TROPICAL STORM RISK

BRIEFING DOCUMENT AND VALUE PROPOSITION

Innovative forecast products to benefit global (re)insurance and claims management

Tropical Storm Risk.com

www.tropicalstormrisk.com

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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 storm activity worldwide.
- The TSR consortium comprises experts on broking, insurance, claims management and seasonal climate forecasting.

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

Scientific partner: UCL/Benfieldhrc.

Innovation, Success and Business Relevance

TSR uses cutting-edge science to develop innovative products to benefit risk awareness and decision making:

1. **Application of seasonal hurricane forecasts for U.S. property catastrophe reinsurance.** ***(First direct demonstration of the business relevance of hurricane forecasts for selling and buying (re)insurance cover*****).**

2. **Tropical Storm Tracker and forecast windfields.** ***(The award-winning leading global tracker on the market).***

3. **Seasonal probabilistic forecasts of basin and landfalling tropical storm activity worldwide.** ***(Leading global forecaster with an impressive track record).***

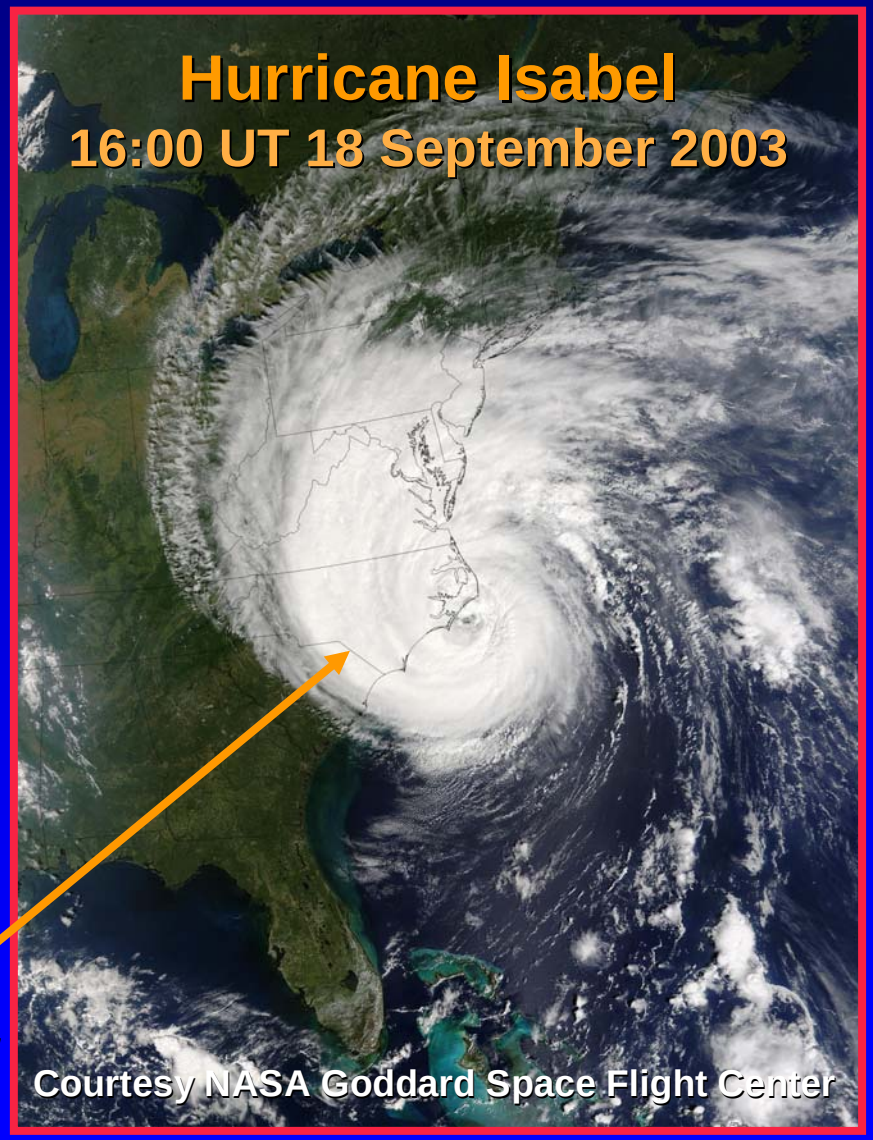
1. Business Application of Seasonal Hurricane Forecasts in Property Catastrophe Reinsurance

US Hurricane Impacts

The annual mean insured damage bill and its standard deviation for U.S. hurricane strikes 1950-2002 is US $ 2.9 billion and US $ 6.7 billion respectively at 2002 prices and exposures.

The U.S. East and Gulf Coasts are among the regions with the highest density of property insurance in the world.

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.

- Skillful long-range forecasts of seasonal U.S. hurricane activity could be used to create:

  Additional profit margin for a seller of reinsurance coverage.
  Reduce costs for buyers of coverage.

- 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 US Losses

Comparison of hindcast U.S. activity forecast index with *(A)* U.S. hurricane economic losses and *(B)* U.S. hurricane insured losses 1950-2002.

