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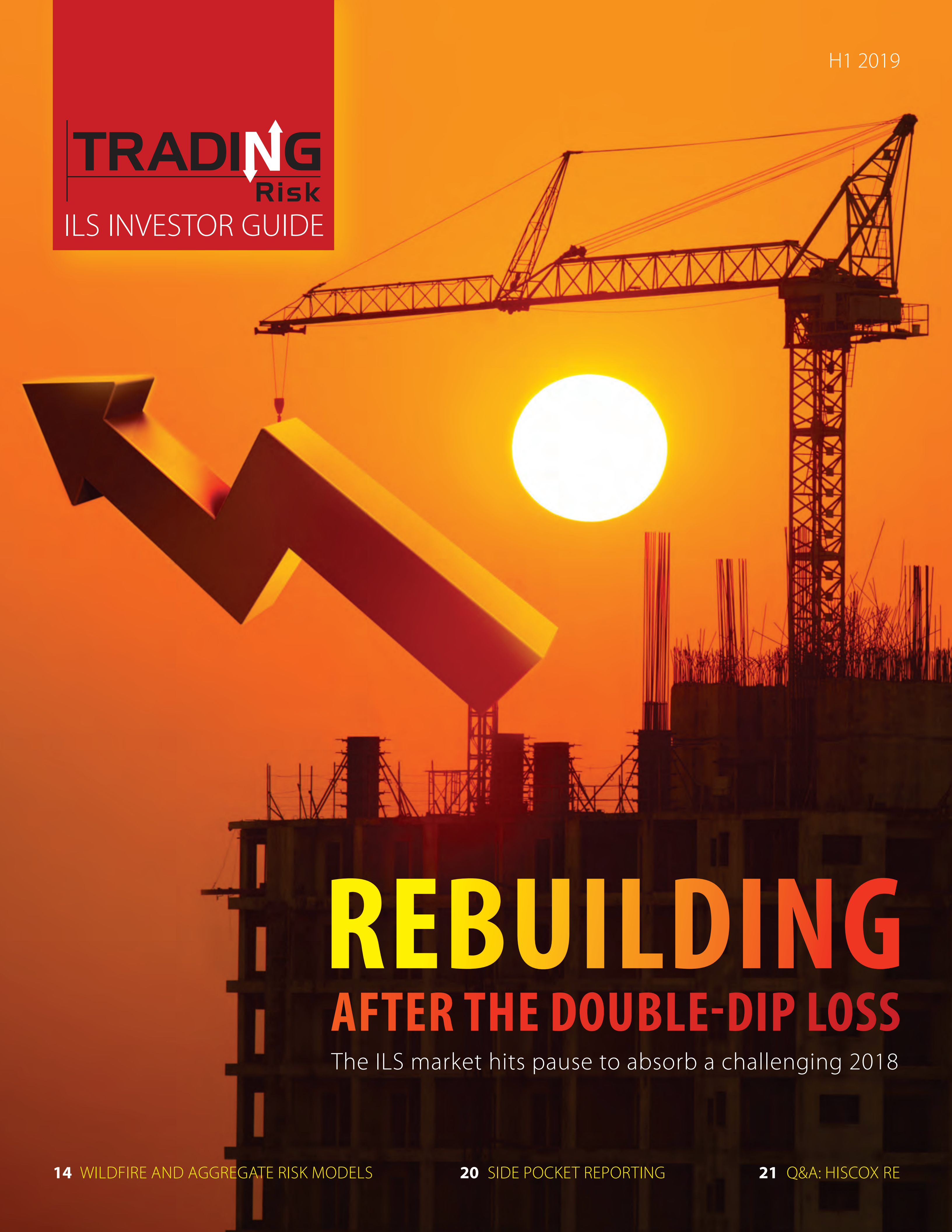
TRADING Risk

ILS INVESTOR GUIDE



REBUILDING

AFTER THE DOUBLE-DIP LOSS

The ILS market hits pause to absorb a challenging 2018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THE POST-LOSS RECOVERY

The past two years challenged the catastrophe (re)insurance market more than any period since the Hurricane Katrina era in 2004-2005.

