

# THE BUSINESS BENEFIT OF SEASONAL US LANDFALLING HURRICANE FORECASTS FROM 1 AUGUST

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# Tropical Storm Risk (TSR)

- Founded in 2000, *Tropical Storm Risk (TSR)* offers a leading resource for forecasting the risk from tropical storms worldwide.
- The current TSR consortium comprises experts on insurance, risk management and seasonal climate forecasting.

Industry partners: **Benfield, Royal & SunAlliance, Crawford & Company.**

Scientific partner: **UCL/Benfieldhrc.**

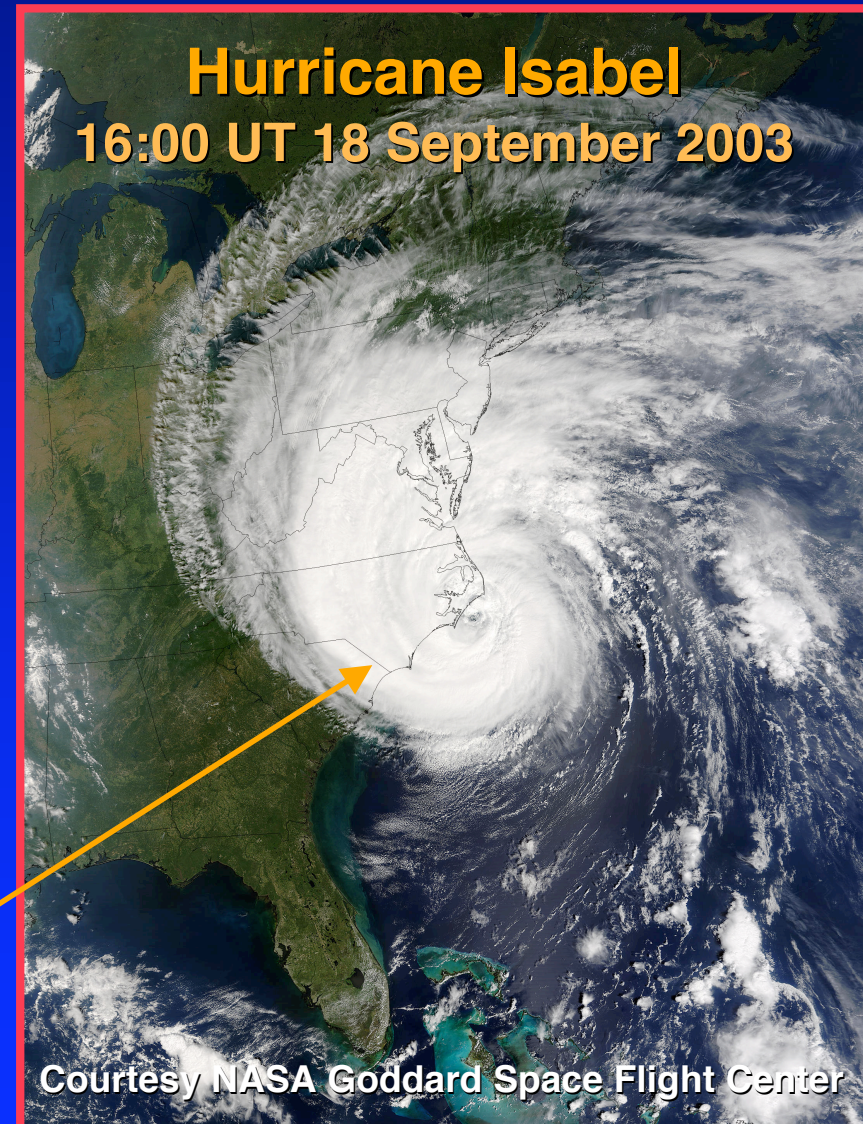




# US Hurricane Impacts

The annual mean damage bill and its standard deviation for US hurricane strikes 1950-2002 is **US \$ 4.8 billion** and **US \$ 7.7 billion** respectively at 2002 prices and exposures.