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

(Saunders and Lea, 2004)

A Economic Losses

Year	Hindcast	Loss	Loss (US $)
1992	-	+	43,152,000,000
1954	+	+	22,845,000,000
1955	+	+	17,204,000,000
1965	+	+	16,557,000,000
1960	+	+	15,918,000,000
1969	-	+	14,298,000,000
1972	-	+	13,978,000,000
1989	+	+	13,436,000,000
1979	+	+	11,264,000,000
1961	+	+	9,339,000,000
1964	+	+	9,193,000,000
1985	+	+	8,661,000,000
1999	+	+	6,222,000,000
2001	+	+	5,470,000,000
1983	-	+	5,289,000,000
1995	+	+	4,860,000,000
1996	+	+	4,544,000,000
1970	+	+	4,352,000,000
1998	+	+	4,327,000,000
1950	+	+	3,659,000,000
1957	-	+	3,187,000,000
1967	+	+	2,673,000,000
1975	+	+	2,290,000,000
1991	-	+	2,234,000,000
1971	+	+	1,580,000,000
1994	+	+	1,340,000,000
2002	-	+	1,220,000,000
1980	-	-	1,128,000,000
1974	-	-	934,000,000
1959	+	-	582,000,000
1956	-	-	457,000,000
1968	-	-	417,000,000
1976	-	-	400,000,000
1958	-	-	290,000,000
1951	+	-	237,000,000
1966	-	-	215,000,000
1963	+	-	193,000,000
1984	+	-	170,000,000
1973	-	-	124,000,000
1997	-	-	121,000,000
1988	+	-	114,000,000
1981	-	-	100,000,000
1978	-	-	98,000,000
1990	+	-	97,000,000
1993	-	-	83,000,000
1952	-	-	82,000,000
1962	-	-	55,000,000
1977	-	-	43,000,000
1986	-	-	38,000,000
1953	+	-	36,000,000
1982	-	-	35,000,000
2000	-	-	29,000,000
1987	-	-	18,000,000

B Insured Losses

Year	Hindcast	Loss	Loss (US $)
1992	-	+	29,016,728,835
1954	+	+	17,900,989,200
1965	+	+	13,648,961,535
1989	+	+	6,710,833,935
1964	+	+	5,769,253,080
1960	+	+	5,595,328,260
1970	+	+	5,413,513,710
1979	+	+	5,058,608,580
1983	-	+	4,635,839,685
1985	+	+	4,213,416,810
1961	+	+	4,119,318,330
1995	+	+	3,636,900,090
1950	+	+	3,628,429,710
1969	-	+	3,498,390,180
1955	+	+	2,887,893,585
2001	+	+	2,615,000,000
1996	+	+	2,464,532,190
1999	+	+	2,382,634,470
1998	+	+	2,003,554,155
1957	-	+	1,394,029,260
1959	+	+	1,189,865,610
1972	-	+	1,133,958,495
1991	-	+	1,094,842,830
1967	+	+	1,052,384,280
1975	+	+	927,940,320
2002	-	+	635,000,000
1980	-	+	336,384,765
1956	-	-	325,876,185
1966	-	-	249,843,030
1984	+	-	158,413,170
1976	-	-	151,621,935
1971	+	-	143,894,550
1974	-	-	140,590,770
1968	-	-	114,799,245
1953	+	-	110,872,155
1986	-	-	81,980,670
1952	-	-	65,229,510
1993	-	-	56,049,315
1997	-	-	48,913,245
1988	+	-	22,592,025
1977	-	-	13,525,590
1963	+	-	4,685,490
1987	-	-	594,870
2000	-	-	0
1994	+	-	0
1951	+	-	0
1990	+	-	0
1981	-	-	0
1978	-	-	0
1958	-	-	0
1982	-	-	0
1962	-	-	0
1973	-	-	0

Business Application

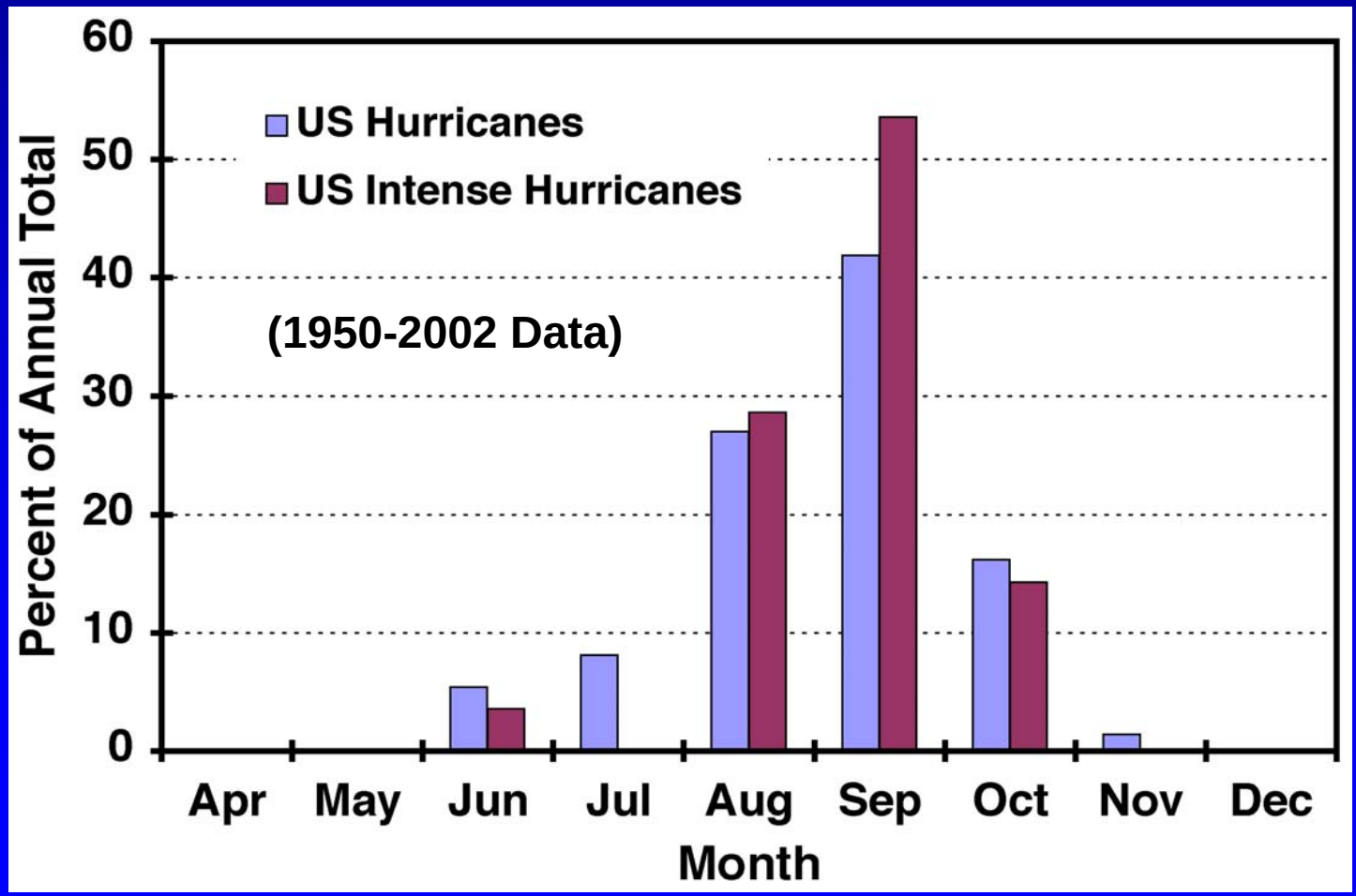
- Is the skill offered by these recent advances in seasonal forecasting high enough to create an additional profit margin to benefit business?

