

GIRO conference and exhibition 2010
Hannes van Rensburg, Antony Dodson

A large offshore oil rig is shown on fire, with a massive plume of orange and yellow flames rising from the structure. The rig is heavily rusted and appears to be in a state of disrepair. The fire is intense, with thick black smoke rising into the sky. The rig is situated in the middle of the ocean, with the water reflecting the fire. The sky is a clear blue.

Offshore Energy Insurance

12-15 October 2010

Agenda

- Background and overview of Offshore Energy insurance
- Evolution of market pricing methods
- Developments to windstorm pricing (asset dispersion)?
- Future market environment – post Deepwater Horizon

Science and Technology

- Oil and gas formation



Cooking



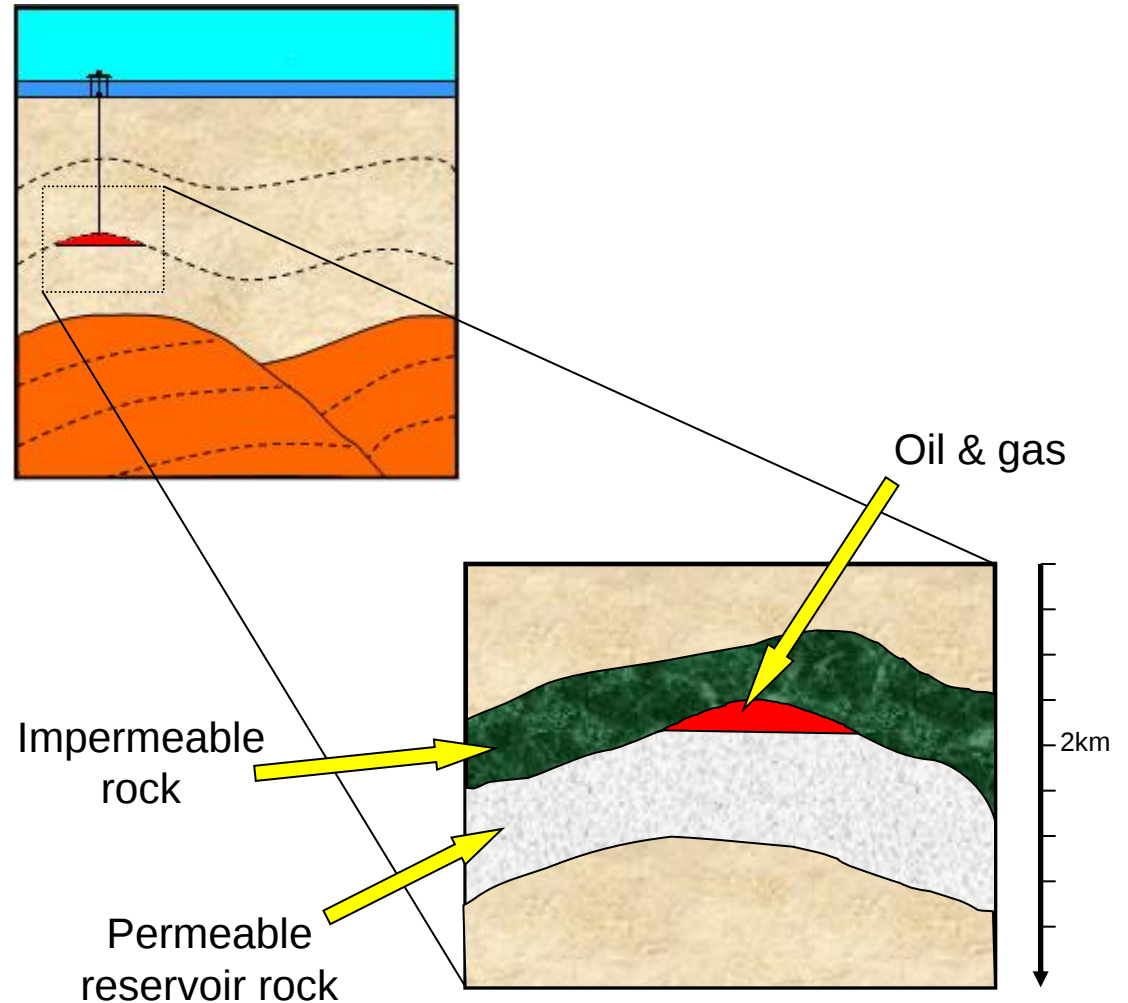
Pressure



Migration



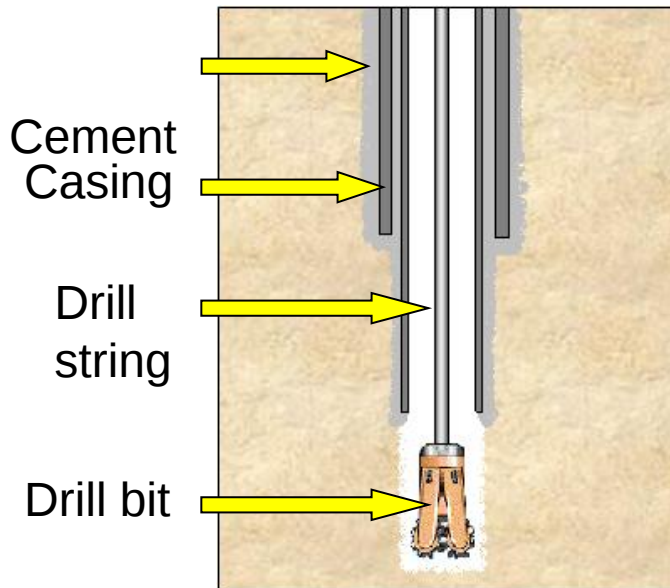
Trapping



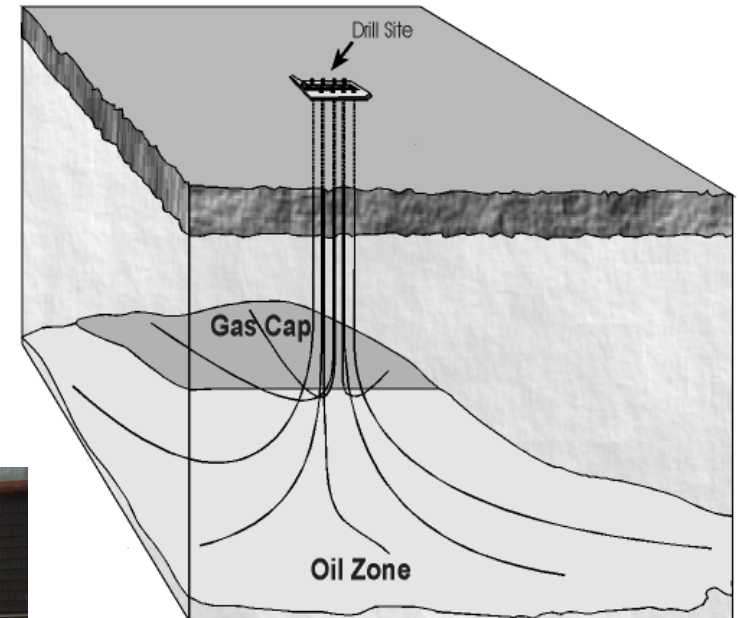
Science and Technology

- Drilling

Schematic



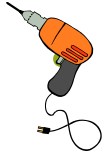
Multiple wells



Blowout Preventer (BOP)

Science and Technology

- Drilling units



Mobile drills (semi-sub, jack-ups.....)



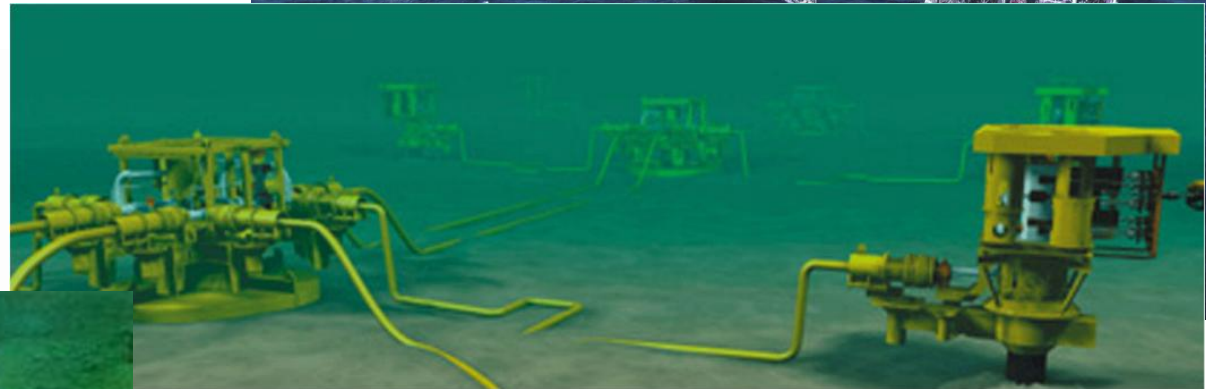
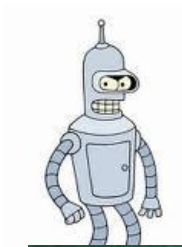
Science and Technology

