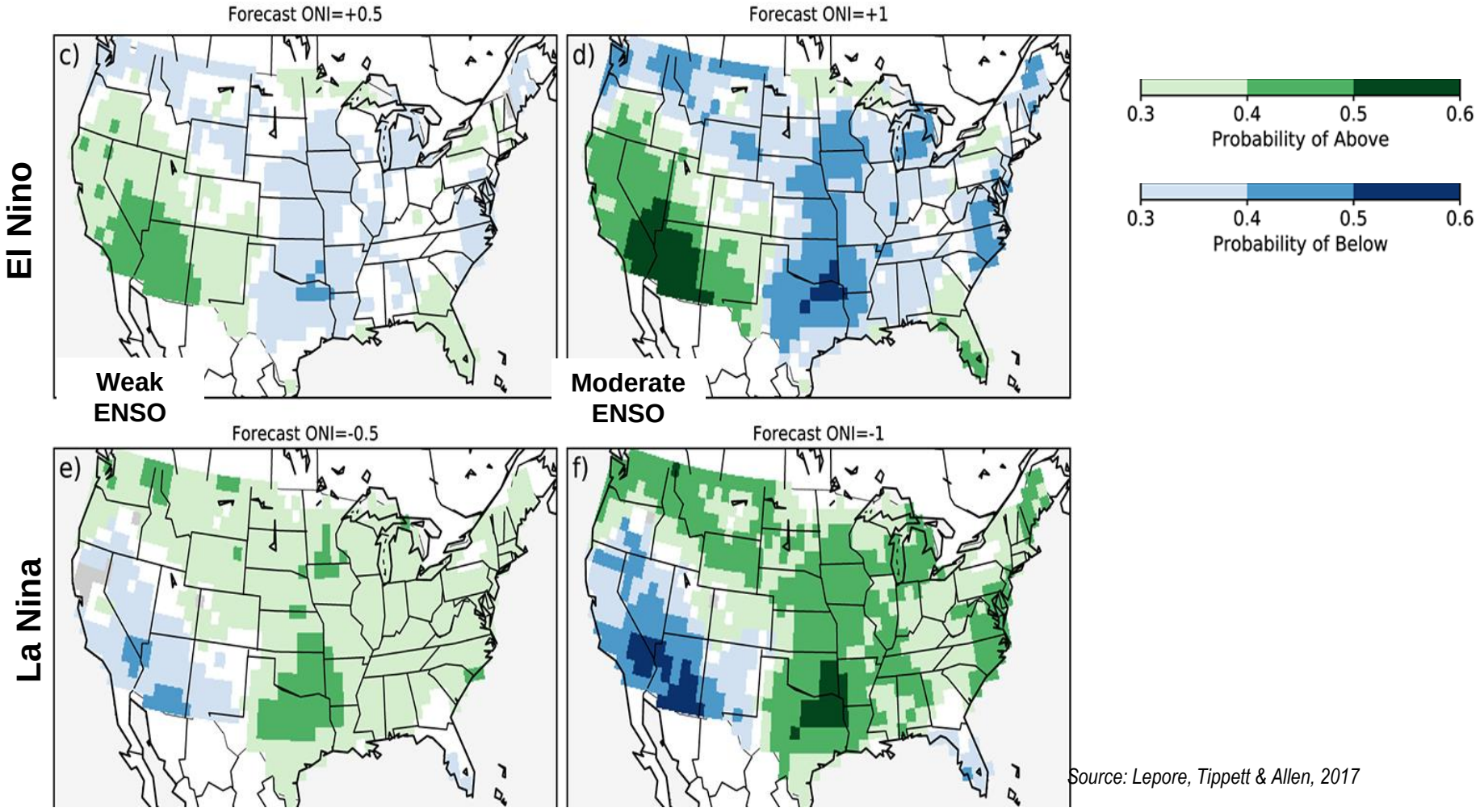
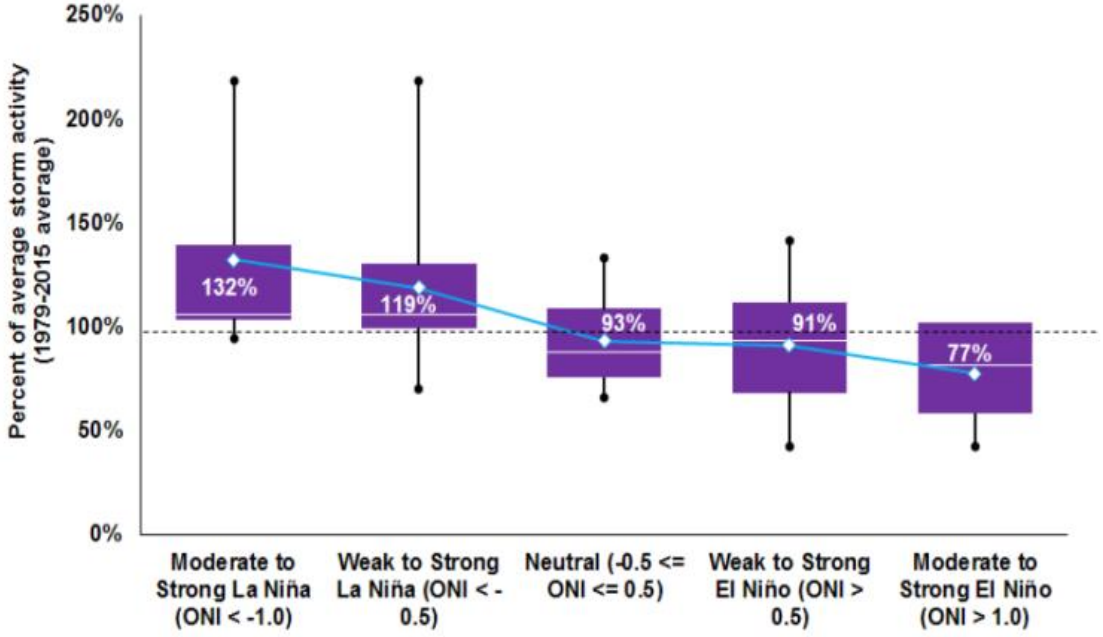
Probability of below-normal, normal and above normal SCS activity