- In collaboration with the Helvetia Patria Group TSR has developed a method to examine the business relevance of their monthly updated U.S. ACE (Accumulated Cyclone Energy) index hindcasts for buy and sell strategies in the reinsurance industry.

- The (re)insurance business application examined is the purchase and selling of Industry Loss Warranty (ILW) covers starting at 1 August. ILW triggers of U.S. $ 5 bn, $ 10 bn and $ 20 bn are examined.

Annual Cycle for U.S. Hurricane Strikes

96% of intense (cat 3 to 5) hurricane strikes on the U.S. and 87% of hurricane hits on the U.S. occur after 1 August.



Business Strategies

Two reinsurance business strategies are examined:

1. **Forecast Sell -** strategy of selling ILW cover to create an additional profit depending on the forecast activity for the upcoming season..

2. **Forecast Buy -** strategy of buying ILW cover based upon the predicted activity of the upcoming season.

These strategies are tested using two modelling methods:

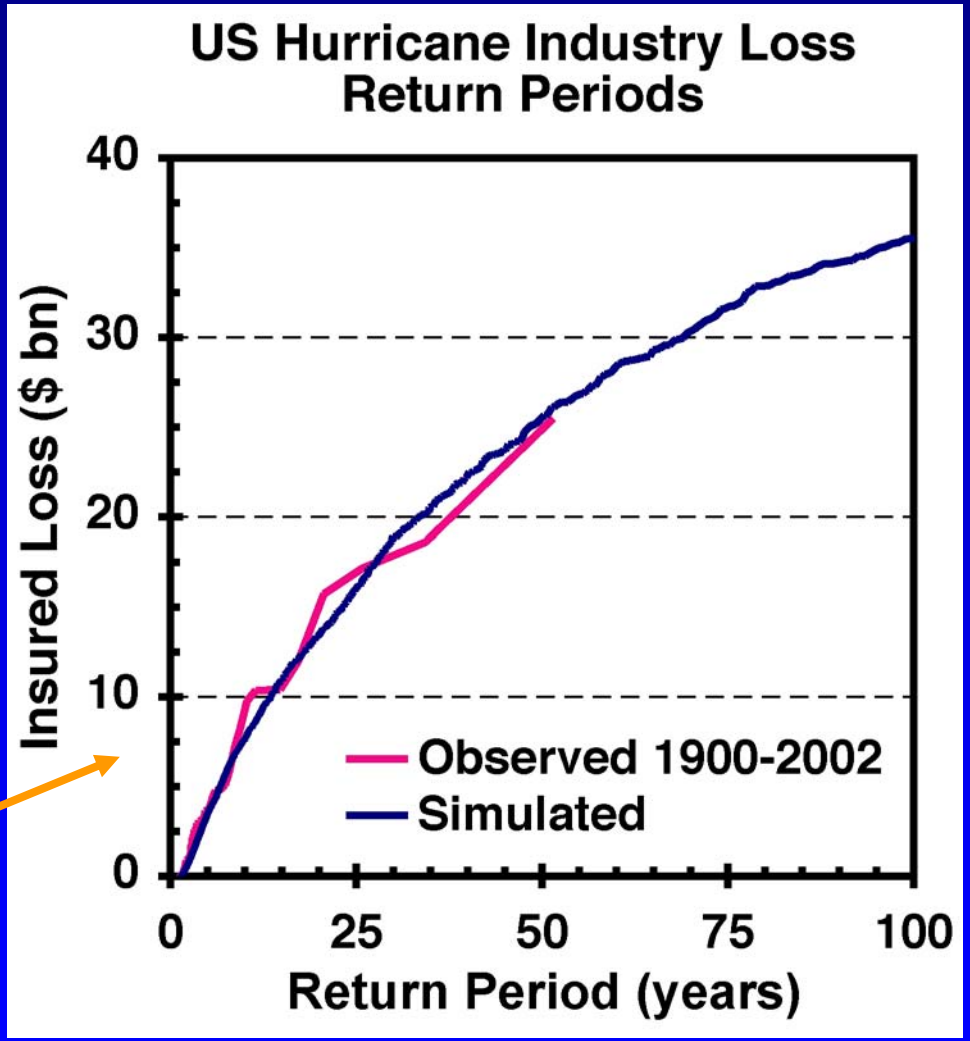
1. **Direct -** 1950-2002 period of historical insured losses.
2. **Simulation Model -** 50,000 year period of simulated U.S. hurricane strikes and insured losses.