- Production

- Platforms / complexes



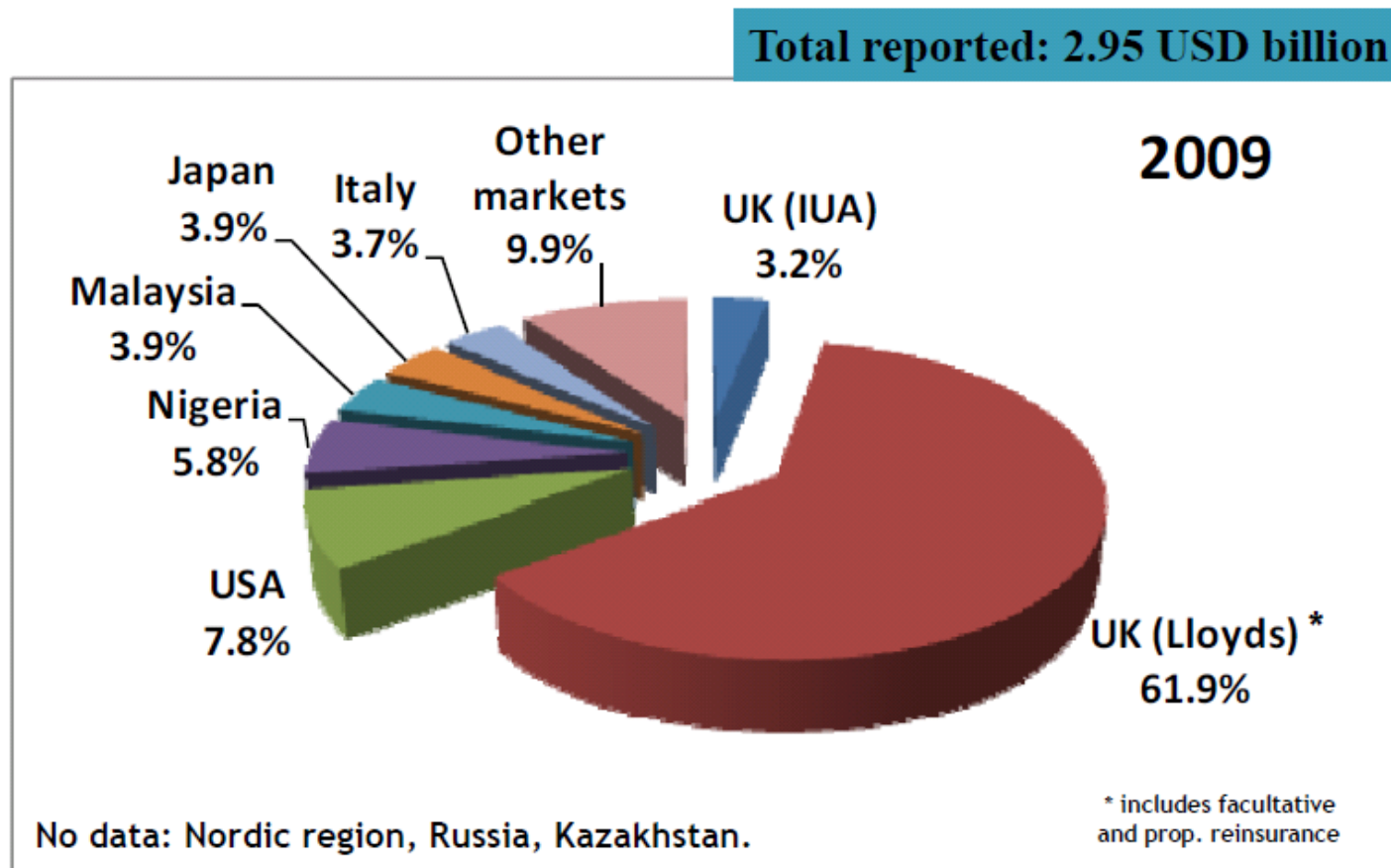
- Subsea



- Pipelines



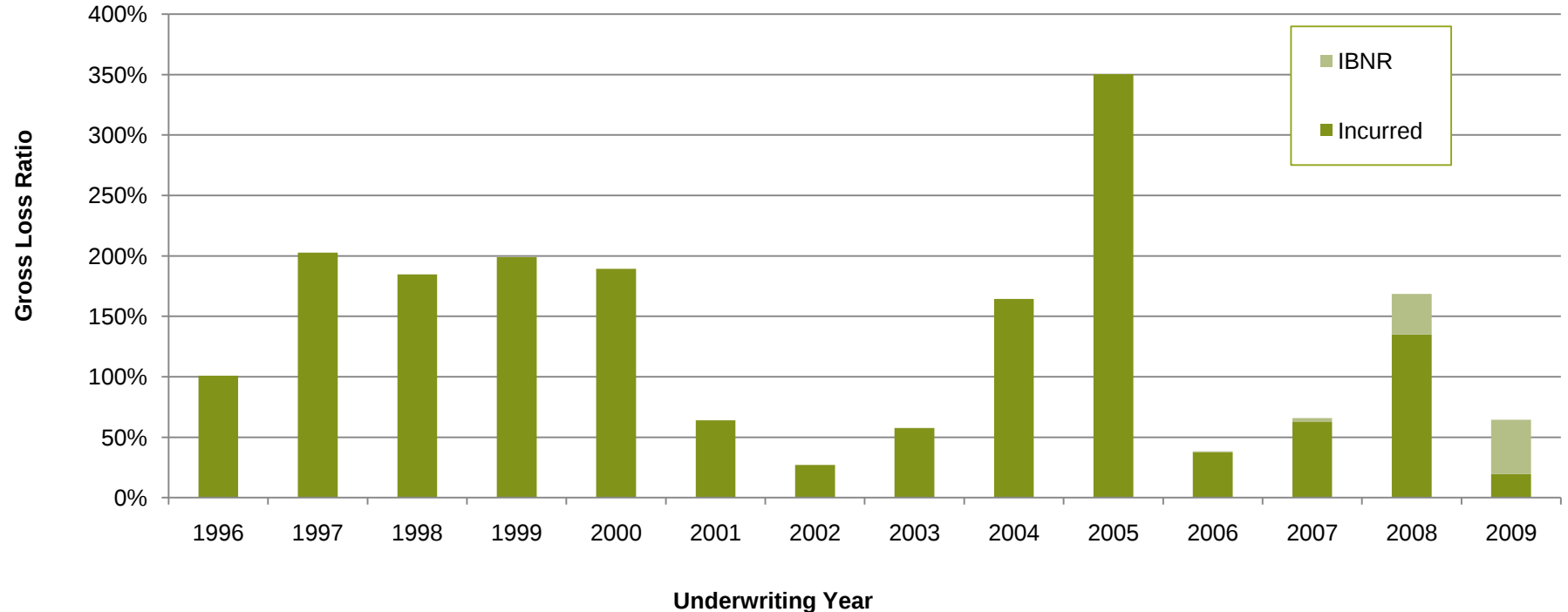
Global Offshore Energy insurance market



Source: IUMI Global marine insurance report 2009

Offshore Energy Insurance Gross Loss Ratios

