Modeling Multiple Peril Crop Insurance Worldwide

Jack Seaquist
CARe Seminar C-7
Philadelphia, PA
June 7, 2011

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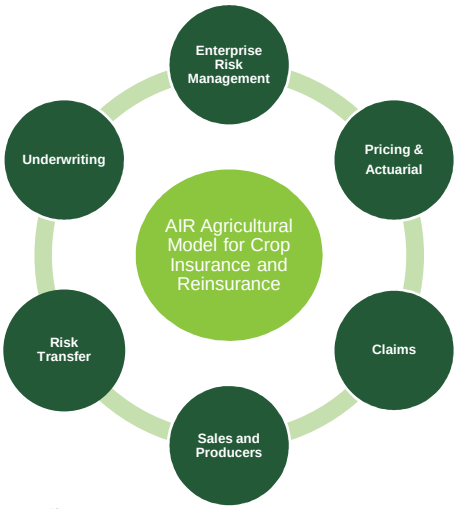
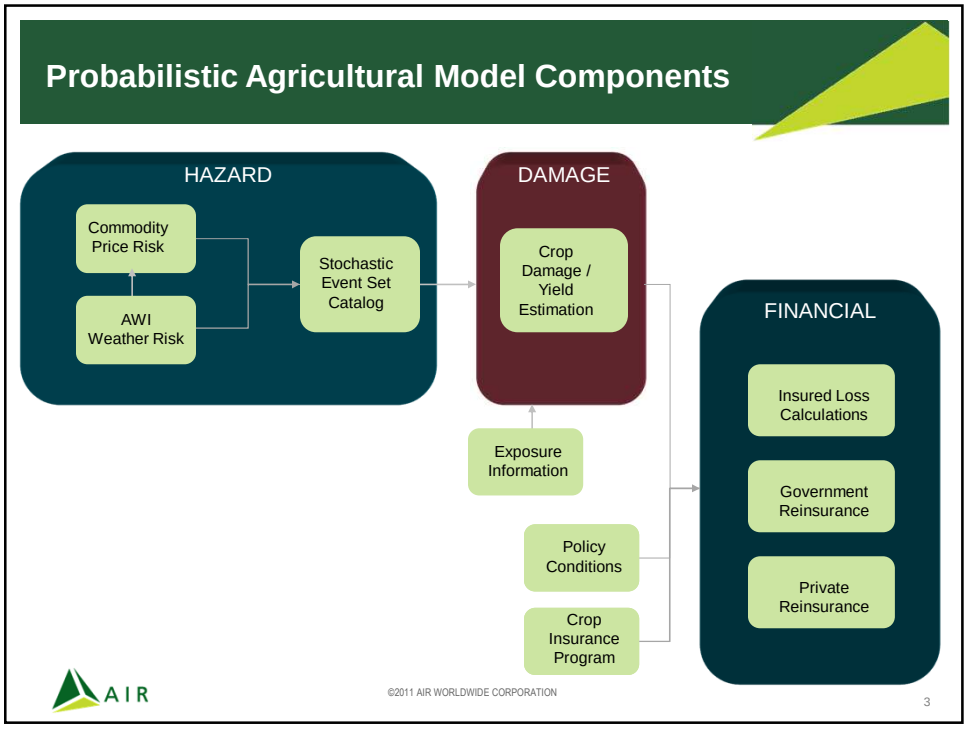
AIR Agricultural Model Applications



The AIR Agricultural Model for the Multiple Peril Crop Insurance is a state-of-the-art fully probabilistic model, accounting for:

- Changes in technology over time
- The evolution of crop insurance programs
- Commodity price volatility
- Weather impact