Simulation Model

The simulation is a robust/ sophisticated model which:

a) Employs distributions fitted to historical (1900-2002) losses and frequency distributions.

b) Matches the observed record impressively.



Observed and simulated return periods for U.S. hurricane insured losses ($ bn) corrected to 2002 prices and exposures.

Simulation Model 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)

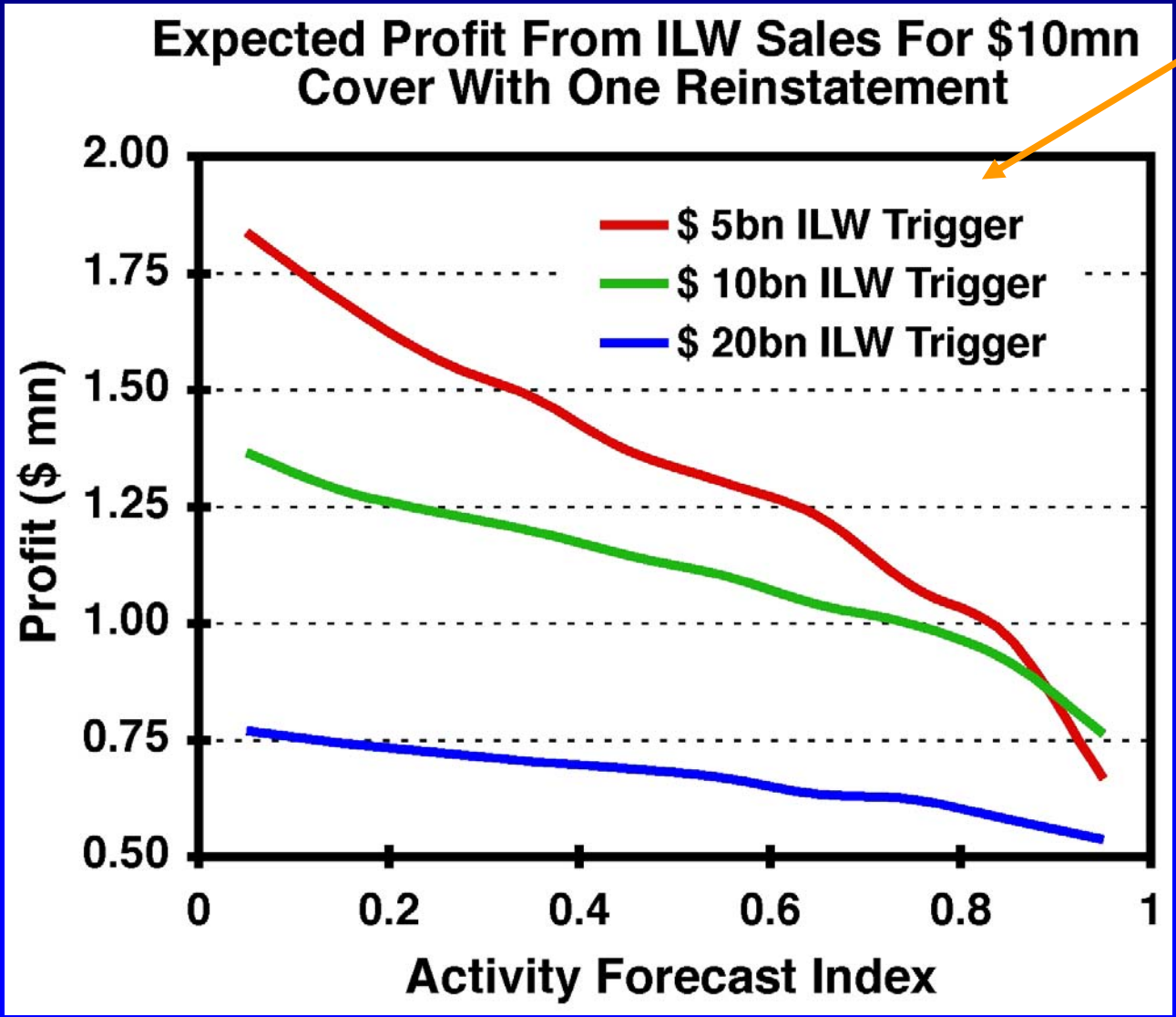
Spearman Rank Correlation Matrix (1900-2002)				
	H Nos	ACE obs	ACE fcast *	Loss
H Nos	1	0.84	0.34	0.68
ACE obs		1	0.43	0.72
ACE fcast *			1	0.34
Loss				1