That devastating season kick-started a major hike in rates – and helped to boost the ILS market's growth – but it is far from clear what the outcome will be this time around.

Retrocession – insurance for reinsurers – has already become more scarce and expensive, but whether reinsurers can continue to absorb these higher costs after years of benefiting from cheaper rates remains to be seen.

Arguably, 2017's Hurricane Irma presents some parallels to the shock loss of Hurricane Katrina, in that the losses continued to rise steeply the following year.

Many will argue that this trend could have been foreseen. But in a positive sign that the industry's framework for estimating losses is accurate, the claims tallies are still within forecasts from firms such as RMS and AIR Worldwide.

More broadly speaking, hurricanes Katrina, Rita and Wilma occurred in a much more upbeat pre-crisis financial marketplace, which would have set a higher threshold on return expectations from the sector.

This time around, the noise from broader equity market volatility is likely to drown out some of the reverberations from the catastrophe losses of the past two years.

There may have been some outliers that posted a surprising level of losses.

But overall ILS performance is still holding true to its promise of delivering positive diversification. Regardless of the direction that yields take this year, the industry is taking on the challenges of the past two years and building stronger structures to face the future.

Fiona Robertson, Managing Editor, *Trading Risk*

INSIDE

Rebuilding after the double-dip loss

The year of hurricanes Harvey, Irma and Maria (HIM) was the loss year the ILS market had prepared for – and the industry's asset managers weathered these events to raise fresh capital and push for expansion.

But 2018 proved to be a challenge that put a handbrake on this growth, as many strategies reported a second successive negative year.

The story behind these losses was a more complex combination than in 2017; rising Irma claims and fresh disaster events from around the globe all played a role.

Individually, events such as Hurricane Michael, Typhoon Jebi and the Camp Fire were not nearly as costly as the 2017 disasters, but were still enough to rank 2018 as the fourth-highest for insured catastrophe losses, according to Swiss Re.

As a result of losses and some redemptions, ILS capacity has shrunk – likely for the first time since the financial crisis. It was down by just under 4 percent in mid-2018 to around $94bn in January 2019, according to *Trading Risk* estimates of ILS assets under management at specialist managers and (re)insurer platforms (see p13).

This retraction is driving projected yields higher in some pockets of the market, as it created a momentum to support higher rates that did not exist in the expansionary environment of a year earlier (see p16-17).

However, following two years of back-to-back disaster activity, ILS investors will be keen to unpick the lessons of 2018 as they weigh up these post-loss opportunities.

Active Q4 compounds losses

No two major catastrophe years are alike – and there are a couple of reasons why the 2018 losses snuck up on the ILS market.

ILS consultants who spoke to *Trading Risk* said there were no major surprises in the ILS market's share of last year's disasters.

But they highlighted deterioration in 2017 events, underwhelming rate increases in the post-HIM renewals, and speedy aggregation of claims as disappointing factors in the year's performance.

These influences came to a head later in the year, making for a more challenging run-up to the January 2019 renewal. The November wildfires marked the point at which 2018 losses began compounding more quickly, whereas the 2017 trio of hurricanes had whipped through the Atlantic before the end of September.

"Things changed significantly in November," one analyst explained. "The losses tended to push most vehicles from positive to slight losses, with some very significantly down."

This rapid change largely reflected the impact of claims on aggregate contracts, it is understood.

Aggregate reinsurance deals pay out when a string of loss events triggers the contract, unlike a standard per-event contract that is designed to protect an insurer against a large single-loss event. These deals tend to attract significant ILS participation, as they are often placed on a one-shot basis without an automatic second lump sum of reinsurance cover.