Probabilistic Agricultural Model Components
HAZARD
Commodity Price Risk
AWI Weather Risk
Stochastic Event Set Catalog
DAMAGE
Crop Damage / Yield Estimation
Exposure Information
FINANCIAL
Insured Loss Calculations
Government Reinsurance
Private Reinsurance
Policy Conditions
Crop Insurance Program
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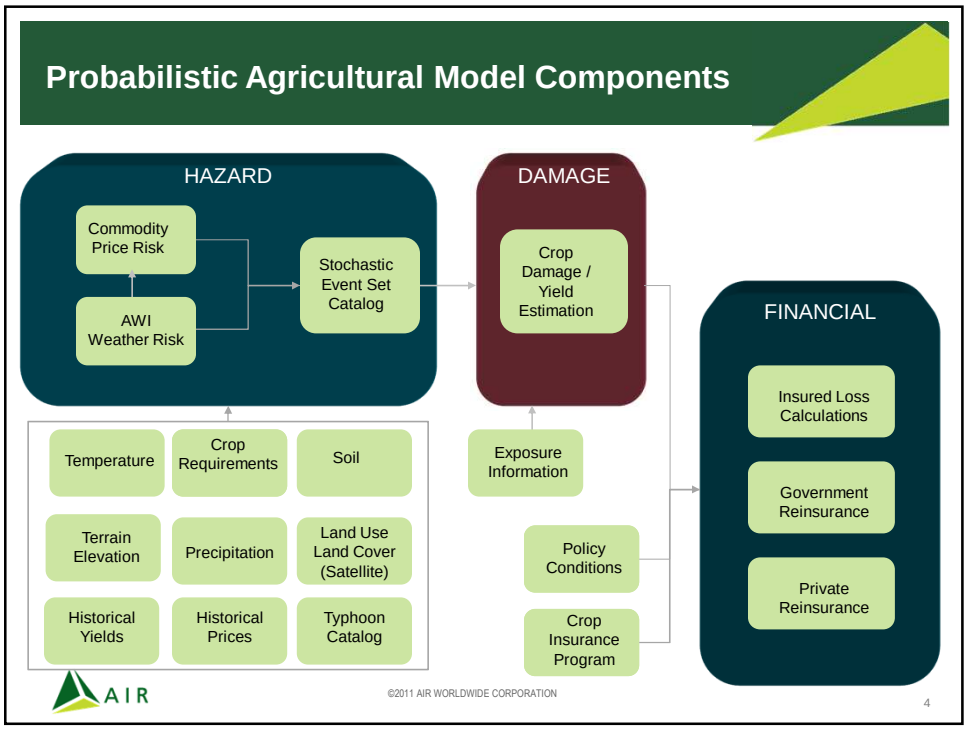
Probabilistic Agricultural Model Components
HAZARD
Commodity Price Risk
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Temperature
Crop Requirements
Soil
Terrain Elevation
Precipitation
Land Use Land Cover (Satellite)
Historical Yields
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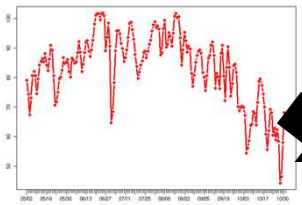
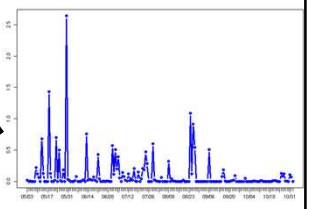
AWI (Agricultural Weather Index) is a Measure of Yield Variability Due To Weather

Daily Temperature

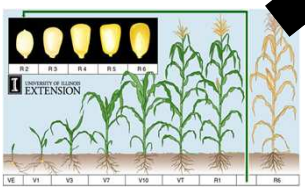


Daily Precipitation

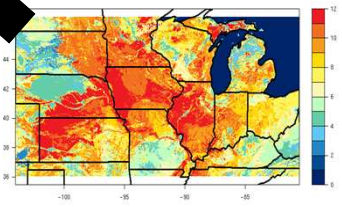


County-Specific AWI Index

Crop Specific Data



Available Water Capacity (Soil)



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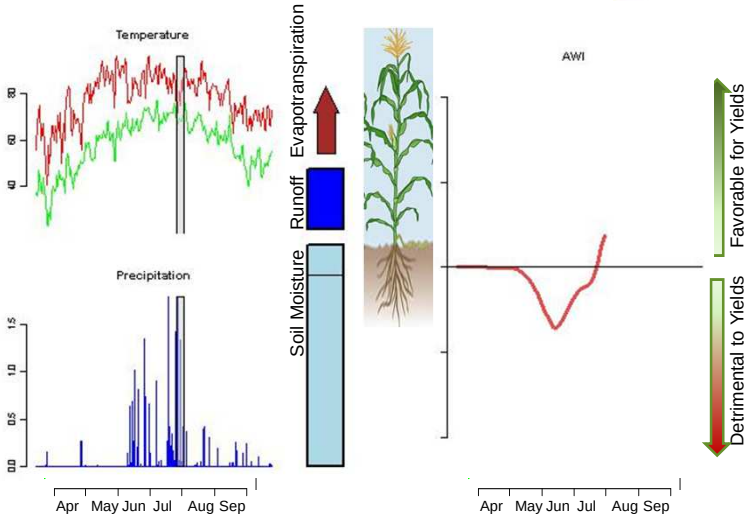
In a Normal Year Water Supply and Water Requirements Are Balanced and AWI Indicates Positive Yield Outcome