* 1950-2002

Simulation (50k 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

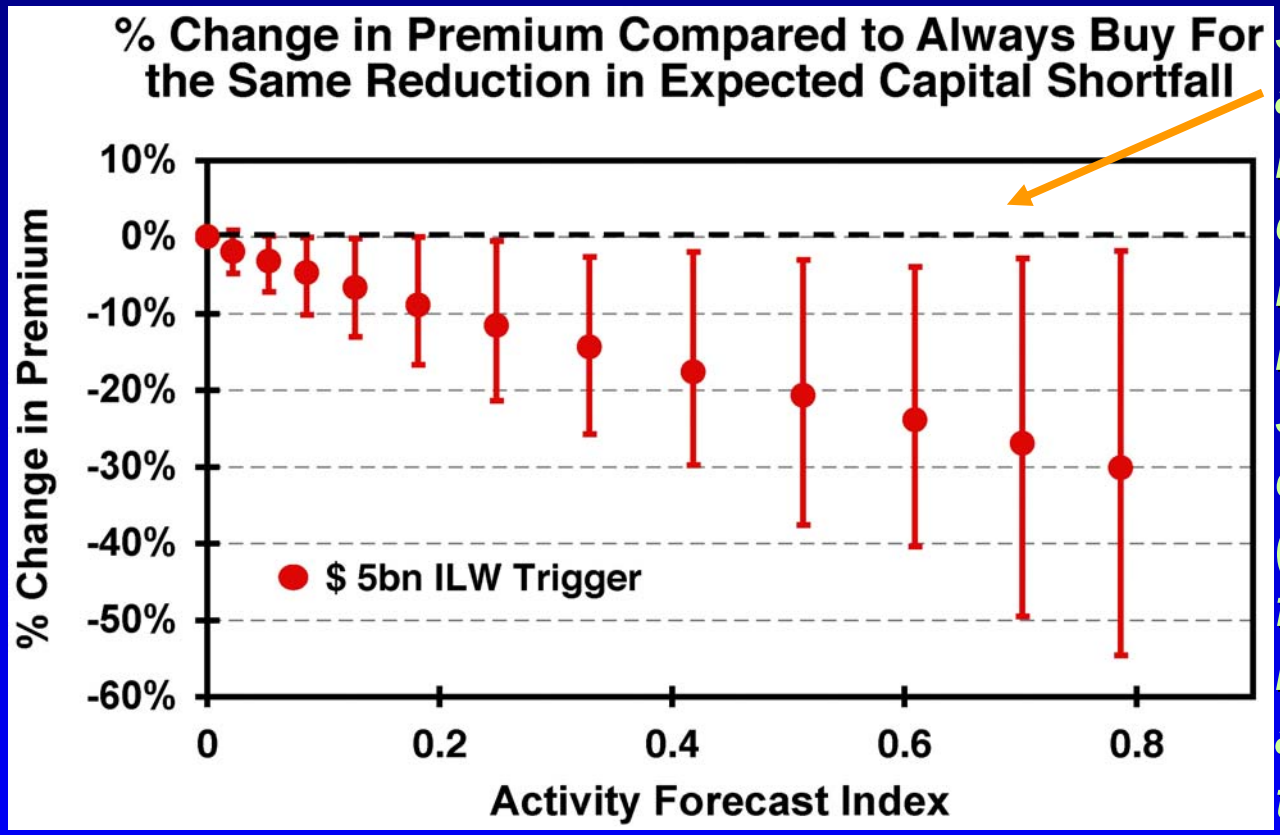
Annual Profits - Forecast Sell



Annual expected profits from ILW sales as a function of activity forecast index and ILW trigger.

These results show a 10-30% increased profitability for a reinsurer selling ILW covers which follow a *Forecast Sell* strategy.

Benefits - Forecast Buy



Savings in premium afforded by the Forecast Buy strategy compared to Always Buy for the same reduction in capital risk. Savings are assessed over a 50-year window (repeated 10,000 times) for $5 bn ILW purchase. Error bars show the 10th and 90th percentiles of the premium reduction.

These results show that for a 50-year window a (re)insurer pursuing the *Forecast Buy* strategy pays 10%-30% less for the same amount of protection (i.e. same volatility or risk).

Future Business Developments

The following new applications and products (all building on the innovative (re)insurance applications described above) would be business relevant:

1. Application of seasonal hurricane forecasts for property catastrophe reinsurance in other regions with useful landfalling forecast skill. These include the U.S. East Coast, the Caribbean Greater Antilles and the Caribbean Lesser Antilles.
2. Application of seasonal hurricane forecasts to influence the price paid for hurricane Cat Bonds within the secondary markets.
3. Creation of a new hurricane activity index for trading within the capital markets.