They also make up a significant share of high-risk retrocession contracts, a market niche that was one of the heaviest hit within the ILS market.

By their nature, aggregate deals are likelier to pick up losses due to minor events, and some argue that models for "frequency" risks do not sufficiently account for this (see p24-25).

Last year, it was the wildfires that proved the 'straw that broke the camel's back' for aggregate deals, pushing contracts into loss-making territory.

ILS managers are now reviewing how well off-the-shelf models capture wildfire risk and whether they

need to make internal adjustments, according to Siglo senior analyst Ratana Tra.

At the same time, they would still refrain from classifying wildfire as a peak peril, he added.

One newer area of exposure that emerged in 2018 was the wildfire liability market: insuring utilities such as Pacific Gas & Electric (PG&E) against damages from fires sparked by their equipment. Here, a $200mn PG&E cat bond is expected to be a full loss and private reinsurance contracts were also impacted.

Mercer's head of ILS Robert Howie noted that the ILS managers the firm followed fell into two distinct camps on the wildfire market: those that wanted to avoid the risks due to concerns over modelling, and those that saw value in providing coverage in areas of scant supply.

"If managers want to dabble in writing wildfire risks, that's fine but we wouldn't want to see huge [expansions in exposure]," he added.

Rising Irma claims rival impact of 2018 events

Deteriorating losses from 2017's Hurricane Irma proved another shock of the year, highlighting concerns about the industry's ability to control the claims process in Florida, as lawsuits proliferated and loss adjustment specialists were in short supply.

"The area that was unexpected was the carryover of 2017 losses – it's a phenomenon we haven't experienced before," Howie said.

Some Florida-based insurers have more than doubled their gross projected Irma losses over the course of 2018. PCS industry loss estimates have also deteriorated by 26 percent above initial estimates, and above 50 percent relative to lower-level estimates prevailing in early 2018.

However, overall estimates remain within initial modelled loss projections.

Tips and lessons from 2018

- Ask your ILS manager for information on their side pocketing and loss-reserving policies to understand how they will handle possible loss creep
- Don't let unmodelled risks be a surprise – ask your manager how they weight off-the-shelf models to account for these aspects
- Be aware of the type of real-world scenarios that could result in a heavy loss year
- Ask managers about their levels of trapped assets going into the New Year, as these are opportunity costs
- In an opaque market, forecasting rate changes can be a difficult task for ILS managers several months out from renewal periods. If your allocation is a more opportunistic play, dependent on achieving specific changes, then consider setting hurdle rates

For some ILS managers, Irma may have even figured as the largest event of 2018. But within the ILS peer group Mercer studies, it was the 2018 events – led by Hurricane Michael, Typhoon Jebi and the wildfires – that had the more significant impact on portfolios.

But the experience reinforced Howie's view that use of side pockets is hugely beneficial within the ILS asset class, in order to contain the impact of loss development to an existing investor base.

Moreover, the continued deterioration in Irma losses is leading to hopes that rate increases in June – when Florida insurers roll over their reinsurance – may be more significant than in early 2019 renewals.

> "Continued deterioration in Irma losses is leading to hopes that rate increases in June may be more significant than in early 2019 renewals"

RenaissanceRe CEO Kevin O'Donnell has said there is a "behavioural cycle" that drives Florida reinsurance conditions as much as supply and demand profitability cycles.

Loss creep from 2017 events, especially Irma, detracted by two percentage points on average from ILS performance in 2018, although with a wide range among managers, Zurich-based consultancy Siglo estimated. But the 3.6 percent 2018 on the Eurekahedge ILS Advisers Index can be mainly attributed to last year's events, the firm agreed.

This index covers a wide range of ILS funds, all equally weighted, from high-risk retro strategies to low-risk cat bond funds (see p10 for more).

As a point of comparison, for the medium-risk ILS funds that Siglo follows, average performance for the year came to a loss of around 0.5 percent, but with a wide dispersion from 12 percent down to 4 percent up.