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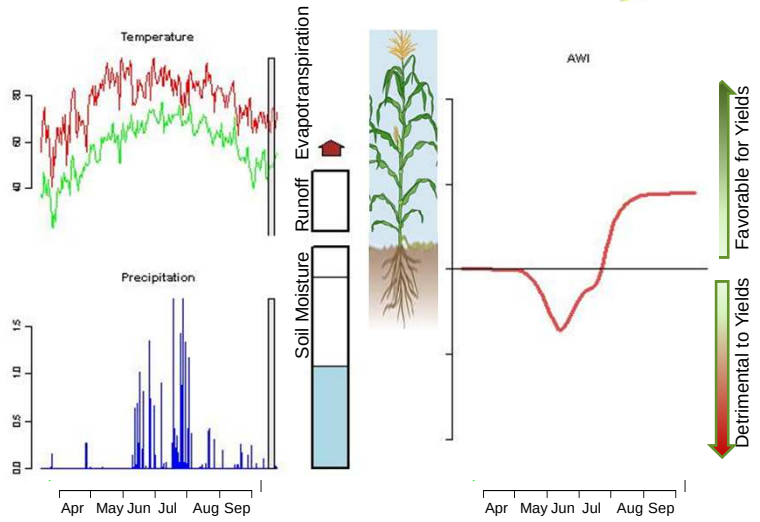

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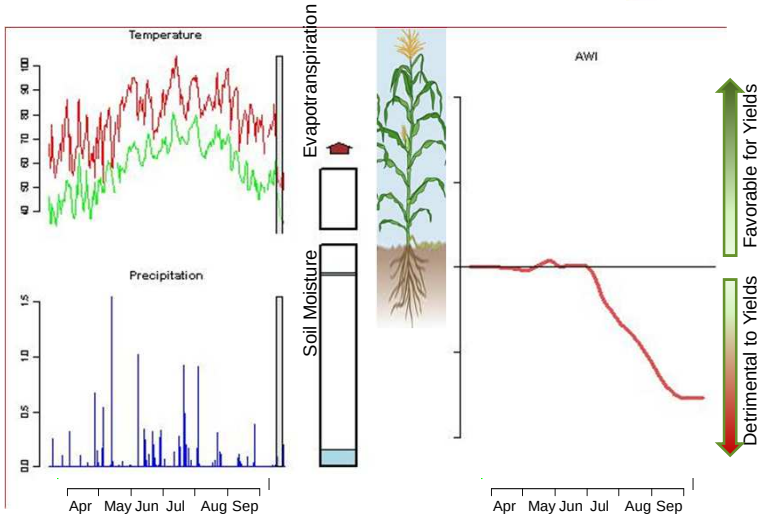
In A Drought Year Water Requirements Exceed the Water Supply and AWI Indicates Plant Damage



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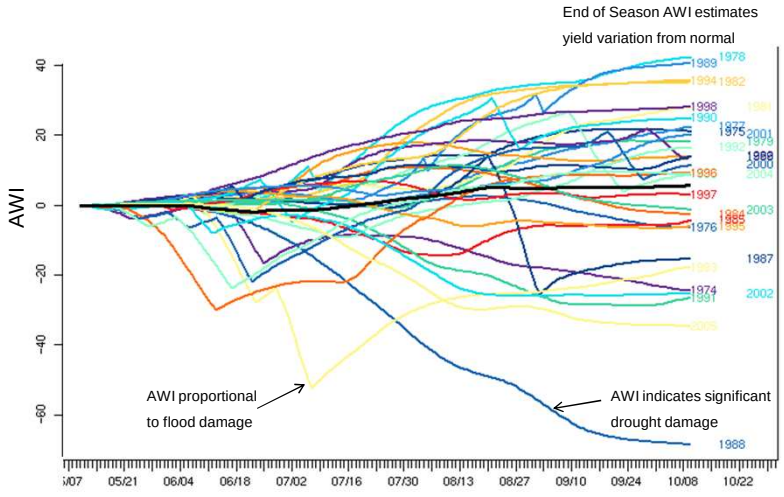
AWI Measures County-level Crop Performance During the Season



