



TOKIO MARINE
TECHNOLOGIES

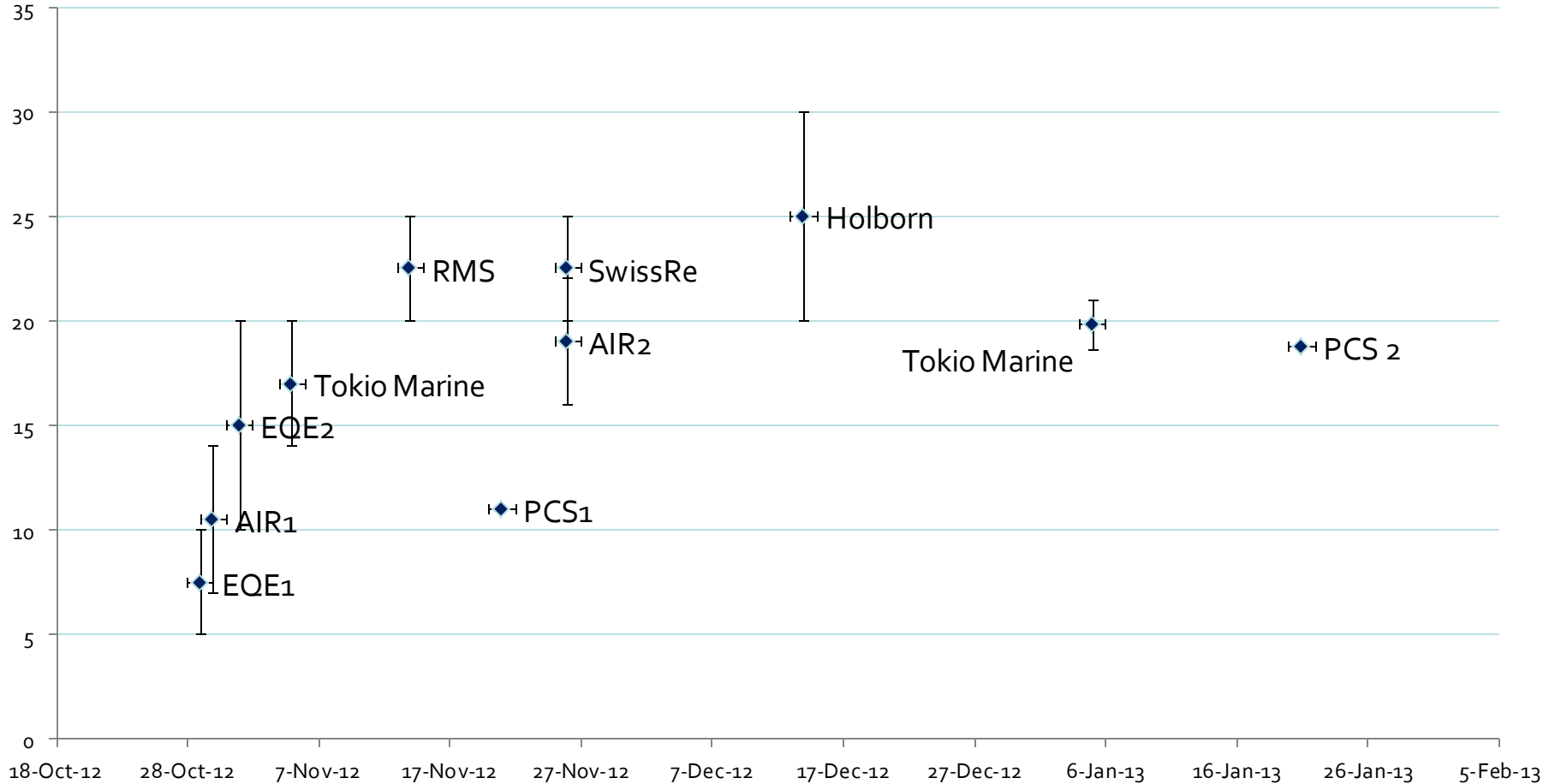
Flood Risk: Lessons Learned from Hurricane Sandy

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Casualty Actuarial Society
2013 Seminar on Reinsurance
Southampton, Bermuda
June 6-7, 2013