2. Tropical Storm Tracker and Forecast Windfields

TSR Tropical Storm Tracker

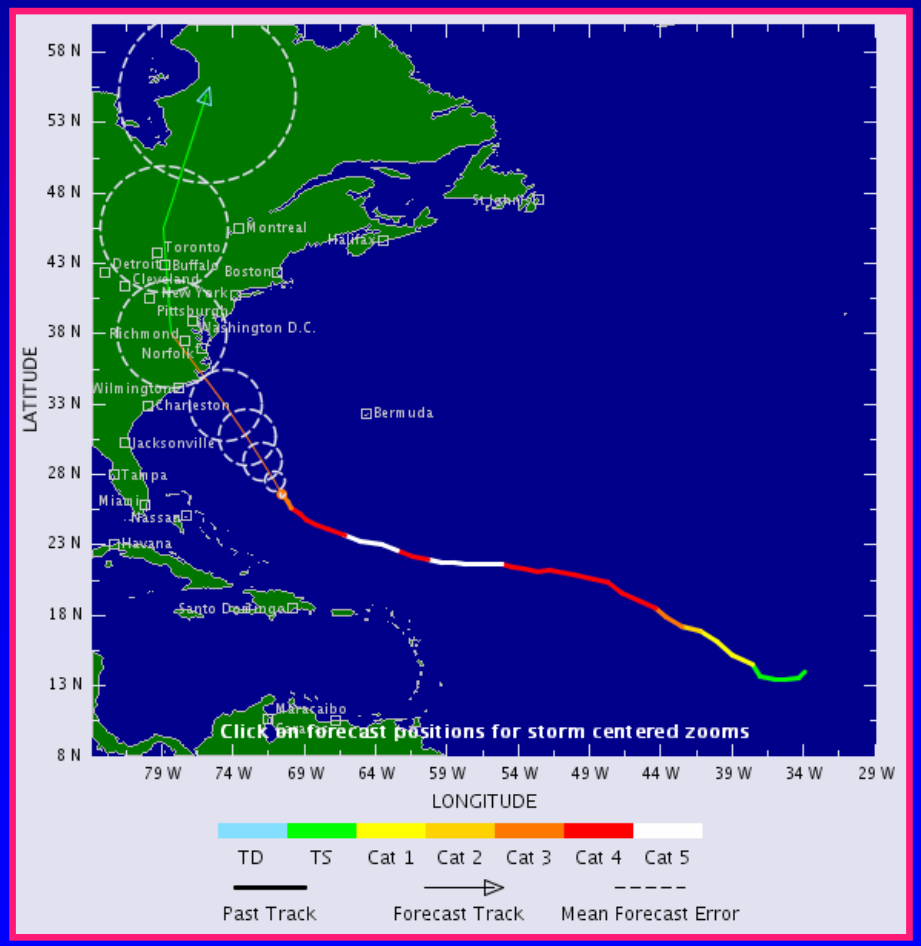
- Award-winning internet application enabling users to assess exactly when, where and to what extent losses are likely to happen from active tropical storms worldwide.

- The Tropical Storm Tracker provides:
  a) Real-time forecasts out to 5 days lead for all active tropical cyclone systems worldwide.
  b) Forecast updates every 6 hours.
  c) Unique current and forecast surface windfields for all systems of at least hurricane force prior to extra-tropical transition.
  d) Best available information on storm position (past, current and forecast), storm strength, storm track and track uncertainty, all with various levels of zoom.