- as at 31 December 2009



Source: Lloyd's (incurred losses)

Evolution of market pricing methods



Overview

Assureds, Perils and Insurance Coverage

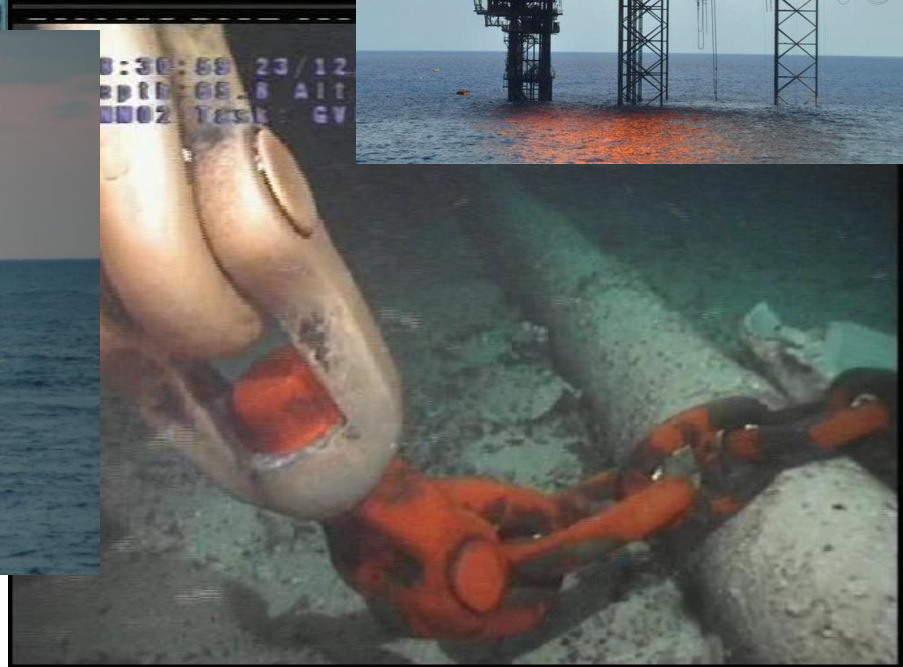
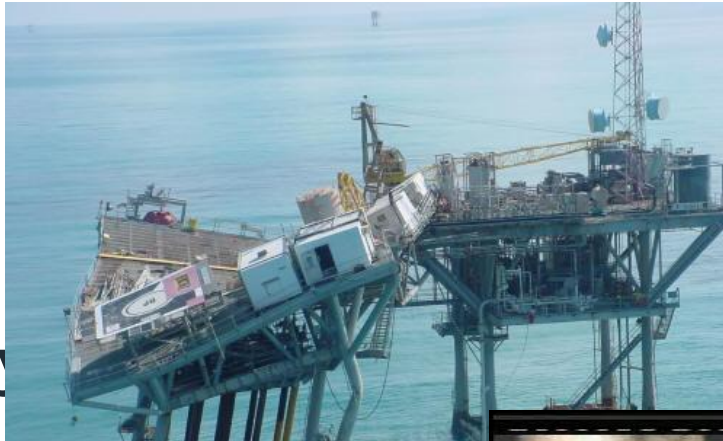
Main players