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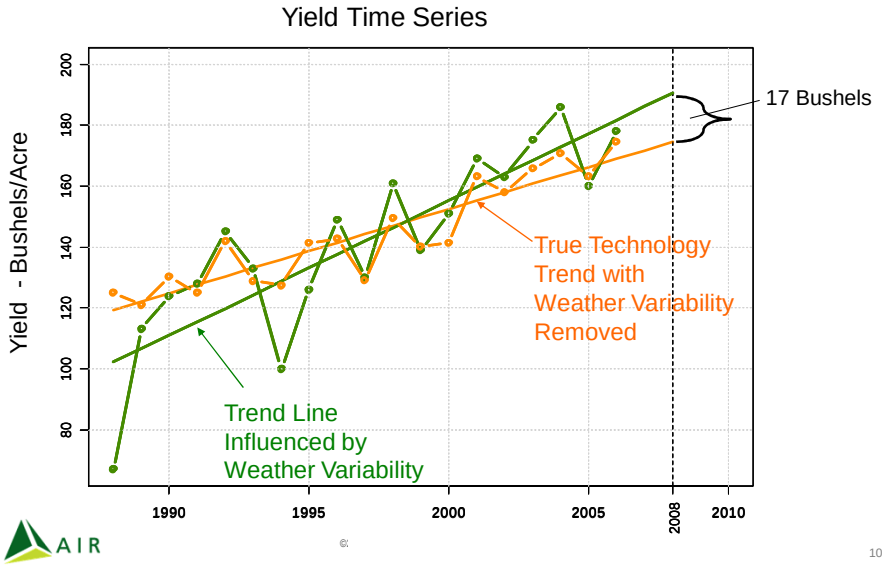
AWI Removes Weather Variability from the Historic Yields to Reveal True Technology Trend



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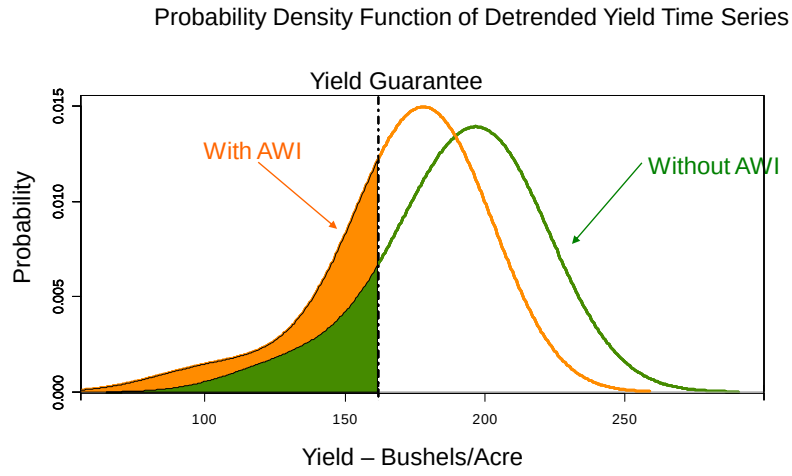
The Choice of Methodology Can Have a Large Impact on Insurance Contracts



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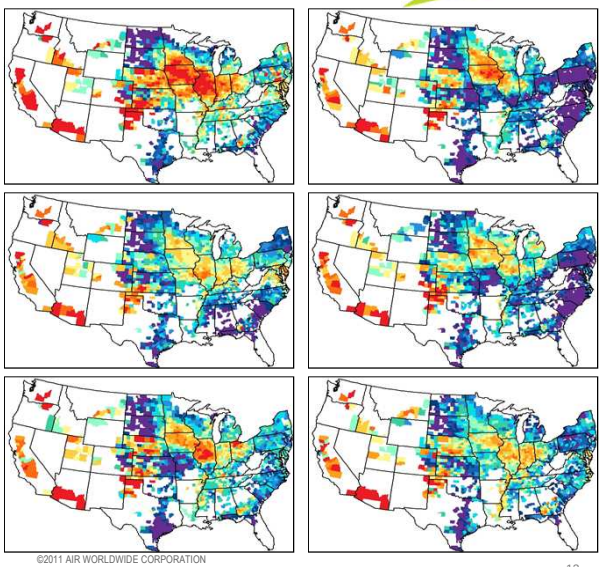
In The US Model AWI Technology Adjusts Historic Time Series of County Level Yields to Current Production Levels

- The catalogue is based on spatially correlated county level yield distributions
- All weather events are summarized by the final modeled harvest yield
- 10,000 outcomes based on variation from historical data
- Current technology level
- Not biased by recent event years



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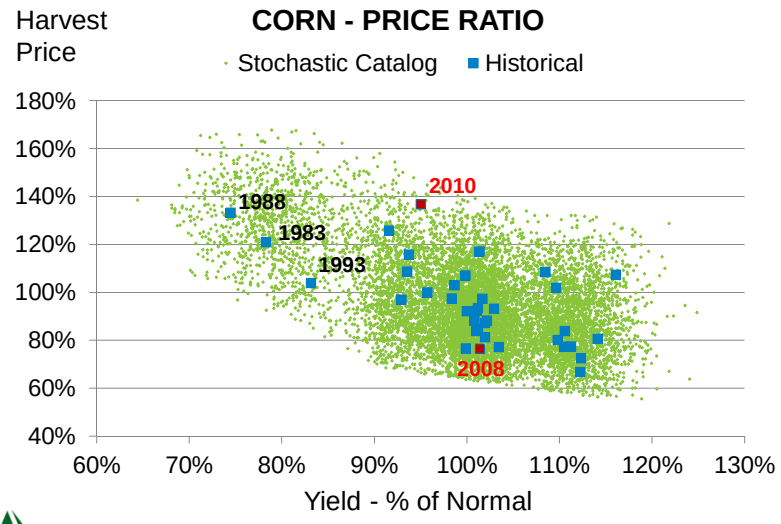
The Price Risk Component Takes Into Account Correlations Between Total US Production and Harvest Price