International losses test models

Outside the US, Japanese typhoons brought forth significant reinsurance losses for the first time in years, as Tra noted: "The [typhoon] models haven't been tested in a while."

Indeed, with insured Jebi losses approaching $8.5bn-$9bn by year end, claims for this event had come in the furthest above modelled loss estimates for any of the year's disasters.

ILS market exposure is more limited in Japan, where traditional companies such as Swiss Re and Munich Re have had huge dominance over reinsurance relationships. However, aggregate retro

continued on page 6

contracts are likely to have picked up claims.

Some reinsurance arrangements have also probably been impacted, such as for AIG which has a large market share in the country, and quota share contracts supporting traditional reinsurers.

Finally, aside from the impact of natural disasters, the starting position in 2018 may not have been as favourable as was initially hoped. Consultants pointed to rate increases that came in lower than forecasts at the end of 2017 as a factor in some post-event funds producing lower returns than expected.

This may have been a particular disappointment for any investors that were moving into the ILS sector in 2018 on an opportunistic basis.

However, Howie noted that so long as the industry is still meeting their broader requirements, most long-term investors were not likely to have been focussed on achieving specific rate changes.

"I think most investors that have a strategic allocation to ILS would rather have their capital deployed than set high hurdles that result in capital not being deployed."

Catastrophe losses of 2018 - the ILS market exposure

Event	Industry loss estimates	Sources of ILS exposure
Irma loss creep	$4.6bn-$7bn	Florida reinsurance programmes, ILW market
Hurricane Michael	$10bn	Florida reinsurance programmes
		Much more uneven loss distribution vs Irma, with some insurers having a much higher market share in counties hit hardest by Michael
California wildfires	$16.5bn	Low-lying reinsurance layers; quota-share sidecars
		$200mn wildfire cat bond for PG&E currently expected to be a full loss
Japanese typhoons	$8.5bn	Quota-share sidecars for reinsurers, aggregate retro and reinsurance for the likes of AIG
Hurricane Florence	$4.5bn	Damage was largely from flooding, which limited the impact on reinsurers as this is generally covered by the US taxpayer
Aggregate – all of the above & others	~$90bn	Retro market exposure
		Some cat bond exposure, including $82mn in USAA deals

Source: Aon for 2018 loss estimates

Winners and losers

As the shake-out from 2017 and 2018 losses occurs, the ILS market is already seeing some early winners and losers from this process.

Markel Catco, a retrocession specialist, has drawn much of the negative focus.

It was revealed to be subject to regulatory investigation late last year, following a substantial revision to its 2017 loss estimates that resulted in returns from that underwriting year falling to a 61 percent loss. This is well ahead of the 28 percent loss it was projecting at year end 2017, which had itself been revised from projections of at most a 15 percent loss in October 2017.

As *Trading Risk* reported at the time, the broader market was sceptical over the firm's initial loss estimates. Subsequently, its owner Markel offered special redemption rights to investors and ejected its founding CEO from the business.

Aside from the reserving procedures that are being investigated by authorities, analysts have also questioned whether the firm's portfolio was being priced adequately for the level of risk it was running.

The past two years of losses have wiped out gains posted by the fund in prior, more benign years – peaking with a nearly 22 percent return in 2013 – and put original investors in the position of having made a 47 percent loss since the fund's 2011 inception. This is equivalent to an annualised loss of 7.7 percent.

Its track record of nearly a decade can be taken as a fair sample of its earnings power, one analyst suggested to this publication.

The extent of the firm's deteriorating result was out of line with competitors, and its portfolio targeted at higher risk-return business – so its losses will not reflect the ILS industry's average experience in the past decade.

But some of the lessons from the Markel Catco saga are generally useful points for ILS investors to bear in mind, such as pointing to the need to be aware of unmodelled or lesser-modelled risks that might cause losses.