Hurricane Isabel caused damage of **US \$ 5.0 billion** (economic) and **US \$ 1.8 billion** (insured).





# Seasonal Forecast Relevance

- Strong correlation link (**0.72; 1900-2002**) exists between US hurricane activity and insured loss.
- Skilful long-range forecasts of seasonal US hurricane activity could be used to **reduce volatility and create an additional profit margin.**
- Two facts have taken the edge off the use of seasonal hurricane forecasts in business decisions to date:
  - Hurricane Andrew*
  - Lack of confidence in the forecast accuracy.*



# Hindcast Link to Losses

Comparison of hindcast US ACE index with (A) US hurricane economic losses and (B) US hurricane insured losses 1950-2002.

The hindcast model anticipates the correct anomaly sign for US hurricane economic loss in 74% of years 1950-2002 and for US hurricane insured loss in 70% of years.

A Economic Losses				B Insured Losses			
Year	Hindcast	Loss	Loss (US \$)	Year	Hindcast	Loss	Loss (US \$)
1992	-	+	43,152,000,000	1992	-	+	29,016,728,835
1954	+	+	22,845,000,000	1954	+	+	17,900,989,200
1955	+	+	17,204,000,000	1965	+	+	13,648,961,535
1965	+	+	16,557,000,000	1989	+	+	6,710,833,935
1960	+	+	15,918,000,000	1964	+	+	5,769,253,080
1969	-	+	14,298,000,000	1960	+	+	5,595,328,260
1972	-	+	13,978,000,000	1970	+	+	5,413,513,710
1989	+	+	13,436,000,000	1979	+	+	5,058,608,580
1979	+	+	11,264,000,000	1983	-	+	4,635,839,685
1961	+	+	9,339,000,000	1985	+	+	4,213,416,810
1964	+	+	9,193,000,000	1961	+	+	4,119,318,330
1985	+	+	8,661,000,000	1995	+	+	3,636,900,090
1999	+	+	6,222,000,000	1950	+	+	3,628,429,710
2001	+	+	5,470,000,000	1969	-	+	3,498,390,180
1983	-	+	5,289,000,000	1955	+	+	2,887,893,585
1995	+	+	4,860,000,000	2001	+	+	2,615,000,000
1996	+	+	4,544,000,000	1996	+	+	2,464,532,190
1970	+	+	4,352,000,000	1999	+	+	2,382,634,470
1998	+	+	4,327,000,000	1998	+	+	2,003,554,155
1950	-	+	3,659,000,000	1957	-	+	1,394,029,260
1957	-	+	3,187,000,000	1959	+	+	1,189,865,610
1967	+	+	2,673,000,000	1972	-	+	1,133,958,495
1975	+	+	2,290,000,000	1991	-	+	1,094,842,830
1991	-	+	2,234,000,000	1967	+	+	1,052,384,280
1971	+	+	1,580,000,000	1975	+	+	927,940,320
1994	+	+	1,340,000,000	2002	-	+	635,000,000
2002	-	+	1,220,000,000	1980	-	+	336,384,765
1980	-	-	1,128,000,000	1956	-	-	325,876,185
1974	-	-	934,000,000	1966	-	-	249,843,030
1959	+	-	582,000,000	1984	+	-	158,413,170
1956	-	-	457,000,000	1976	-	-	151,621,935
1968	-	-	417,000,000	1971	+	-	143,894,550
1976	-	-	400,000,000	1974	-	-	140,590,770
1958	-	-	290,000,000	1968	-	-	114,799,245
1951	+	-	237,000,000	1953	+	-	110,872,155
1966	-	-	215,000,000	1986	-	-	81,980,670
1963	+	-	193,000,000	1952	-	-	65,229,510
1984	+	-	170,000,000	1993	-	-	56,049,315
1973	-	-	124,000,000	1997	-	-	48,913,245
1997	-	-	121,000,000	1988	+	-	22,592,025
1988	+	-	114,000,000	1977	-	-	13,525,590
1981	-	-	100,000,000	1963	+	-	4,685,490
1978	-	-	98,000,000	1987	-	-	594,870
1990	+	-	97,000,000	2000	-	-	0
1993	-	-	83,000,000	1994	+	-	0
1952	-	-	82,000,000	1951	+	-	0
1962	-	-	55,000,000	1990	+	-	0
1977	-	-	43,000,000	1981	-	-	0
1986	-	-	38,000,000	1978	-	-	0
1953	+	-	36,000,000	1958	-	-	0
1982	-	-	35,000,000	1982	-	-	0
2000	-	-	29,000,000	1962	-	-	0
1987	-	-	18,000,000	1973	-	-	0