Coverages

Property
Control of
On-up)
liability

Deck)

Hire



Rating overview

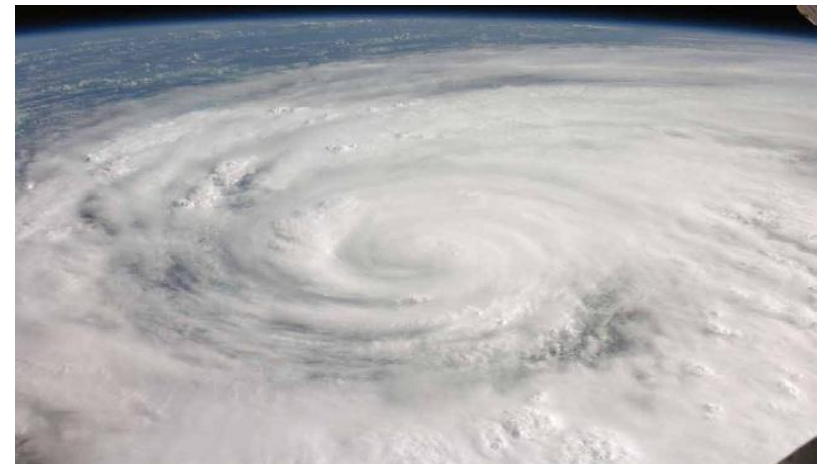
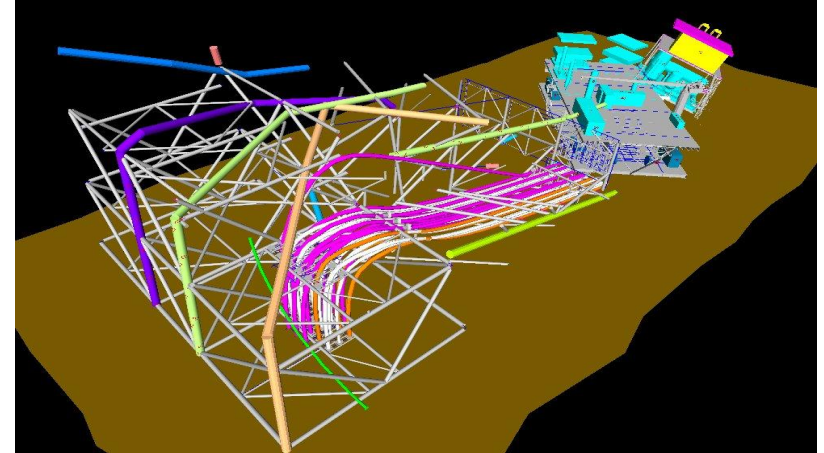
- Pre Ike

	Property Damage	Control of Well	LOPI / LOH	Liability	Clash (ex-wind)
Exposure	Sum insured	Well length	Maximum period x Maximum unit value	Revenue Sum insured No. of wells	Total complex value plus CoW limit, etc
Risk factors	Asset type Area Operator Water Depth Air gap (hurricane)	Well depth Area Well type Horizontal wells? Contractor	Oil price Day rates Asset type	Operator Loss record Location Contract	See PD/CoW
Key policy terms	XS defined for 100% interest Separate hurricane limit/XS	Re-drill? Clean-up? UGBO? Contract terms Limit/XS	Waiting period	Limits DIC/DIL	Combined single limit Highest single XS

Rating Overview

- Pre Ike

- Control of Well coverages triggered without loss of well control
 - Re-drill
 - Re-drill without re-drill
 - Seepage & pollution clean-up
- BUT coverages rated on well length
 - Not directly related to hurricane risk
 - Difficult to monitor aggregate exposure
- Post Katrina
 - Gulf of Mexico footage rates tripled
- Post Ike
 - windstorm pricing re-structured



Rating Overview

- Post Ike

- Explicit windstorm and non-windstorm pricing
- Additional Coverage
 - Scheduled
 - Rate applied
- Per windstorm
 - Based on p
 - Total asset
- Notional rates
 - 15-20% rat
 - Put the Ca