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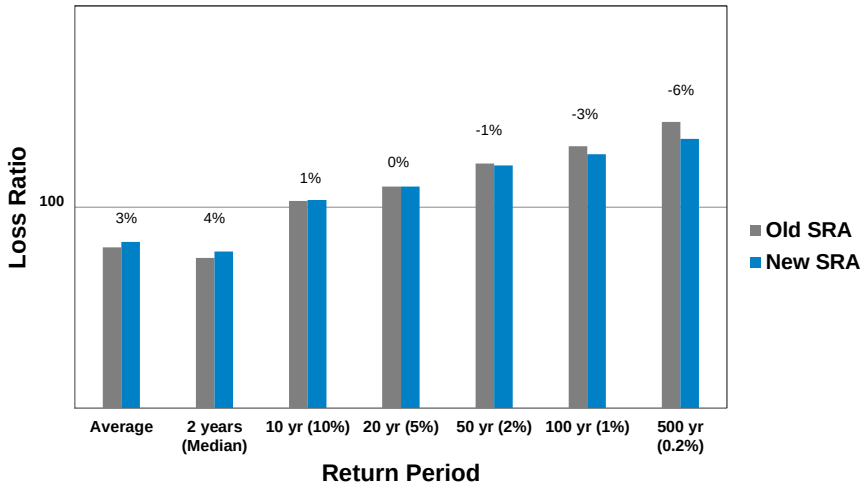
New SRA Reduced the Overall Profitability of the Industry and Increased Protection for Catastrophic Events



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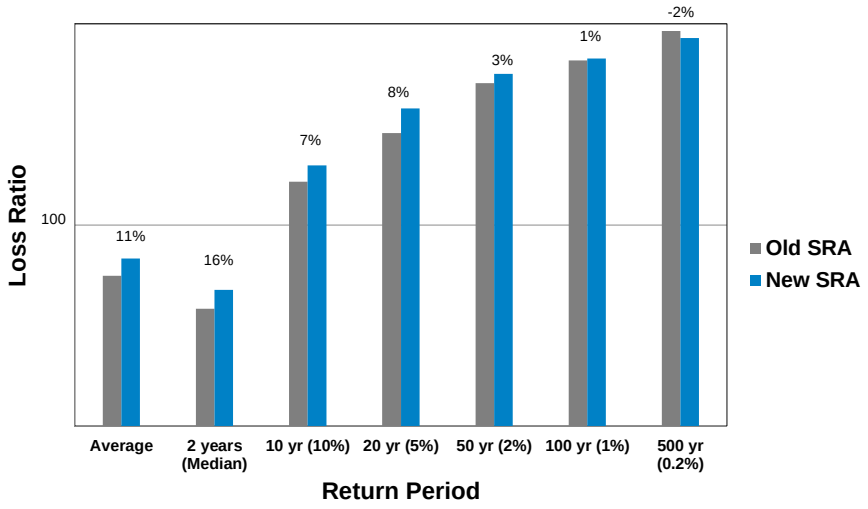
Impact of 2011 SRA Change - Illinois



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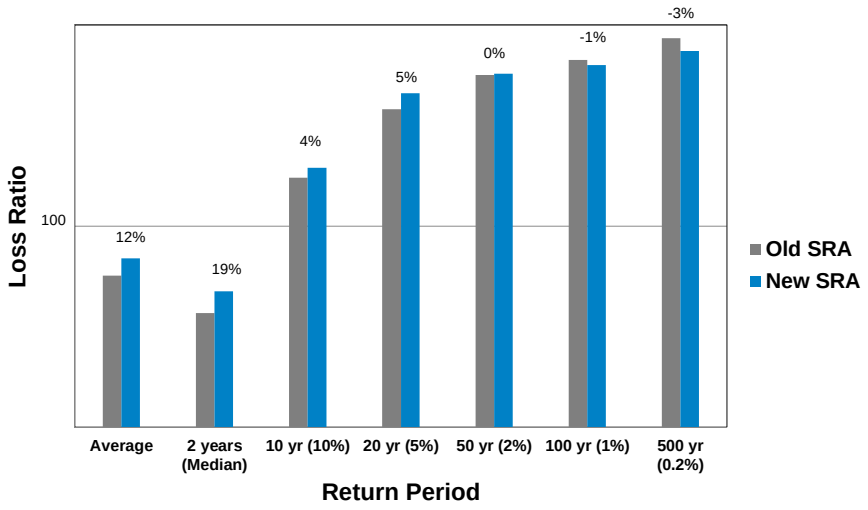
Impact of 2011 SRA Change - Iowa