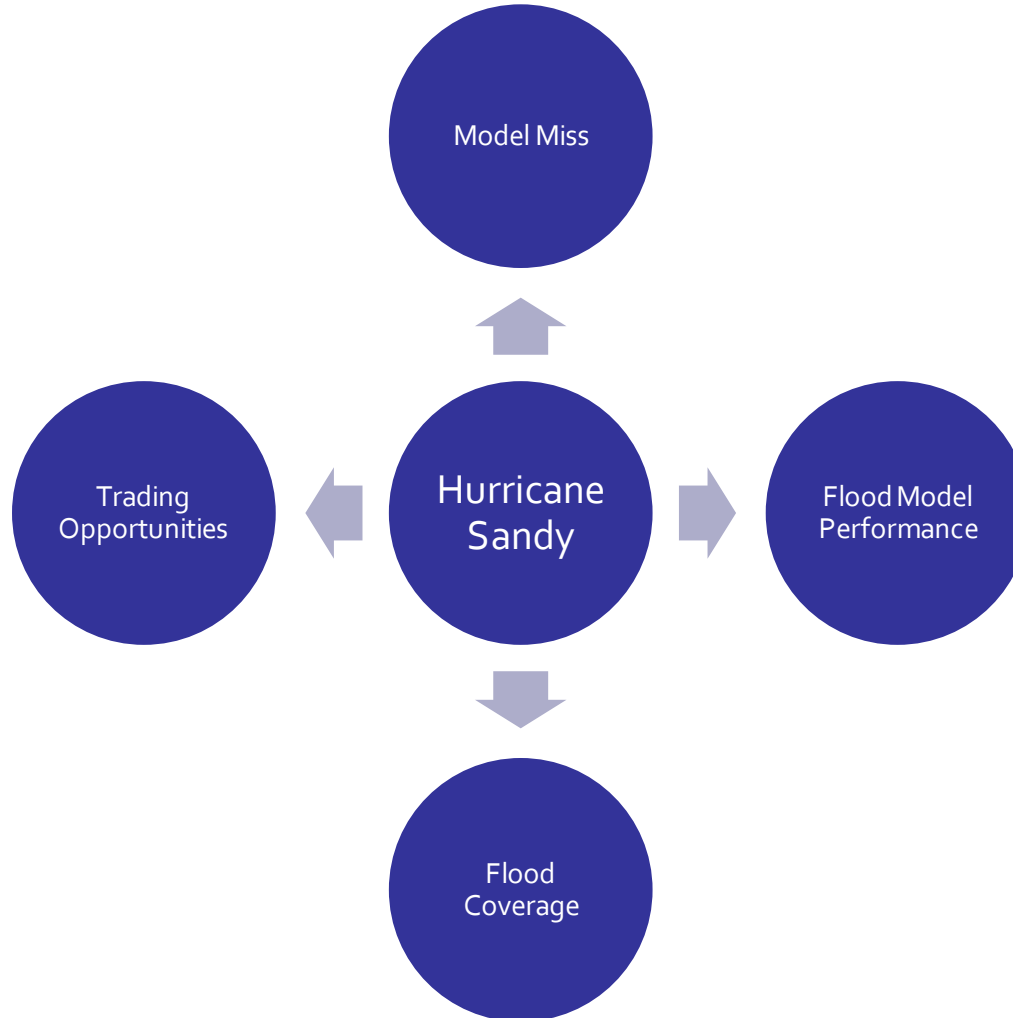
Hurricane Sandy Industry Loss Estimates

Evolution of Industry Loss Estimate



Source: PCS, RMS, EQE, AIR, Holborn, Swiss Re

Lessons Learned



Industry Loss Estimates

States	PCS Re-survey Loss Estimate (millions)	Model A View (millions)	Model B View (millions)
Connecticut	\$ 500	\$ 250	\$ 432
New Jersey	\$ 6,300	\$ 12,750	\$ 8,420
New York	\$ 9,600	\$ 9,750	\$ 10,795
Pennsylvania	\$ 700	\$ 1,500	\$ 1,727

Line of Business	PCS Re-survey Loss Estimate (millions)	Model A View (millions)	Model B View (millions)
Personal	\$ 7,017	\$ 8,000	\$ 10,614
Commercial	\$ 8,927	\$ 16,250	\$ 9,785
Auto	\$ 2,716	\$ 750	\$ 1,190

Modeled overall losses can be right for the wrong reasons

How Good is the PCS Loss Estimate?