ke PD

orm limit

Rating using Cat models

Windstorm events with probabilities

Event	Freq	Cat	Sz1	Sz2	Sz3	Sz4	Sz5	Sz6
WER125	0.482020	1	0.409411	24.21709	40.41046	23.32991	30.95942	31.13951
WER126	0.159569	5	44.0218	39.76613	40.97164	26.20793	6.119819	14.25691
WER127	0.212008	2	33.30863	40.68069	11.43023	36.62743	1.228728	17.36211
WER128	0.176001	2	16.91612	13.66002	36.02074	44.36076	18.53665	29.63639
WER129	0.946763	2	13.40516	13.45370	17.88962	19.2466	19.50285	117.2441
WER130	0.273003	1	30.26403	41.03954	6.01024	18.30017	17.84701	47.27015
WER131	0.022206	2	19.69106	0.009113	46.32091	6.160301	1.23364	17.40472
WER132	0.0207179	3	43.06301	22.79670	2.215144	0.764506	49.49705	10.95913
WER133	0.432267	3	45.60711	13.00965	26.91096	36.4391	40.63096	23.02445
WER134	0.022229	1	4.662489	1.050476	49.95477	9.100242	9.510221	237.6169
WER135	0.024022	3	16.40777	24.47293	437.4436	0.044225	1.619676	31.58624
WER136	0.082274	3	35.70299	43.37842	237.1470	31.00031	9.050456	42.17057
WER137	0.428193	1	9.646297	63.08696	14.41076	15.72496	16.50601	7.047895
WER138	0.411071	1	44.22653	42.60124	30.20074	22.95019	25.73709	6.051911
WER139	0.544669	1	27.92292	26.95694	107.00424	44.02743	4.300346	36.08113
WER140	0.911241	1	32.11694	20.21248	28.43192	45.61123	36.70099	41.37699
WER141	0.063151	1	13.92383	34.24651	32.05733	45.20303	37.21702	32.2361
WER142	0.710403	5	39.96765	31.02719	44.70195	46.11361	14.01149	25.51628
WER143	0.050059	1	44.11076	32.23636	22.89614	22.82059	9.230336	18.14004
WER144	0.041244	2	42.97026	37.52152	30.02002	45.20465	37.22114	26.965

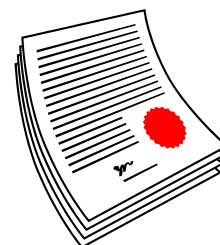
Damage with probabilities

A/C #	Mean(GU)	SD (GU)	rho (GU)
1	1,969,839	3,457,002	1.755
2	2,095,056	4,316,974	2.061
3	1,872,362	3,212,780	1.716
4	1,411,789	3,190,222	2.260
5	1,294,264	3,448,971	2.665
6	1,379,387	2,983,004	2.163
7	1,312,130	2,756,702	2.101
8	2,165,464	6,589,846	3.043
9	1,704,687	3,678,613	2.158
10	1,412,406	2,116,184	1.498

Insurance losses with probabilities

A/C #	Mean(GU)	SD (GU)	rho (GU)
1	1,969,839	3,457,002	1.755
2	2,095,056	4,316,974	2.061
3	1,872,362	3,212,780	1.716
4	1,411,789	3,190,222	2.260
5	1,294,264	3,448,971	2.665
6	1,379,387	2,983,004	2.163
7	1,312,130	2,756,702	2.101
8	2,165,464	6,589,846	3.043
9	1,704,687	3,678,613	2.158
10	1,412,406	2,116,184	1.498

Coverage details

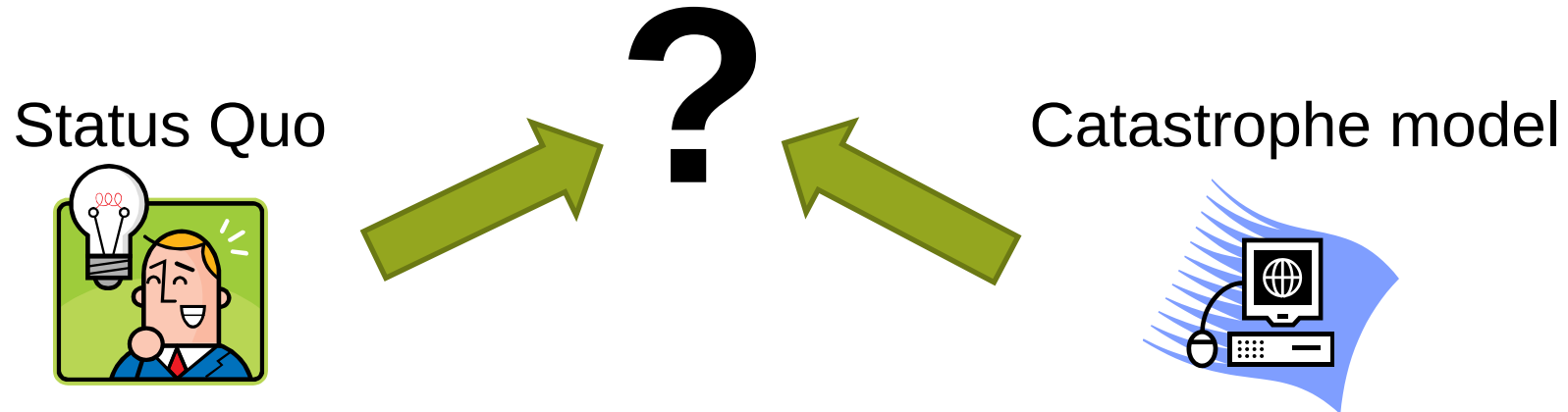


**Expected loss
+
Loadings
=
Premium**

Asset details

Account	Area	Area	Lat	Long	AssetType	Year Built	Deck Height (ft)	Water Depth (ft)	PD Value (USD)
1 ES 328	EastCane	28.10294	-82.4759	FIXED	1965	45	100	4761.905	
1 GA 321	Collection	28.49195	-84.4145	FIXED	1965	45	100	4761.905	
1 GA 343	Collection	28.43952	-85.1542	FIXED	1965	45	100	4761.905	
1 IA A42	High Island	28.23249	-80.9002	FIXED	1965	45	100	4761.905	
1 IA A42	High Island	28.21475	-80.9020	FIXED	1965	45	100	4761.905	
1 MI 097	Managonda	27.55001	-90.3728	FIXED	1965	45	100	4761.905	
1 MI 099	Managonda	27.54505	-90.3528	FIXED	1965	45	100	4761.905	
1 MP 90	Main Pass	29.34305	-88.3603	FIXED	1965	45	100	4761.905	
1 MP 154	Main Pass	29.35121	-88.2010	FIXED	1965	45	100	4761.905	
1 MP 175	Main Pass	29.34409	-88.2118	FIXED	1965	45	100	4761.905	
1 MP 178	Main Pass	29.34302	-88.2022	FIXED	1965	45	100	4761.905	
1 MP 207	Main Pass	29.27022	-88.3443	FIXED	1965	45	100	4761.905	
1 MP 242	Main Pass	29.21902	-88.1904	FIXED	1965	45	100	4761.905	
1 MP 223	Main Pass	29.23033	-87.8722	FIXED	1965	45	100	4761.905	
1 MP 250	Main Pass	29.21285	-87.5843	FIXED	1965	45	100	4761.905	