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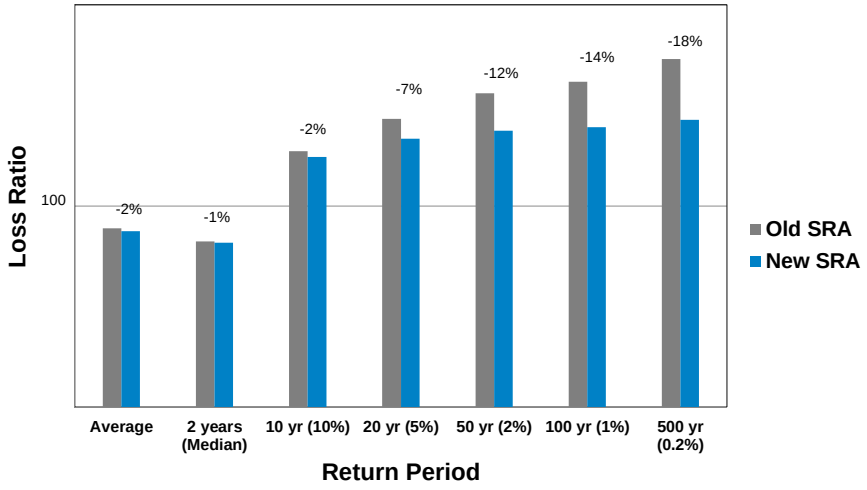
Impact of 2011 SRA Change – North Dakota



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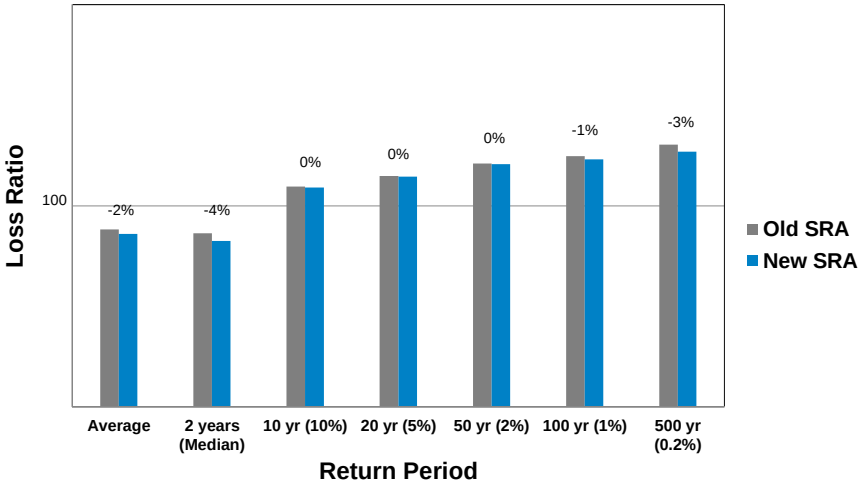
Impact of 2011 SRA Change - Texas