Date	Total Auto Loss NJ
11/16/2012	\$ 274,841,513
11/30/2012	\$ 489,026,673
12/14/2012	\$ 621,017,992
12/28/2012	\$ 658,321,463
1/11/2013	\$ 679,643,697
1/28/2013	\$ 682,792,570
2/14/2013	\$ 683,377,873
2/28/2013	\$ 683,523,850
3/14/2013	\$ 683,560,235
3/28/2013	\$ 683,569,302

PCS loss estimate is \$700 million for NJ auto, loss based on multiple sources for NJ auto is \$684 million, a difference of 2.3%

Close enough...

Flood Loss Modeling

Hazard

- Surge Modeling
- Rain Component
- Flood Velocity Modeling
- Flood Duration

Vulnerability

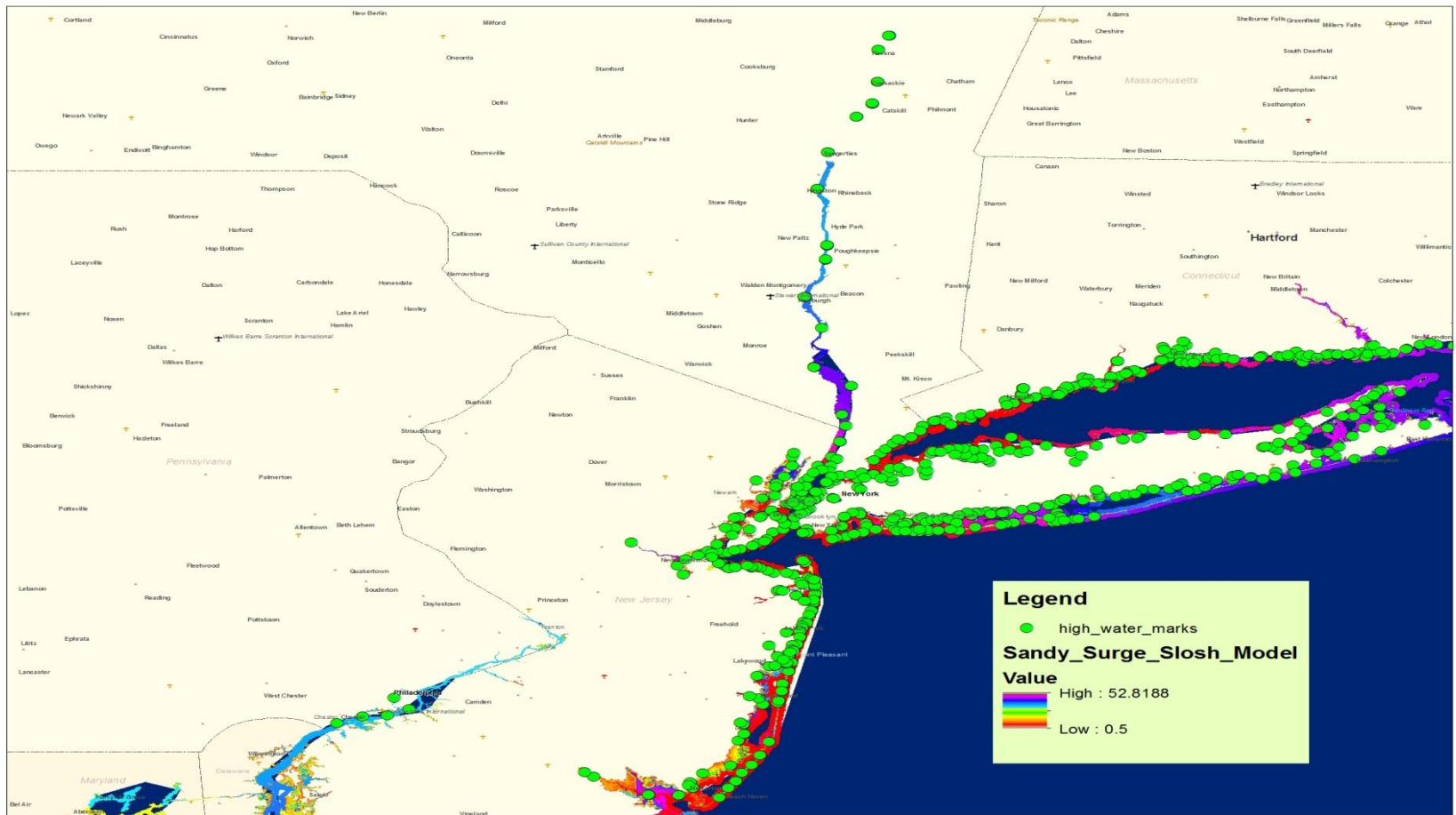
- First Floor Elevation
- Location of Contents
- Flood Velocity-Damage Curves