Source: Lepore, Tippett & Allen, 2017

Shifts in Mar-May(MAM) SCS activity and ENSO

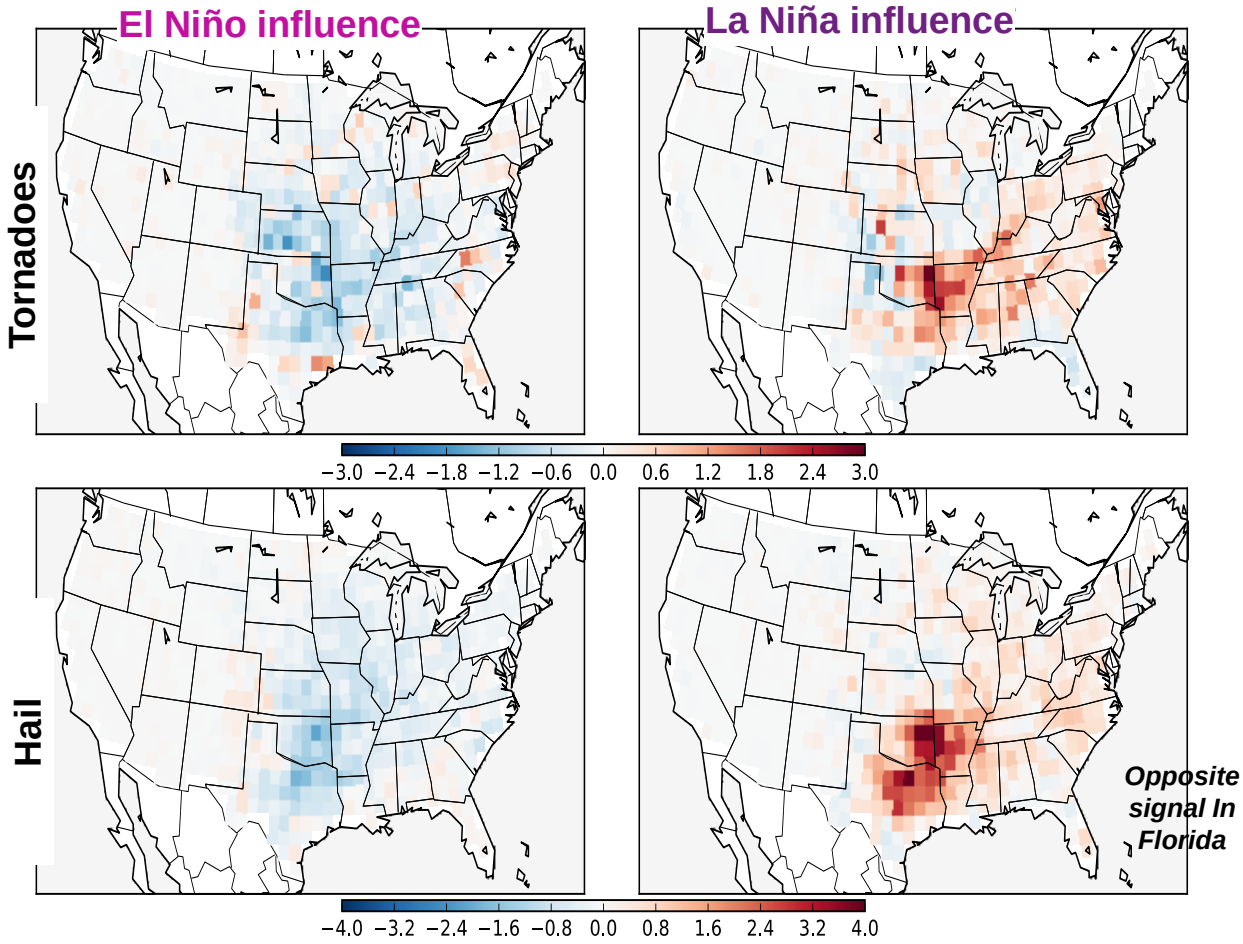
- Shifts in MAM storm activity conditional on winter months (DJF) ENSO state
- Substantial variability in addition to ENSO
- ENSO shifts odds of above or below normal activity



SCS frequency is relatively higher following La Nina and lower following El Nino.

ENSO can be used to predict U.S. spring SCS activity

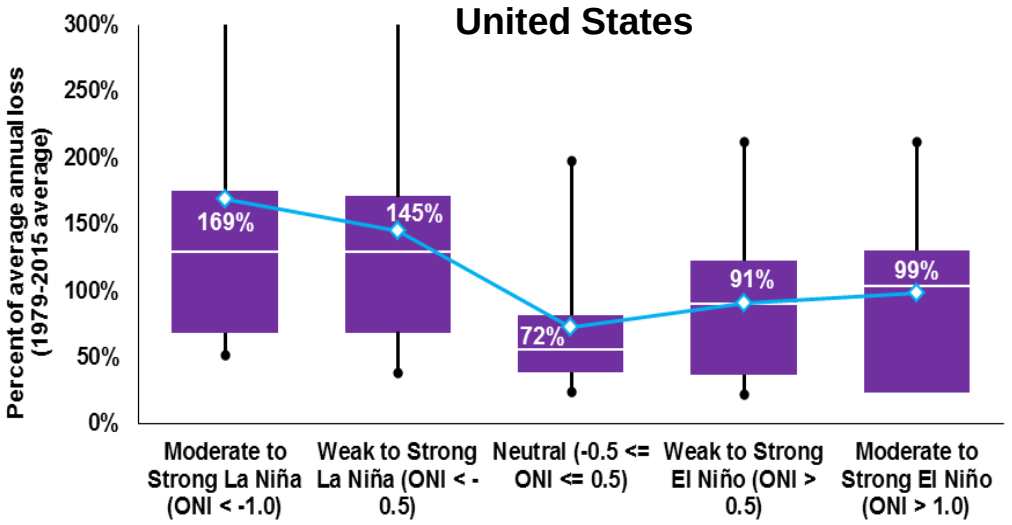
- March-May tornado/hail reports/environment blend conditional winter ENSO index value
- Dec-Feb (DJF) ENSO state is a good indicator of spring time storm activity