# Business Application

- Is the skill offered by these recent advances in seasonal forecasting high enough to create an additional profit margin to benefit business?
- In collaboration with the Helvetia Patria Group TSR is developing a method to **examine the business relevance** of their monthly updated US ACE index forecasts for **buy and sell strategies** in the **reinsurance industry**.
- Early results show that a **Forecast Strategy** which uses the TSR early August US hindcasts to decide whether to buy or sell cover gives **at least a 10-20% additional profit** for both.



# Business Strategies

Four reinsurance business strategies are examined:

1. **Always Buy** - strategy of buying cover to reduce volatility regardless of hurricane forecasts.
2. **Always Sell** - strategy of selling cover regardless of hurricane forecasts.
3. **Forecast** - strategy of using the seasonal forecast to decide whether to buy or sell cover.
4. **Random** - strategy of buying/selling cover at random but at same rate as the forecast strategy.



# Modelling Approaches

Two approaches have been developed (each giving similar results):

**1. Direct Method** (*Actual Insurance Loss Data*).

The forecast strategy for buying or selling US cover is applied to time series of historical insurance industry loss data 1950-2002.

**2. Indirect Method** (*10k Year Simulation*).

The forecast strategy together with a distribution of forecast errors 1950-2002 is applied to a simulation of 10,000 years of modelled US hurricane strikes and industry losses.





# Summary Statistics (1)

	Obs (1900-2002)	Simulation
Mean H Nos	1.60	1.59
SD H Nos	1.29	1.26
Mean US ACE	2.46	2.45
SD US ACE	2.26	2.34
Mean US ACE forecast*	2.19	2.20
SD US ACE forecast*	1.05	1.00
Mean ACE forecast error*	0.00	-0.25
SD ACE forecast error*	1.74	2.12

\* 1950-2002

	Obs (1900-2002)	Simulation
Average total loss	2907	2910
SD total loss (\$m as 2002)	6693	7980



# Summary Statistics (2)

## Observed (1900-2002)

Spearman Rank Correlation Matrix (1900-2002)				
	H Nos	ACE obs	ACE fcast *	Loss
H Nos	1	0.84	0.34	0.68
ACE obs		1	0.43	0.72
ACE fcast *			1	0.34
Loss				1