Loss Calculation

- Wind vs. Flood Policy Language
- BI/CBI



Model Comparison with High Water Marks



Source: USGS

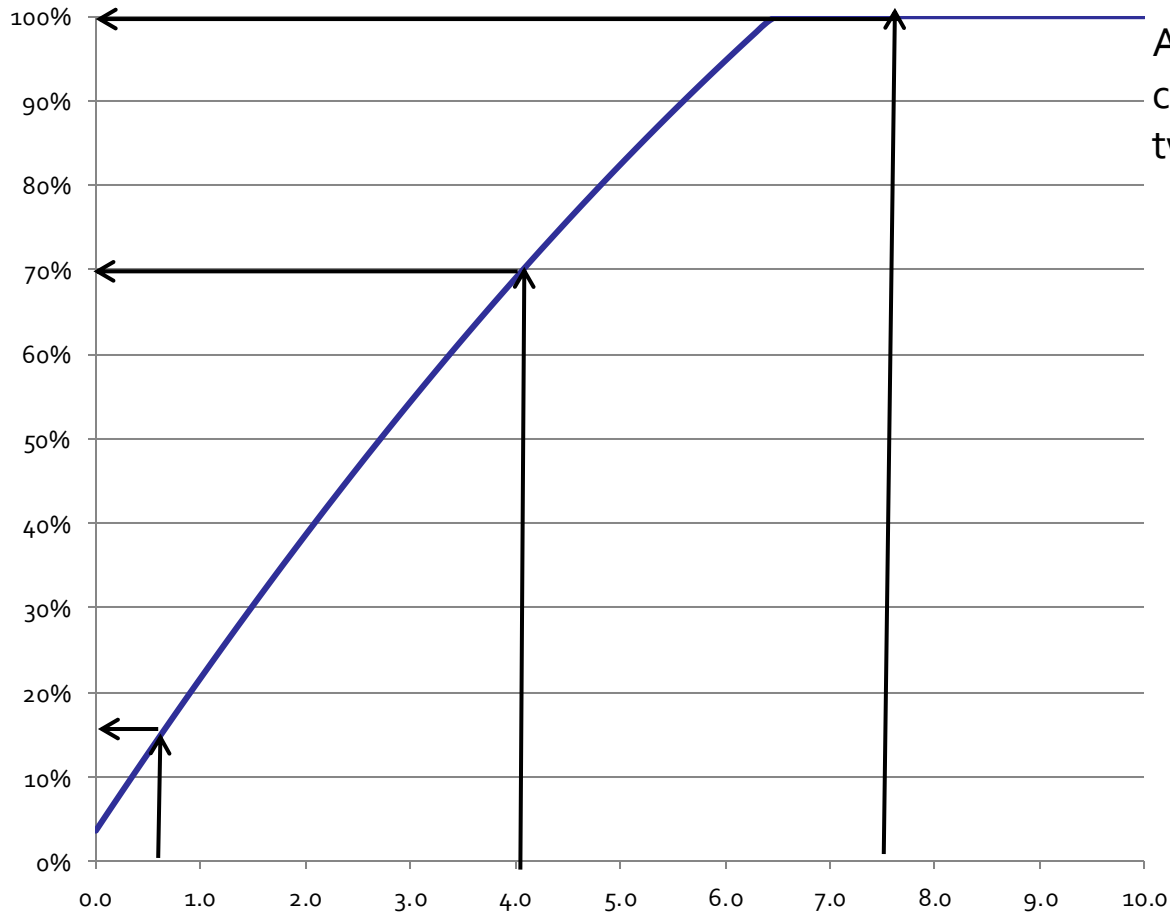
Model Comparison with High Water Marks

HWM_ID	HWM Survey Elevation (ft)	Modeled Elevation (ft)	Absolute Difference (ft)
HWM-NJ-ATL-103	7.7	10.1	2.4
HWM-NY-NAS-903	8.0	7.3	0.7
HWM-MA-DUK-253	7.0	7.2	0.2
HWM-NJ-MON-215	5.1	10.7	5.6
HWM-NY-RIC-717	16.9	1.7	15.2
HWM-NJ-OCE-314	5.3	10.9	5.6
HWM-NJ-CPM-004	6.9	8.9	2.0
HWM-NJ-CPM-005	6.7	8.9	2.2
HWM-NY-NAS-001	9.8	1.0	8.8
Mean Absolute Difference			3.4
Maximum Absolute Difference			15.2

Source: USGS

Vulnerability to Depth of Water

Vulnerability Curve



Absolute difference means error can go in either direction. Maybe two wrongs make a right?