Two different worlds



- + Simple rating structure (rate x exposure)
- + Consistency between accounts
- + Quick
- Cross-subsidies between accounts?
- Commercial influences easily mixed up with technical influences

- + Considers the details
- + Commercial influences are explicit
- Complexity reduces transparency and results are difficult to sense check
- Mostly calibrated at the micro-level
- Modelling the impossible? (eg non-PD coverages)
- Cat models have not always been right

Developments to windstorm pricing

- Asset dispersion



The rating process

1. Identify new risk factor – better differentiator
2. Measurable values of this factor – rating factor levels
3. Calibrate rate relativities – data and models

Windstorm example using Cat models

1. Asset spread
2. Spatial dispersion measure
3. Use Cat model to generate losses and calibrate premium adjustment factor

Asset dispersion

- Example account



Asset dispersion

- Another example account

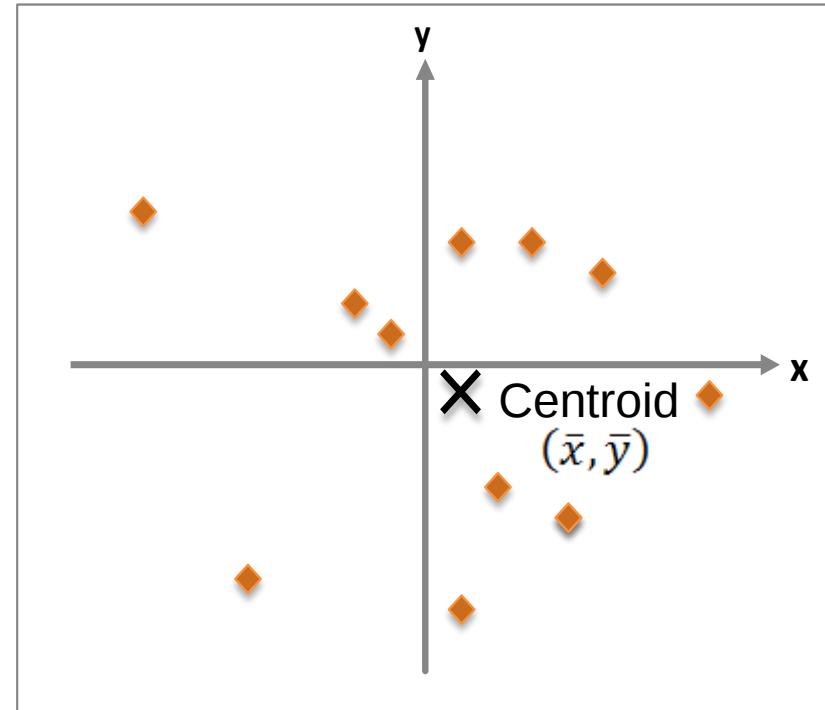


Measures of asset dispersion

- Variance in two dimensions

- $$\bar{A} = \begin{bmatrix} \text{Var}(X) & \text{Cov}(X, Y) \\ \text{Cov}(X, Y) & \text{Var}(Y) \end{bmatrix}$$

- Trace is the sum of squared distance from the centroid
- Each point can be weighted (eg asset value)
- Other measures
 - Determinant, largest eigenvalue, nearest neighbour distance, ...