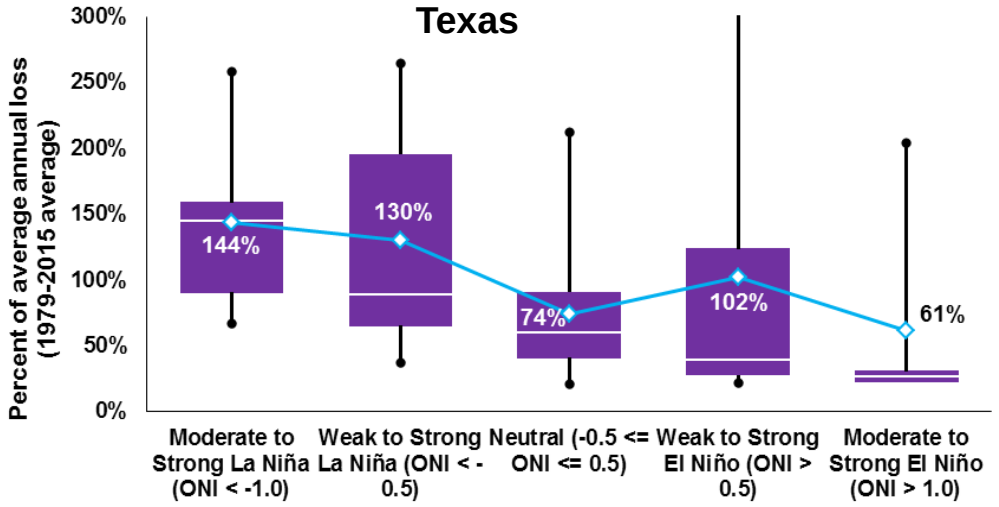


Gunturi and Tippett, Willis Re report, 2017

Shifts in PCS loss and ENSO

- PCS data only include events with significant property loss for the industry
- In general ENSO shifts indicates odds of above or below average annual loss





Severe convective storm perils

Hail

Hazard is represented by hail stone size and Kinetic energy

Damage to roof and siding (roof covering, roof deck, roof equipment, etc.)

Tornado

Hazard and vulnerability represented using the Fujita and Enhanced Fujita Scale (tornado intensity)