\* 1950-2002

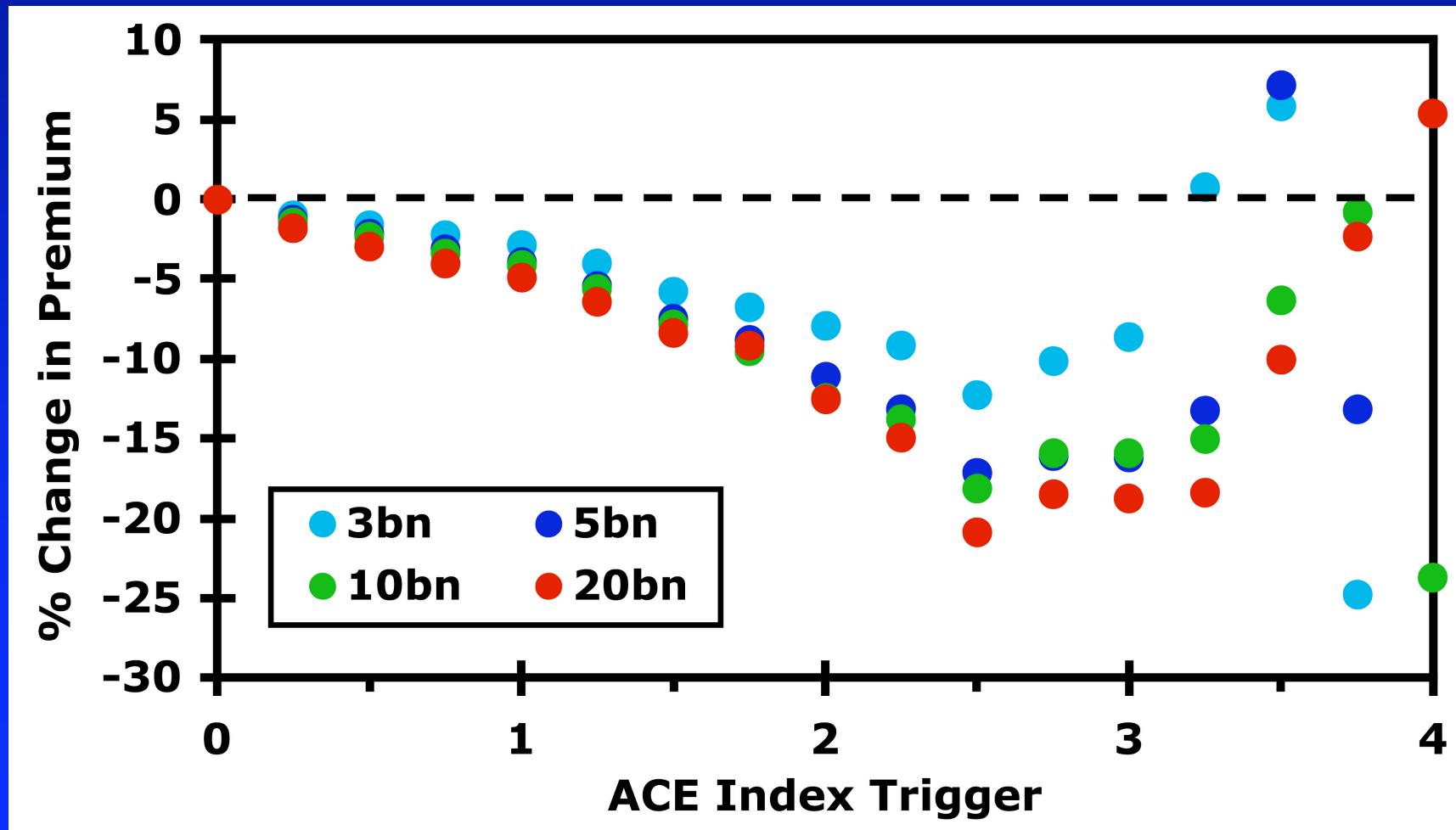
## Simulation (10k years)

Spearman Rank Correlation Matrix				
	H Nos	ACE obs	ACE fcast	Loss
H Nos	1	0.85	0.39	0.73
ACE obs		1	0.43	0.66
ACE fcast			1	0.29
Loss				1