However, Markel Catco's difficulties also came from very well-modelled hurricane risks. Its core portfolio was always designed to withstand a one-off major windstorm, but a string of multiple events represented its worst-case scenario that was designed to produce major pay-outs to its counterparties.

Hence, simple questions such as asking ILS managers for a guide to the type of scenario that will tip a portfolio into heavy losses should help inform and guide investor expectations.

Another point to consider is that Markel Catco often used no-loss return targets as headline figures in its annual outlook for the year. But given that its product was pitched at a risky-enough level that it expected to incur some claims regularly, this may have led some investors to overlook the degree of risk they were running in benign catastrophe years.

Instead of no-loss return targets, most ILS managers will give projections on how much they might earn assuming median or average catastrophe loss years.

As Catco's owner begins to clear up after the messy results of the past two years, its difficulties have contributed to the ILS industry's overall growth pausing in early 2019.

But with these experiences behind it, the ILS market is likely to head into its next phase of expansion on a sounder footing after overcoming the challenges of the past two years.

Navigating volatility

Lorenzo Volpi, managing partner and head of business development at Leadenhall Capital Partners, says that 2019 is a year for investors to review their ILS requirements

Catastrophe risk is all about being paid to take on volatility, and disaster events over the past two years have provided a fresh reminder of that tenet.

But within the asset class, investors are able to leverage some control over the level of volatility that they're taking on – and some are making adjustments to their targets, with various results.

"Investors are calibrating return aspirations with a volatility that their strategies can accept, which is also a function of the investment horizon," says Leadenhall Capital Partners head of business development Lorenzo Volpi.

"For some, less volatility in exchange for a fixed income-style return is very attractive," Volpi explains.

"For others who put ILS in an alternative bucket targeting returns in the high single digits or in the low teens, the higher return for riskier strategies is more palatable.

"Whilst this comes with greater volatility, the higher returns would support a faster pay-back time after very active years like 2017 and 2018."

Although the past two years have brought an unprecedented accumulation of events, they followed a long period of below-average cat loss activity for US hurricanes, since Katrina, Rita and Wilma in 2005.

The experience fits into an anticipated pattern for ILS investors – years of above-target returns, followed by years of above-average losses.

Rates have risen in response to the unprecedented accumulation of events in the past two years, helping to offset the losses incurred – or in insurance industry jargon, offering "payback".

"Existing investors who have reloaded would accelerate the payback over those who have reduced their exposure," Volpi notes.

Meanwhile, there are signs of some increased demand for more remote risk strategies.

At this end of the spectrum, Leadenhall has seen inflows of just over $100mn in the past year into its new Remote Risk Fund, which Volpi says reflects a momentary shift in perspective from some investors.

"If you still love the asset class for its low correlations with broader financial markets, some investors are thinking that the way to look at it is to go into more risk-remote strategies."

But this trend is not just about investors trying to avoid messy loss years from frequency risks.

Their second angle is motivation to look for higher relative spreads on remote-risk reinsurance layers, where effectively they benefit from a pricing floor.

No matter how low the modelled risk, it would not make sense to write reinsurance cover for less than the yield on cash alternatives. That means premiums can offer a much higher multiple of the projected risk level than at higher risk-return equivalent layers.

Historically, net yields of 4 to 5 percent were considered typical of low-risk ILS segments. But as some investor appetite moves further away from the money, ultra-remote risk strategies might involve targeting reinsurance business with net yields of around 3 percent or lower.

Given that the bulk of Leadenhall's investors are pension funds, foregoing higher absolute yields is something that some of them are willing to consider – especially when they are also observing potential downturns and volatility in the global equity and bond markets.

"For the pension funds, their primary goal is about preservation of capital in the long term."

However, there are geographical considerations that limit the appeal of this play to some ILS investors. So far, most of the take-up has been from US dollar and UK sterling allocators, Volpi says.