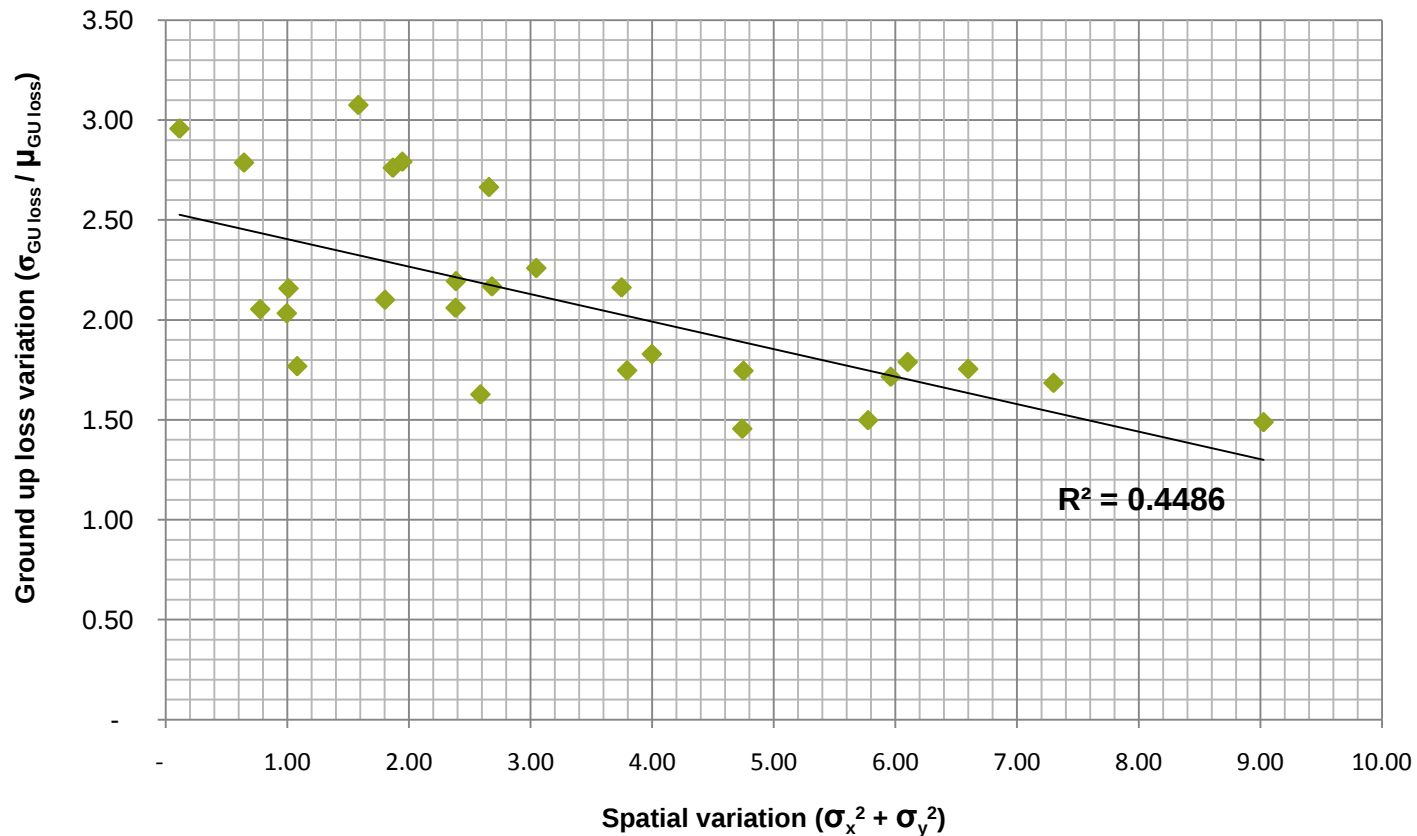
Improvements to rating

- Sample portfolio

- 27 fictional accounts
 - Asset values scaled such that all accounts have the same total insured value
 - All asset types set as equal
 - Asset locations are real
 - ie. A one-way analysis
- All the accounts would notionally be charged the same premium
- All the accounts would have the same windstorm retention and windstorm limit

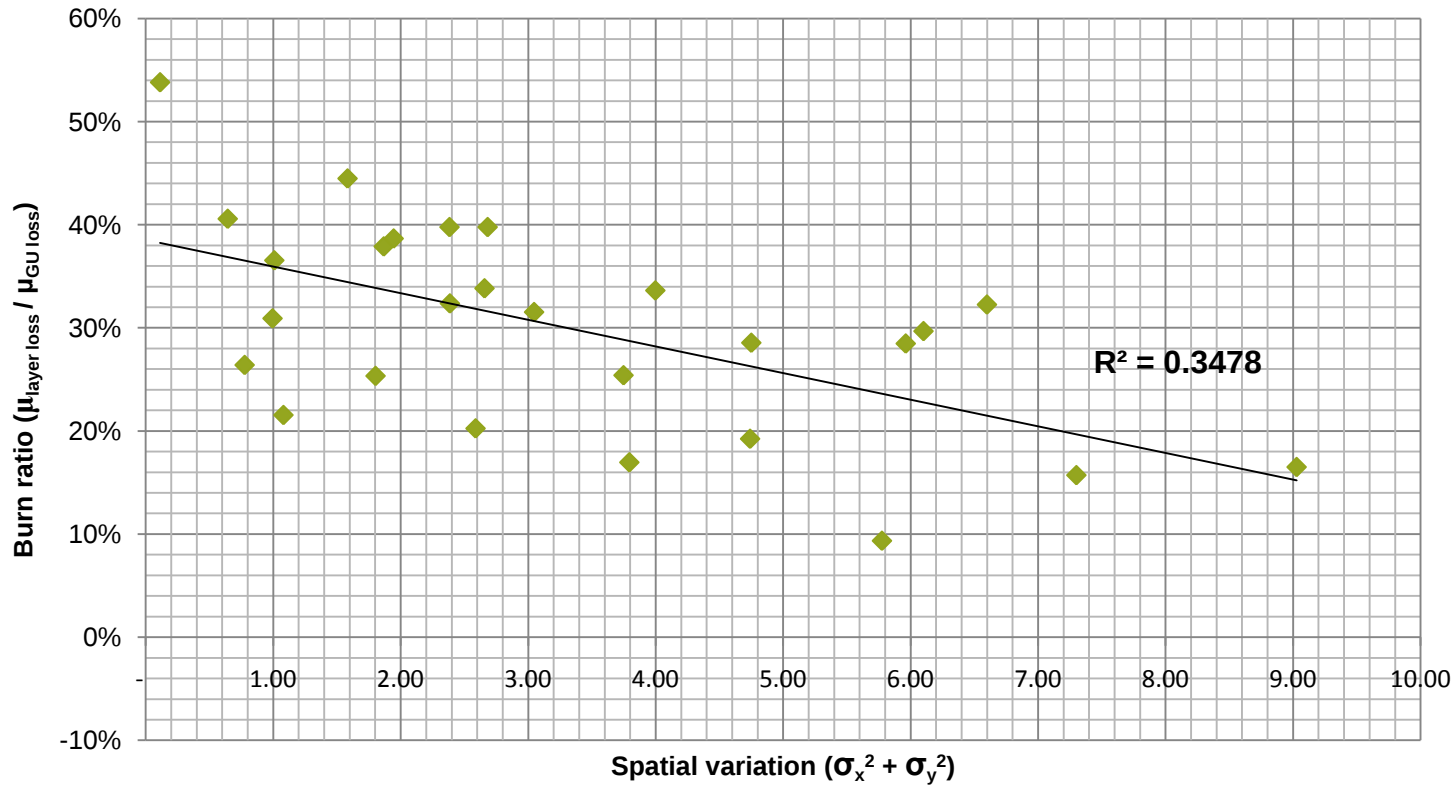
Improvements to rating - findings

Cat loss standard deviation vs asset dispersion
(27 accounts)



Improvements to rating - findings

Insured layer burn vs asset dispersion
(27 accounts)



Conclusions

- Sample portfolio

- Both variance and average burn (negatively) correlated with the asset dispersion
- Dispersion statistic can be used to adjust mean windstorm risk premium if Cat model not used in underwriting process
- Further extend the idea to adjust cost of capital based on portfolio dispersion:
 - Monitor aggregate exposures
 - Manage risk appetite, increase line sizes or price more aggressively