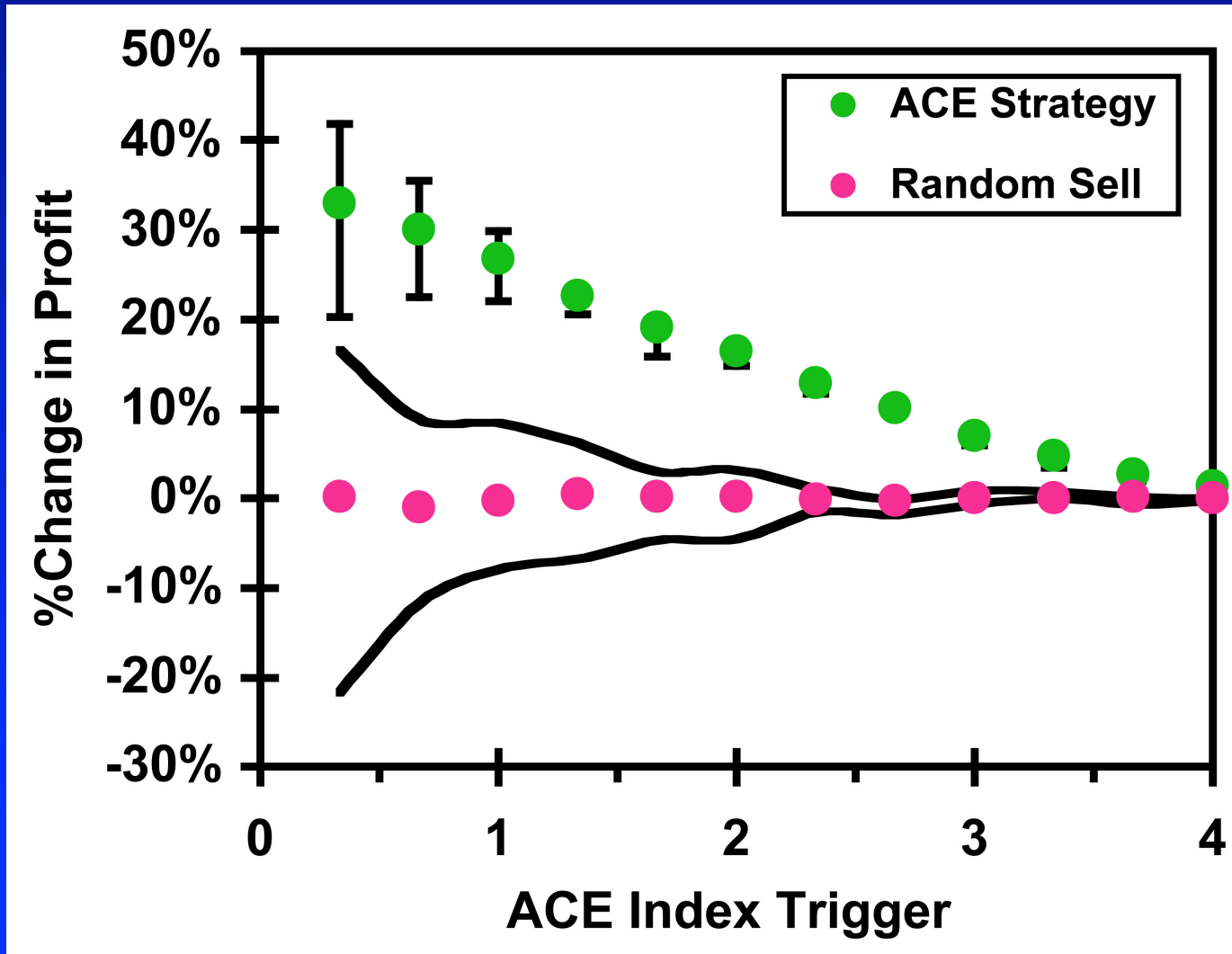


# Benefit Over Always Buy

Reduction in premium paid with Forecast strategy compared to Always Buy strategy for same level of volatility.



# Benefit Over Always Sell



Change in profit with Forecast strategy over the Always Sell and Random Sell strategies for same premium sold.



# Summary

- Over a period of years the 'Forecast' strategy provides clear additional profits over the Always Buy and Always Sell reinsurance strategies.
- Depending upon the ACE index trigger these profit margins are **10-20% over Always Buy and 10-30% over Always Sell.**
- This is the first example of the practical value of a seasonal US hurricane forecast.