For Swiss and European investors, the costs of hedging (at nearly 200 to 300 basis points) are almost in line with the net yields available from ultra-low-risk ILS portfolios – making it a difficult strategy to justify relative to alternatives.

However, leverage can change the case for these investors as well.

"The other way of making returns interesting is providing the element of leverage," Volpi says, explaining that collateral "overlays" are possible if investors are already invested in treasuries or cash that could be deployed as collateral against their ILS commitment.

This would usually entail the fund pledging to capital top-ups if catastrophe events erode cash and counterparties require fresh security.

"To do this, you need investors with huge balance sheets and perhaps ratings – their credit standing is very important," Volpi notes.

However, with leverage, net returns of 3 percent or less from remote risk strategies can be boosted to the 6 to 7 percent range, possibly higher.

The other classic leverage model used in the reinsurance sector is for a rated carrier to "take back tail risk" by committing to meet obligations if ILS collateral has been fully wiped out.

"Selling the tail risk can be attractive for investors unable or unwilling to provide a top-up pledge, but then you're giving premium away," Volpi explains.

Sidepockets or out of pocket?

As investors study ILS manager performance over the past year, treatment and transparency of side pocketing has become more of an issue.

"We are pro-side pockets where there is significant potential loss volatility," affirms Volpi.

But he also says that, with no standard way of handling side-pocketing procedures in the industry, investors need to get involved in the dialogue to express their preferences.

For the while he believes that investors are generally accepting of side pockets to help managers treat both existing and new investors fairly. Some have begun to express a desire to limit illiquid side pockets where possible.

"The question mark I have is how far do you want to mitigate volatility," he says. "Some investors don't want side pockets unless there will be volatility of more than 5 percent in the valuations".

"You can never be sure in this asset class that something from the past won't hit you in the future – but you do worry about mitigating that risk."

For its own part, Leadenhall was able to cap the impact of rising 2017 claims within its side pockets "with a decent buffer" according to Volpi.

This means new investors have not taken any of the hit from rising Irma losses associated with private placements.

Financing deals boost life ILS options

Leadenhall's life ILS strategies have been one step removed from the turbulence of natural disaster losses in the past couple of years.

Volpi sees the life segment as another area that is drawing more attention at the moment – due to the demand for capital driven by a favourable regulatory environment that is encouraging life insurers to transfer risk off their books or monetise the value locked up in profitable business lines.

The emphasis within life ILS is also shifting from a focus on mortality risk to seeing more financing deals.

"It's becoming more recognised as a good complement to a credit or private debt portfolio."

These deals are enabling life ILS investors to chase higher yields – in the high single-digit range, compared to low single-digit mortality yields – at the cost of locking up capital for 5 to 10 years.

The diversification of life ILS is not as lowly correlated as in the non-life market, but Volpi says the correlation of lapse risk in times of financial stress has often been less dramatic than investors might initially anticipate, and the financial impact on transactions of such one-off spikes can often be small.

Having exposure to a geographically diverse portfolio of trades can further help stabilise any underlying lapse and mortality risks.

Overall, balancing different ILS strategies is just one of the ways that investors are seeking to control the volatility of taking part in the asset class author Michael Lewis dubbed "Nature's casino".

Benefits of ILS side pockets

Side pockets are designed to contain the valuation volatility associated with investment positions potentially affected by recent cat events. By leaving those potentially impaired investments in the main fund rather moving them into side pockets, the Fund would risk:

- Penalising new investors if any loss developed at levels higher than expected; or
- Penalising existing investors if a conservative reserve had been created for the loss which was subsequently released in the main fund for the benefit of both existing and new investors.
- Penalising remaining investors if any loss developed at levels higher than expected and the fund has experienced redemptions as they would share a higher share of the creep.

By allocating potentially impaired investments to side pockets, investors in the fund at the time of an event are the only ones to benefit from a recovery should the loss be lower than originally anticipated or to suffer any adverse loss development on the assets in question.