Complete destruction of a structure is possible

Straight-line wind

Uses peak gust/1min wind speed for hazard and vulnerability classification

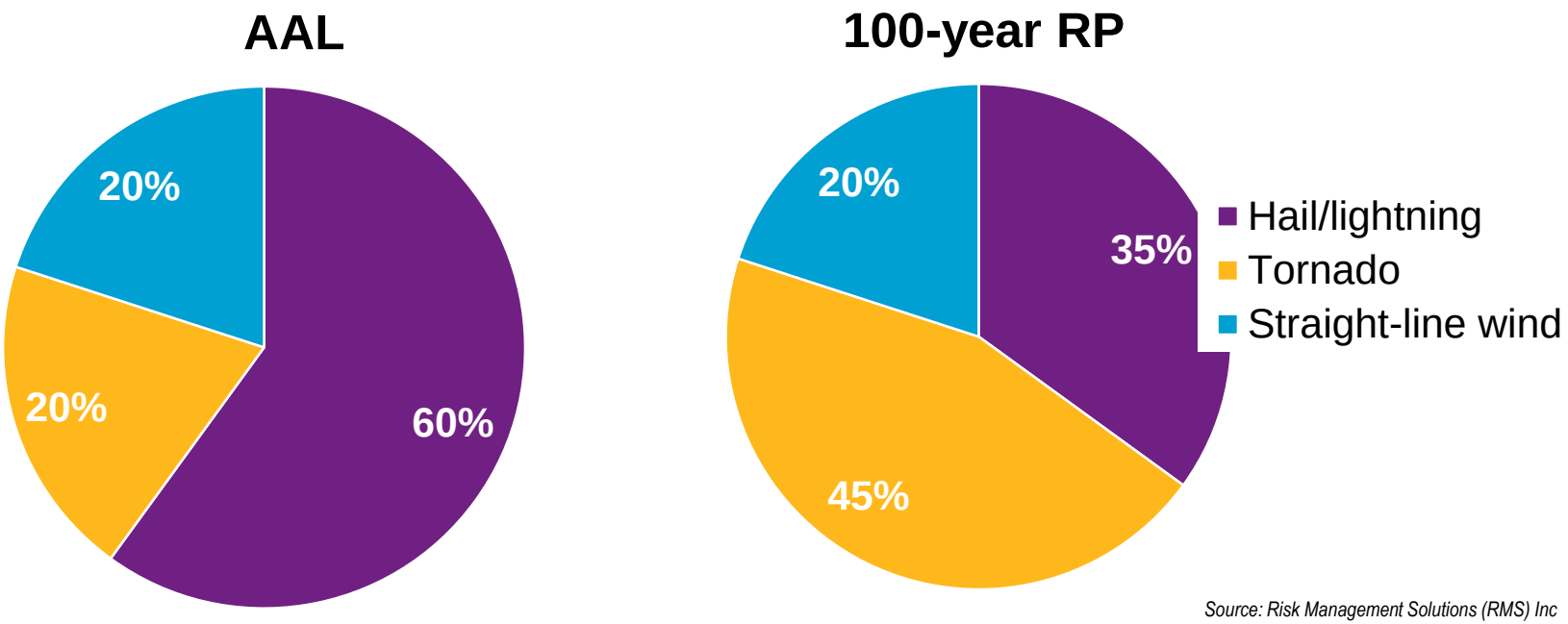
Damage to roof and siding (roof covering, roof deck, roof equipment, etc.)

Lightning

Implicitly modeled

Contribution of severe convective storm risk by peril

- Based on U.S industry perspective
- Varies by region
- Models' view is based on historical trends, does not explicitly account for ENSO or climate change considerations



Source: Risk Management Solutions (RMS) Inc

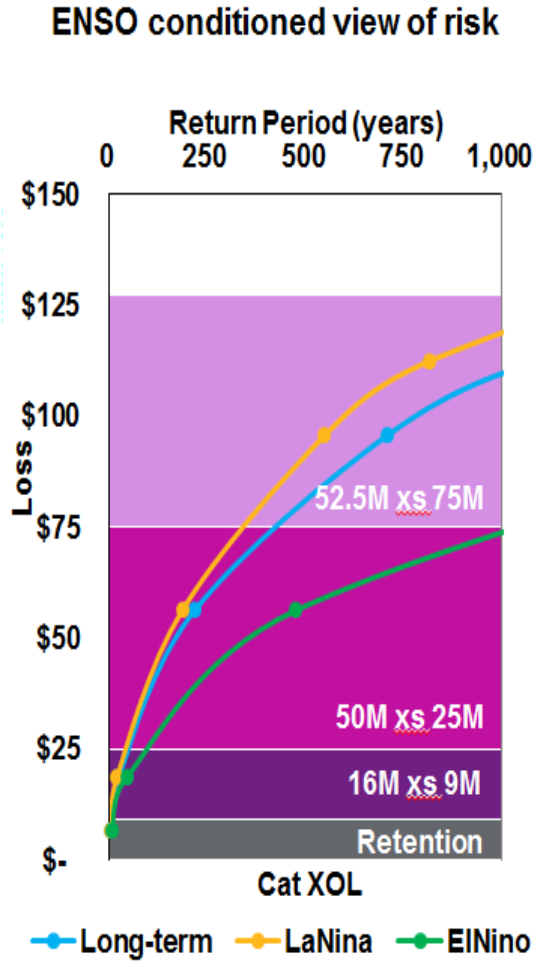
ENSO conditioned model's view of risk

- Willis Re is researching the impact of ENSO on severe convective storm loss estimates for business use
- Developed a method to quantify the impact of ENSO conditioned event catalog in vendor models
- Vendor models are adjusted to reflect the variability in Tornado, Hail and Straight-line wind perils due to El Niño and La Niña conditions