Current to future market situation

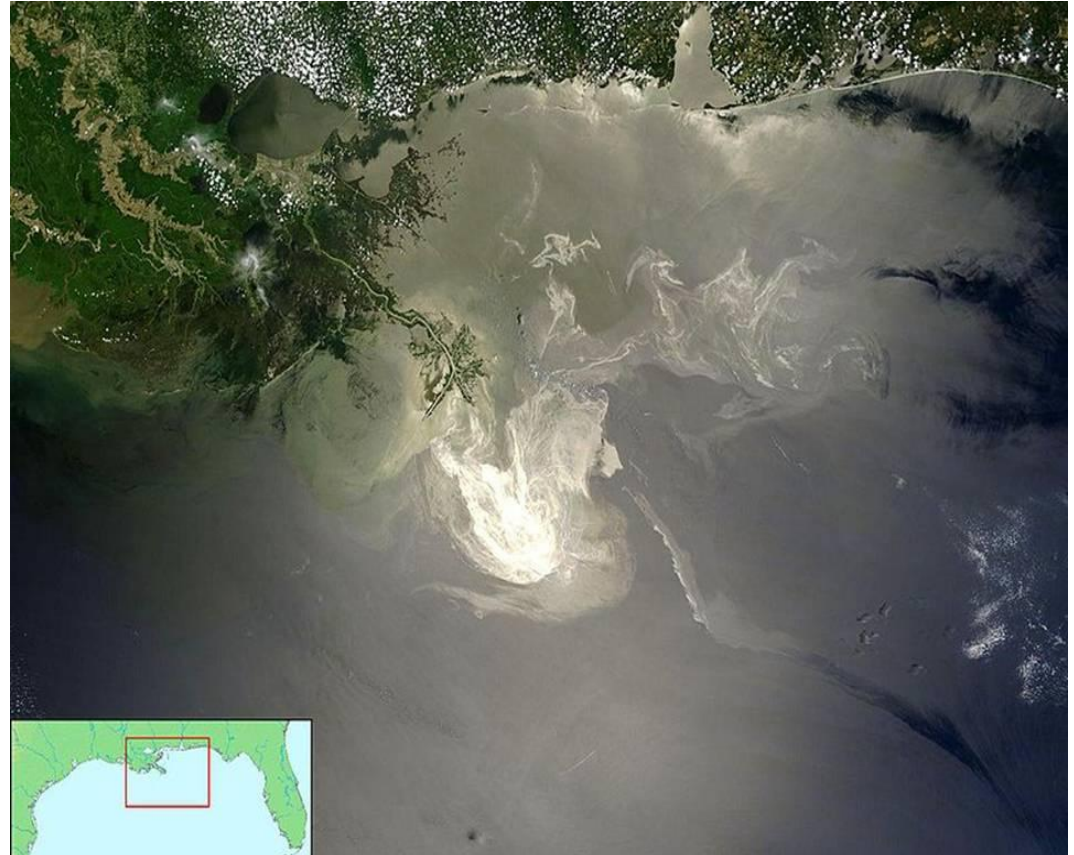
– Deepwater Horizon



Deepwater Horizon

– Background

- **Where?**
 - Macondo prospect
 - Mississippi Canyon
 - 60km from shore
- **Who?**
 - Operator: BP
 - Joint Venture Partners:
 - Anadarko
 - MOEX (Mitsui)
 - Drilling Contractor: Transocean
 - Drilling Rig: Deepwater Horizon
 - Products:
 - Halliburton (cement)
 - Cameron (BOP)



Deepwater Horizon – Background

- What and when?

22 April

Deepwater
Horizon
sinks

30 April

Oil spill
reaches
US shores

8 May

1st attempt
to cap the
well fails

28 May
“Top kill”
fails

4 June

Cap
successfully
placed over
leak



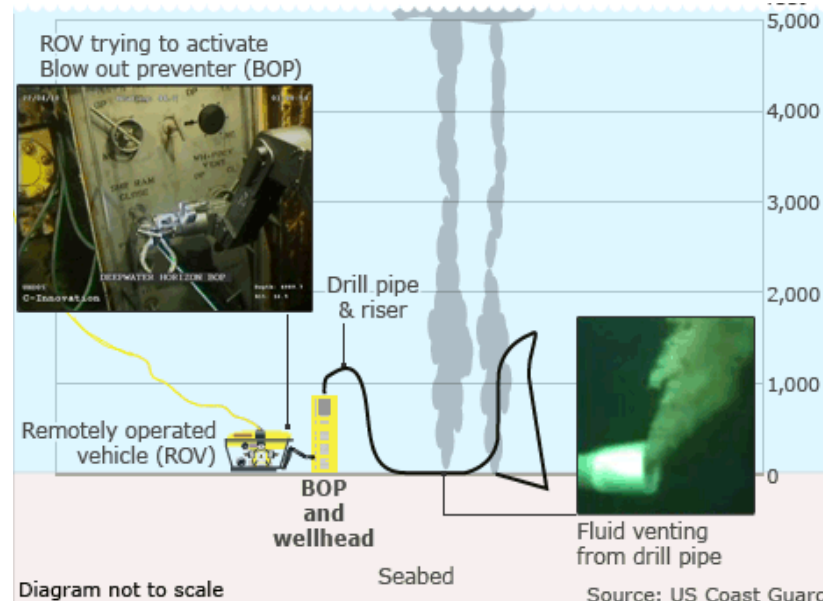
20 April

Blowout
ignites -
killing 11
rig workers

26 April

RoVs detect oil
leak from riser
and drill pipe.

Failure to
activate BOP



19 September

Transocean
successfully
complete relief
well and plug leak

Deepwater Horizon

– The cost

- \$1.5bn - \$3bn insured loss
 - PD (Deepwater Horizon insured value = \$600m)
 - Control of Well, clean-up
 - Liabilities
 - Contingent liabilities?
 - D&O?
- \$20bn+ total cost
 - BP self-insured
 - Oil Pollution Act (OPA) 1990 - Exxon Valdez
 - BP elected not to stand behind \$75m liability limit

Deepwater Horizon

– The fallout

- Long lasting environmental damage?
- Tony Hayward leaves BP
- Deepwater drilling moratorium
- Increased regulation of the oil industry
- Legal challenges to “knock-for-knock” provisions
- Amendments to OPA 1990
 - Increased or unlimited liability?
- Increased demand for Liability and Control of Well limits
 - Rate increases (including RI)
 - New capacity entering the market?
 - New rating for offshore liabs?



Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenter(s).