ILS returns range widely in second loss-struck year

After 2017's record-breaking losses, benchmarks of ILS industry performance showed an improved result in 2018.

But last year still stands as the second-worst on record for the Eurekahedge ILS Advisers index, with a loss of 3.92 percent.

The index tracks a group of 34 funds, including a selection of cat bond funds that averaged a 1 percent gain throughout 2018.

The private ILS funds tracked by the index were under more pressure, falling to a full year loss of 7.5 percent.

Hurricane Irma still retains the record for the largest hit to the index, when it fell by 8.61 percent in September 2017.

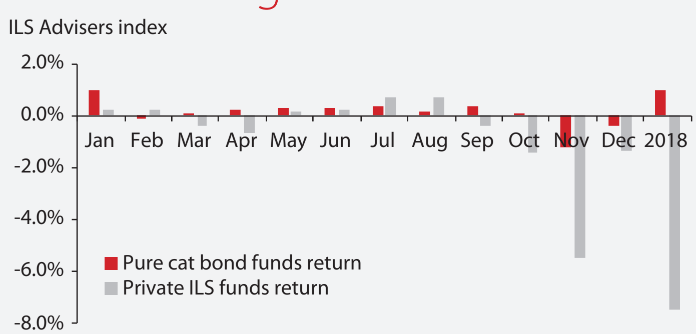
This precipitous monthly drop was not rivalled in 2018, although the impact of the Californian wildfires and Hurricane Irma loss creep meant November came close. That month weighed heavily on the year's performance with a downturn of 3.68 percent, marking the benchmark's third-largest hit after Irma and the 2011 Japanese earthquake.

There was though a new unfortunate record: 2018 showed the highest number of monthly losses in a calendar year, as returns fell to a negative level no fewer than six times.

But the year occasionally showed a huge range of divergence in performance among ILS funds – such as in November when there was a record 43 percentage point spread in results.

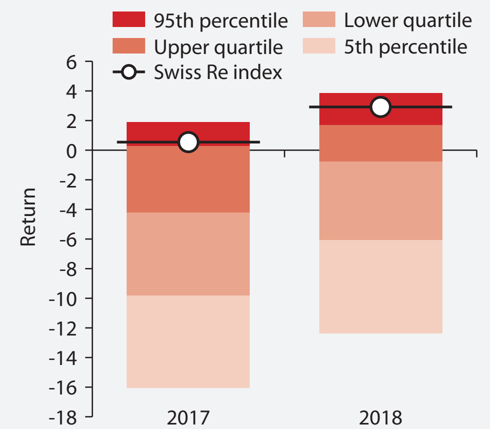
This would have reflected a severe markdown recorded by retro fund Markel Catco that month. This fund's full-year loss of 61 percent (incorporating 2017 deterioration) would have been a major drag on the index average in 2018.

Cat bond vs general ILS returns



Source: Eurekahedge ILS Advisers

Mercer's ILS universe



Source: Mercer

> "ILS annualised returns now stand at 4.58%"