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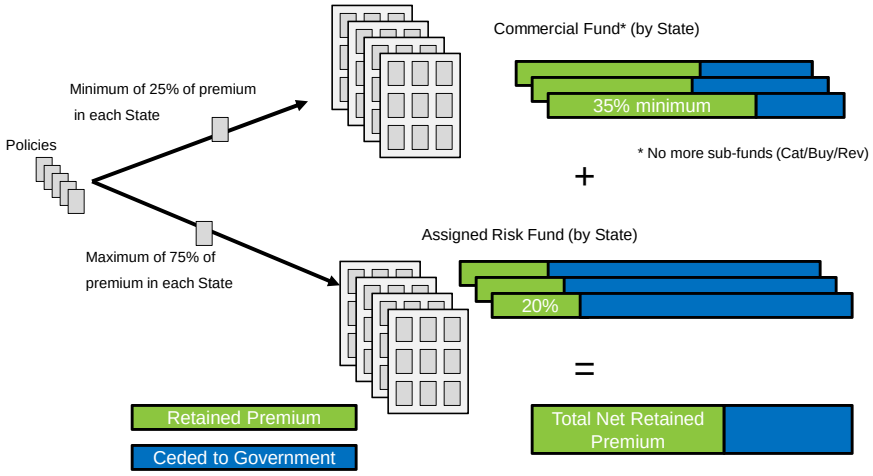
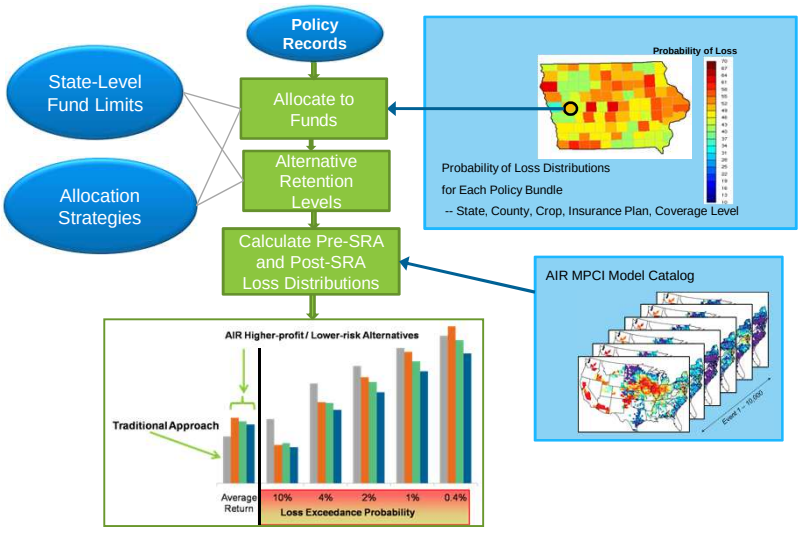
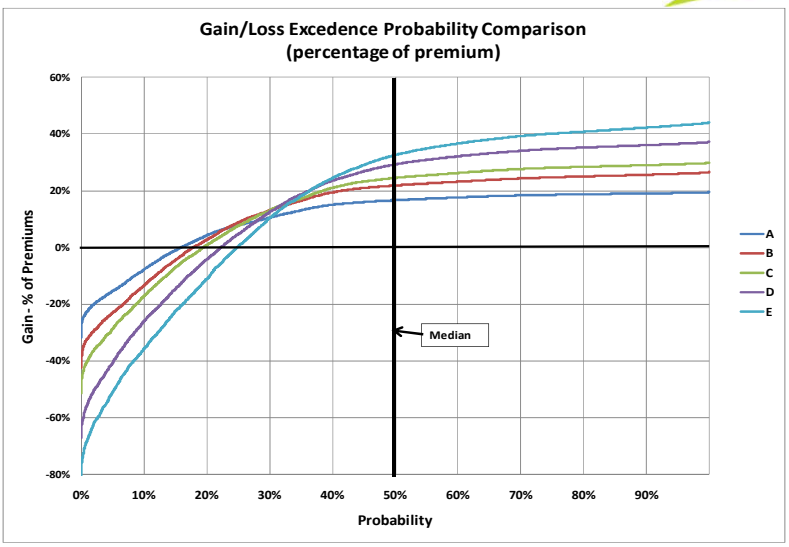
New 2011 SRA Fund Allocation Rules



Fund Allocation Process with AIR MPCI Model



Crop Insurers' SRA Fund Allocation Strategies Greatly Impact Reinsurer Risk

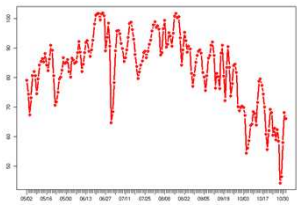


China Crop Insurance Program Covers Cost of Production Rather than the Value of the Crop

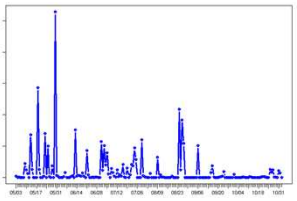
- Separate programs by province
- Perils covered and policy terms vary by crop and province
- Named perils might include
  - Rainstorm, flood, windstorm, hail, waterlog, drought, frost, diseases, insect pests, tornado, mud-rock flow, landslide, low temperature
- Indemnity varies by plant growing stage
- Losses shared and limited by governments

AWI (Agricultural Weather Index) is a Measure of Crop Damage Due to Weather

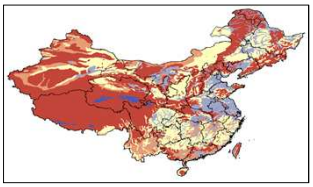
Daily Temperature



Daily Precipitation

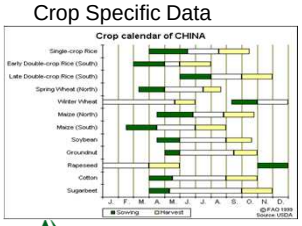


Available Water Capacity (Soil)