ENSO conditioned model's view of severe convective storm risk

Occurence loss and Catastrophe excess of loss

- A sample Mid-west residential portfolio
- On occurrence loss basis, chance of exceeding $75M loss is
  - 0.54% (1 in 184) during LaNiña climate
  - 0.46% (1 in 216) using model's default (long-term rates)



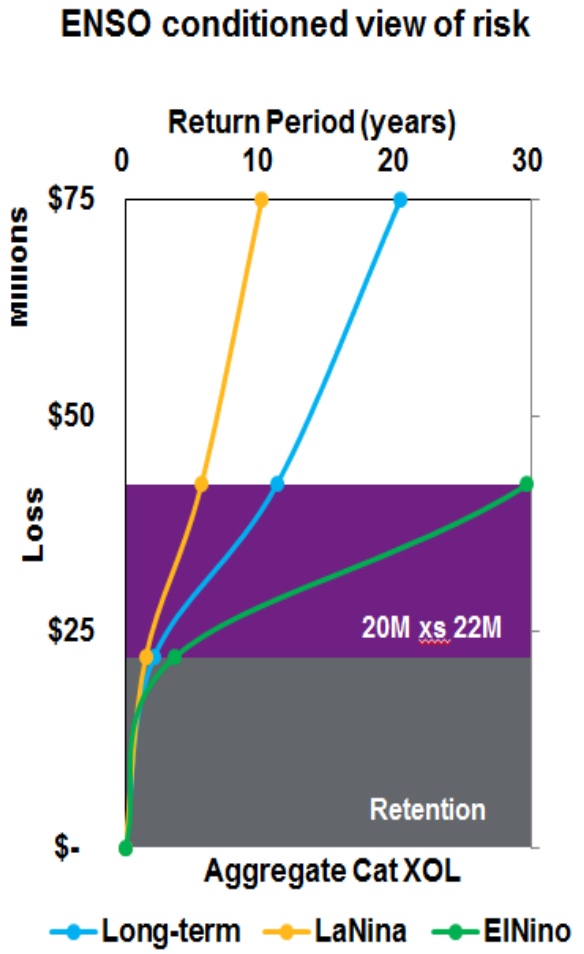
Cat XOL Layer	Exceedance probability		
	Default	La Niña	El Niño
$52.5M xs $75M	0.14% (1 in 705)	0.18% (1 in 547)	0.05% (1 in 1,910)
$50M xs $25M	0.46% (1 in 216)	0.54% (1 in 184)	0.21% (1 in 474)
$16M xs $9M	4.3% (1 in 23)	5.6% (1 in 18)	2.3% (1 in 43)
Retention	25% (1 in 4)	33% (1 in 3)	17% (1 in 6)

ENSO conditioned model's view of severe convective storm risk

Aggregated loss and Aggregated Catastrophe exess of loss

- A sample Mid-west residential portfolio
- On aggregated loss basis, chance of exceeding $42M loss is
  - 17% (1 in 6) during LaNiña climate
  - 9% (1 in 11) using model's default (long-term rates)

Aggregate Cat XOL Layer	Exceedance probability		
	Default	La Niña	El Niño
$20M xs $22M	9% (1 in 11)	18% (1 in 6)	3% (1 in 30)
Retention	48% (1 in 2.1)	67% (1 in 1.5)	28% (1 in 3.6)



Comparison with ENSO and Atlantic hurricane

- Atlantic hurricane
  - More active during La Nina
  - But summer ENSO is difficult to predict more than a few months in advance
  - Forecast info available in summer
  - Activity is not landfall
- U.S. SCS
  - More active during La Nina
  - DJF ENSO predictable many months in advance
  - Forecast info in early winter
- Does the shared ENSO connection mean U.S. SCS correlates with Atlantic hurricane?

Key takeaways

- ENSO is a good indicator of spring time severe convective storm activity
  - Early prediction
- ENSO can help understand the year-to-year variability in severe convective storm risk
- ENSO conditioned view of severe convective risk estimates can help taking better informed reinsurance purchasing and underwriting decisions
- Shared ENSO connection between severe convective storm and Atlantic hurricane means increased risk to portfolios exposed both perils

Thank you!

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