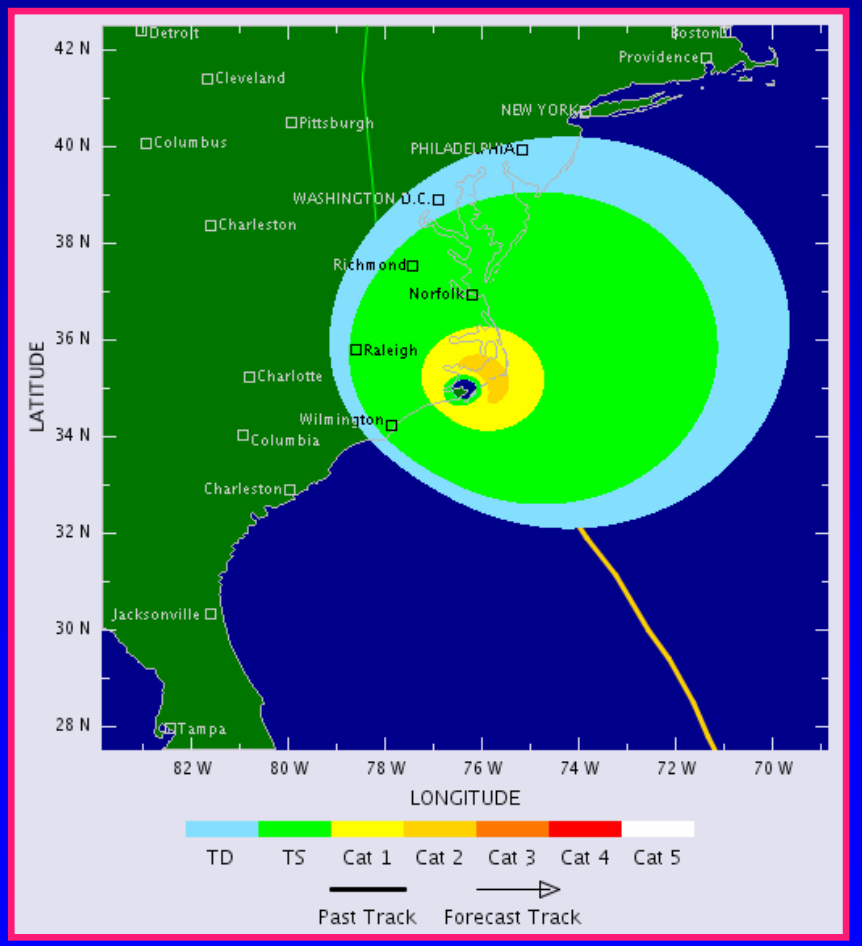
Isabel - Forecast Products

Landfall: 17:00 GMT 18th September 2003

Forecast Track and Error Out to 120 Hours Lead

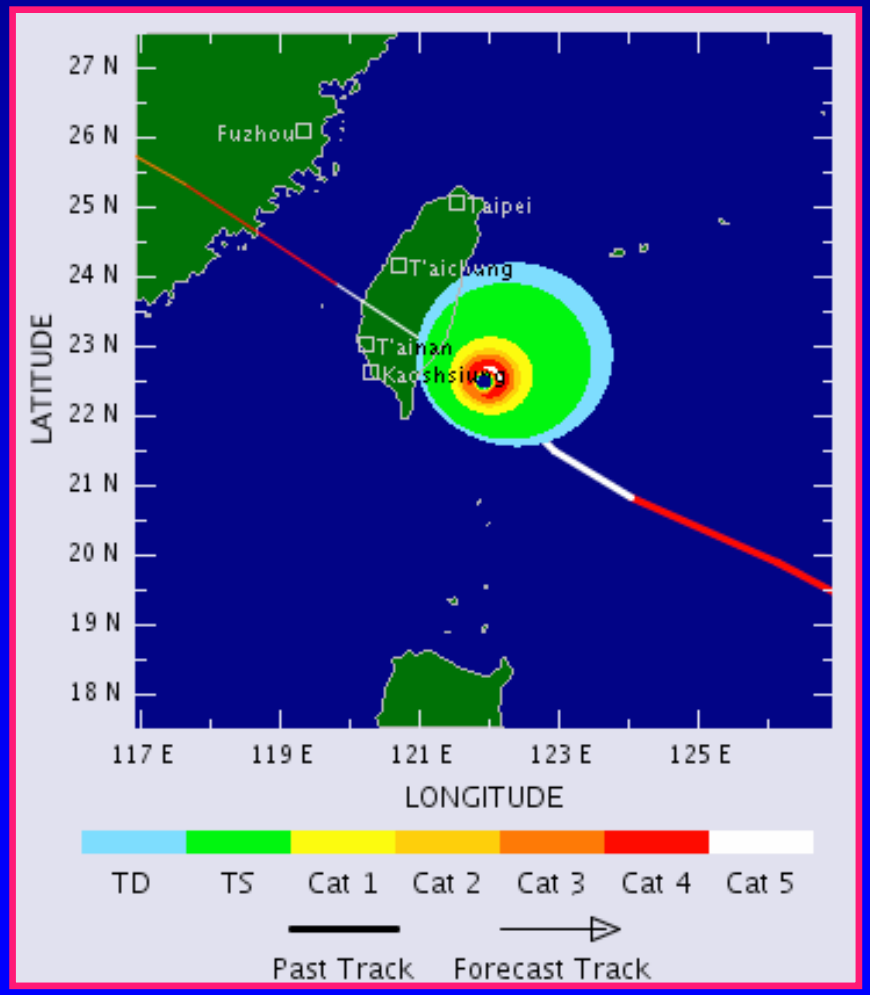


Forecast Windfield 12 Hours Lead

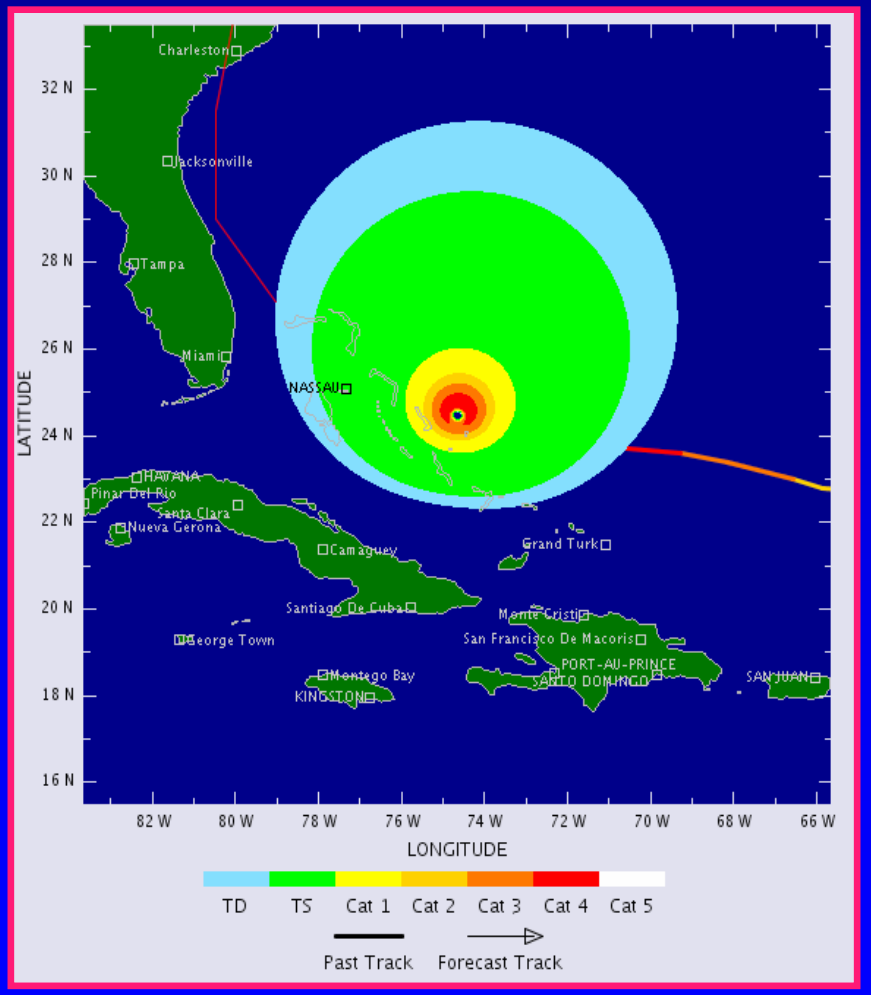


Historical Storms

Super Typhoon Bilis
Taiwan, 22nd August, 2000



Hurricane Floyd
14th September 1999



Future Business Developments

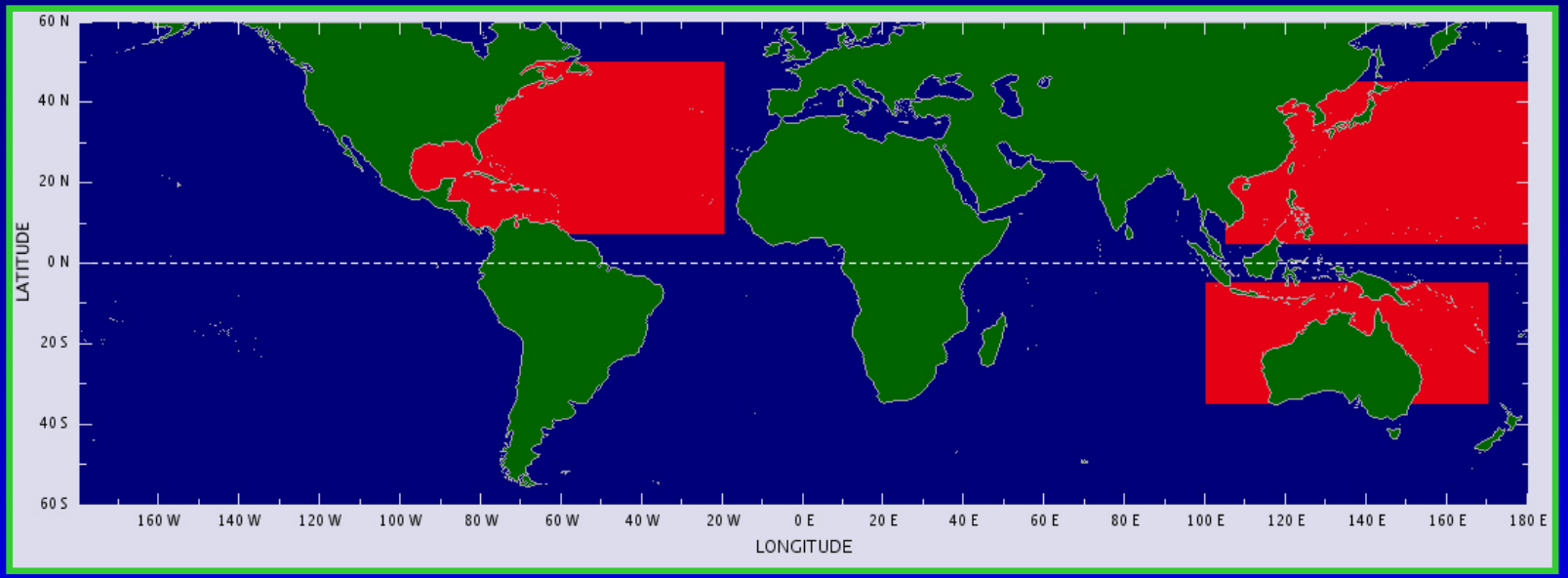
The following potential new products - all building on the TSR Tropical Storm Tracker - would be business relevant:

1. An automatic storm alert e-mail system.
2. Storm forecast strike probabilities for major cities (out to 5 days lead).
3. Historical archive of tropical storms, windfields and losses.
4. Short term forecasts of loss.
5. TC activity index for the Cat Bond market. Combining short term loss forecasts with seasonal loss forecasts to create a dynamic TC activity index.

3. Seasonal Probabilistic Forecasts of Basin and Landfalling Tropical Storm Activity Worldwide

Regions and Track Record

Forecast Regions



TSR has an impressive forecast track record and regularly outperforms its competitors. Recent successes include:

1. **The 2002 and 2003 North Atlantic hurricane seasons.**
2. **The 2002 and 2003 Northwest Pacific typhoon seasons.**
3. **The 2001/2, 2002/3 and 2003/4 Australian-region tropical cyclone seasons.**

Features

1. Totally innovative prediction methodology.
2. Forecasts of seasonal activity for the North Atlantic, Northwest Pacific and Australian-region, and for landfalling strikes on the U.S., U.S. East and Gulf Coasts, Caribbean Lesser Antilles and Australia.
3. Probabilistic and deterministic predictions.
4. Predictions of Accumulated Cyclone Energy (arguably the best current measure of a season's overall activity).
5. Monthly-updated forecasts:

North Atlantic:	December to August
Northwest Pacific:	March to August
Australian-region:	May to December