— US Army Corp Com Office SF Metal AB

Exposure Data



Elevated house, First Floor
Elevation above BFE

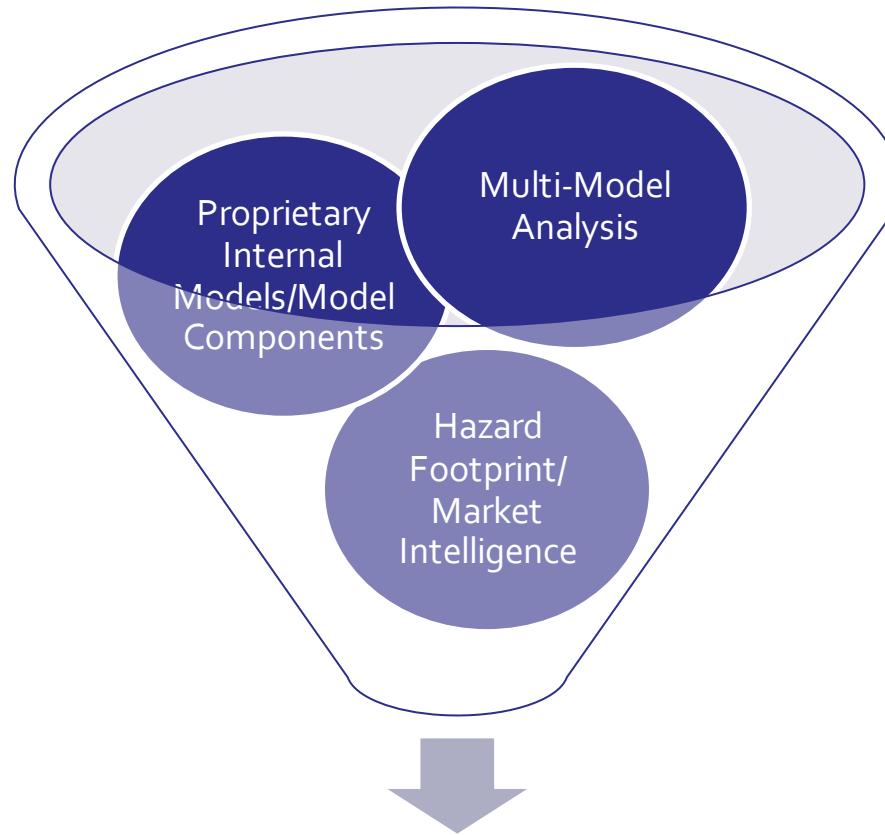


How good is the exposure data?

First Floor Elevation below
BFE



Loss Estimation Process



Industry Loss Estimate



Hedging Opportunities

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Insider

When the Biggest Risk...

EQECAT

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Canny retro buying pays off for Tokio Millennium

15 April 2013

Canny retro buying enabled Tokio Millennium Re to reduce its net Sandy loss to a mere \$0.5mn - equivalent to one-hundredth of the firm's \$52.4mn US crop loss - the company's 2012 annual report shows.

The firm kept its Sandy loss minimal thanks to its reinsurance protection, in particular a \$20.5mn payout from industry loss warranties (ILWs) traded as livecat contracts during the storm.

This helped the company to reduce its \$26.3mn gross Sandy loss to less than \$1mn net...

Scale enhanced.
Business as usual.