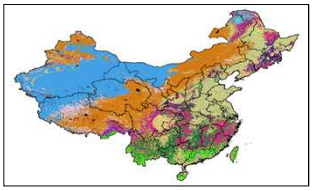


AWI

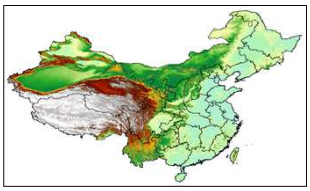
Crop Specific Data



Land Use Land Cover



Terrain Elevation



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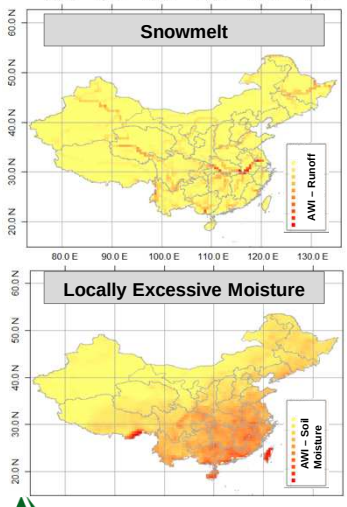
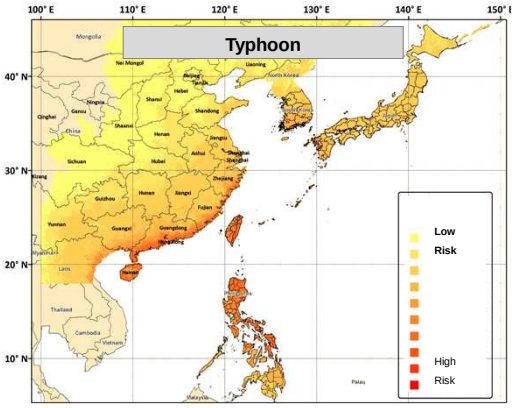
A Comprehensive Approach Captures Flood Losses from Multiple Sources

Derived from historical years 1980-present



Derived from Asia-Pacific Typhoon model



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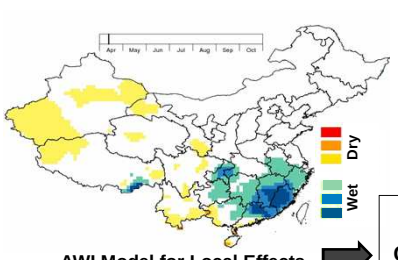
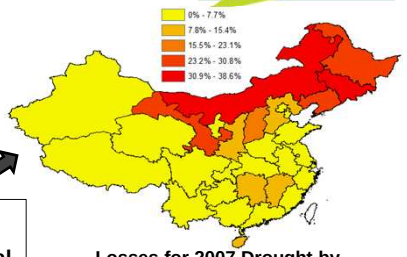
Higher Resolution Damage Estimates Based on AWI Are Validated against Province Level Losses

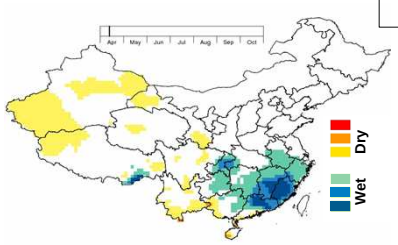


AWI Model for Local Effects

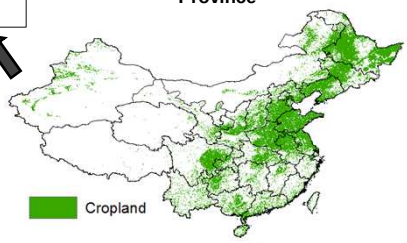
Damage to Crops on Local Level



Losses for 2007 Drought by Province



Accumulated Effects



High Resolution Crop Mask

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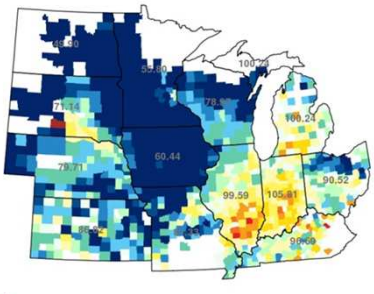
Closing Thought – What if the 1993 Flood Happened in 2011?

1993 Corn Yield

(Percent of Expected Value)



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State	Actual 1993 RMA Gross Loss Ratios	AIR Modeled (Recasted) Gross Loss Ratios	AIR Modeled (Recasted) Post-SRA Loss Ratios
Iowa	465%	247%	168%
Illinois	63%	21%	66%
Indiana	55%	22%	67%
Ohio	91%	54%	61%
Minnesota	610%	214%	161%
Nebraska	188%	80%	83%
US Total	219%	106%	97%

Key Differences Between 1993 Flood and 2011 Flood: Timing, Location, Policy Mix, Premium Rates, SRA Program Terms

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