Future Developments

Innovative research and development planned for the near future (all with business potential) include:

1. Detailed examination of the seasonal predictability of landfalling tropical cyclone numbers for Far East and SE Asian territories (using the innovative techniques developed for predicting landfalling Atlantic activity).

2. Assessment of the added benefits of including Met Office, ECMWF and Meteo-France dynamical climate prediction data into the TSR seasonal models.

3. Examination of the intraseasonal (eg August only and September only) predictability of tropical Atlantic, Caribbean Sea and Gulf of Mexico tropical cyclones.

4. Value Proposition

Product Application and Further Research

TSR is keen to seek partnerships with innovative and forward-looking companies interested in :

1. Applying and developing the business potential of its innovative products.

2. Funding further innovative applied research (as described above) on the forecasting of tropical storm activity worldwide.

Benefits of Partnership

To TSR:

- Knowhow transfer
- Benchmark and testing possibilities
- Funding.

To Sponsor:

- Innovative research from TSR
- Potential product application and development
- Outstanding technology transfer and PR.

TSR Funding System

- Current sponsors contribute either £30k or £35k annually.
- Sponsorship runs for 1 year (usually from 1st July) and is renewable 3 months in advance.
- Each sponsor contributes a member to the TSR Management Board which meets quarterly in London.

Summary

- TSR uses cutting-edge science to develop innovative forecast products to benefit risk awareness and profitability within the (re)insurance and claims management industries.
- A series of further innovative business-relevant developments are planned for the near future.
- TSR is keen to seek partnerships with companies interested in applying and developing the business potential of its innovative products.