Alterra's operations have moved to Market



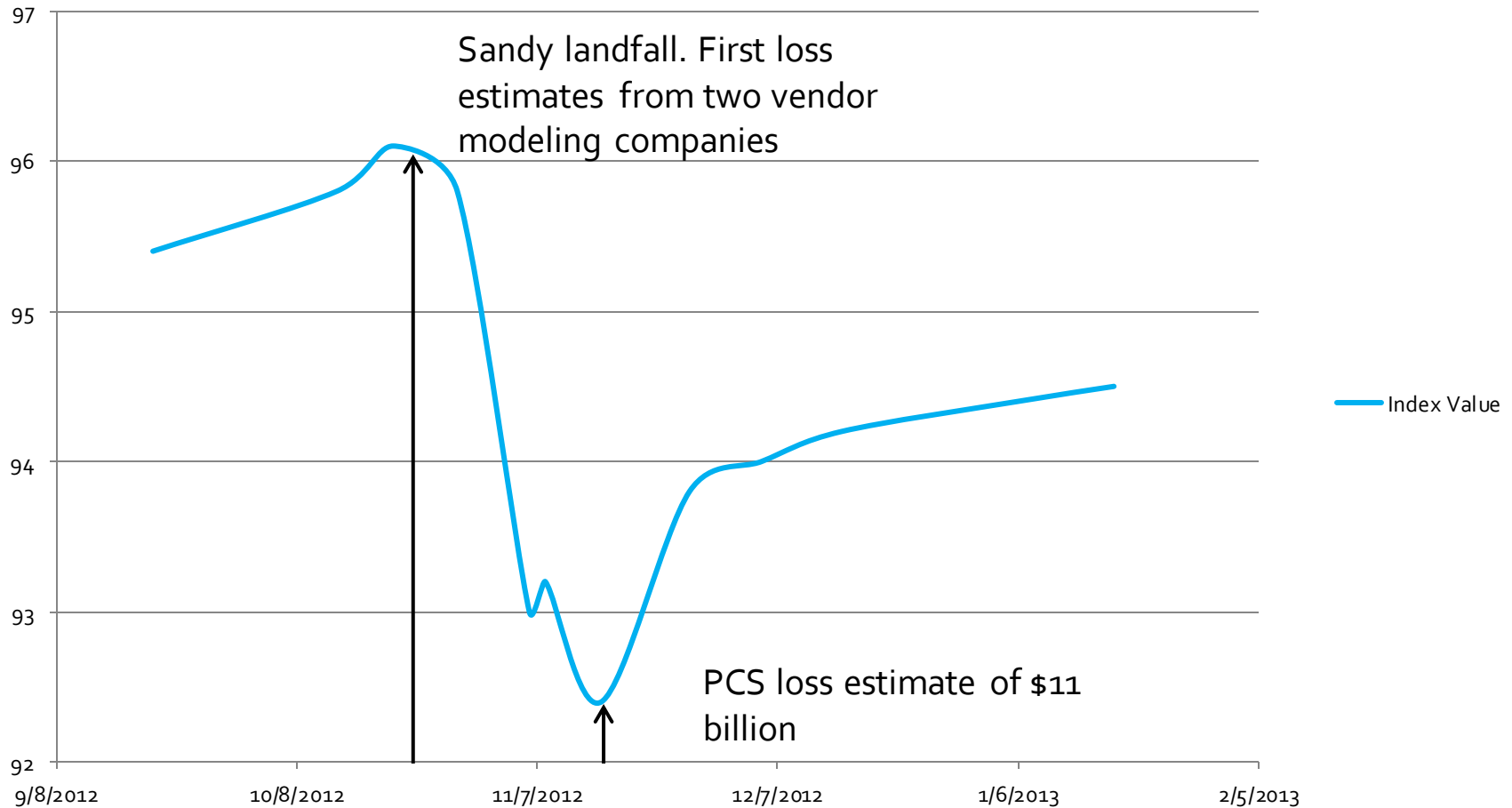
Source: Insurance Insider



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Trading Opportunities

Swiss Re Global Catastrophe Bond Index



Source: Swiss Re, Artemis

Challenges Remain

Hazard

- Modeling Flood Velocities
- Modeling Impact of Debris

Vulnerability

- Velocity-Damage Curves
- Exposure Data

Loss Calculation

- Policy Language
- BI/CBI



Challenges Remain



No physical damage at UPS or any of its customers

overstock.com®

Revenue impacted by power outages for consumers

Concluding Remarks

- + Model miss needs to be investigated in detail.
- + Underlying flood model evaluation and appropriate modeling techniques can, to some extent, alleviate model miss.
- + First floor elevation of a structure is an important parameter that needs to be leveraged for flood loss estimation.
- + Challenges including understanding of commercial flood policy terms, damage due to flood velocity, flood duration and accurate exposure data, among others remain in flood modeling.