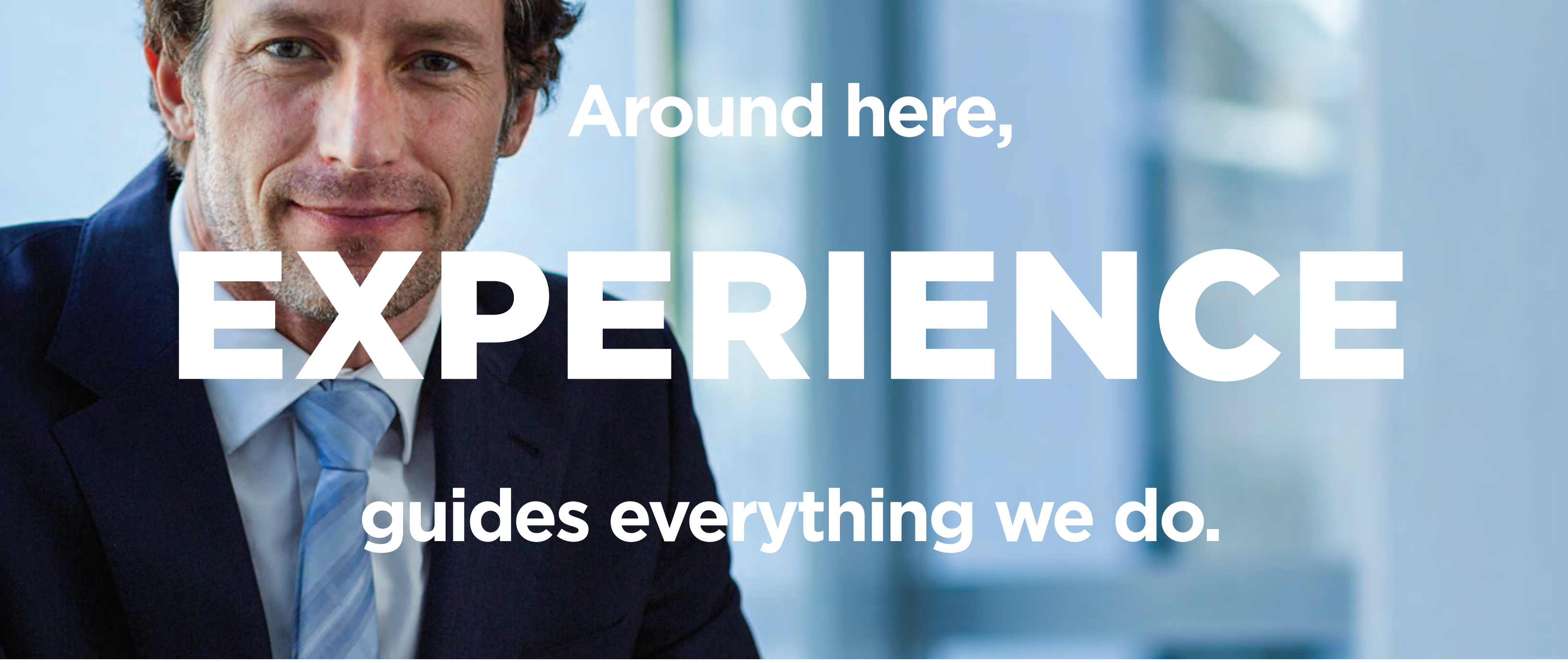
Another gauge of ILS performance from consultancy Mercer – covering a narrower group of 29 funds – showed a more modest loss for 2018.

Mercer's ILS universe delivered a median 0.8 percent loss for the year, better than the 4.3 percent loss registered in 2017. Mercer's figures also place it as the second-worst year for ILS returns, albeit more closely behind 2011, when the ILS funds the firm tracks delivered a median 0.1 percent drop.

The top 5 percent of performers achieved a 3.9 percent gain – better than the 1.9 percent gain turned in by the 2017 top percentile performers. The bottom 5 percent took a 12.5 percent loss, narrower than last year's 16.1 percent drop.

Overall, even after the past two years of losses, annualised returns from the asset class are holding up – measuring 4.58 percent since 2006, according to the ILS Advisers index.

This has fallen from 5.31 percent at year end 2017. And while some measures of the index's risk-adjusted returns, such as the Sharpe and Sortino ratios, have slipped a little in the past year, the downside deviation risk has remained relatively steady – at 2.96 percent in early 2019, from 2.84 percent in December 2017.



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ILS assets level out after 2017-2018 losses

ILS assets contracted overall for the first time since the financial crisis in early 2019, following two years of significant losses.

Over the second half of 2018, estimated assets under management (AuM) fell by around $5bn, or 6 percent, at a group of 34 independent ILS managers tracked by *Trading Risk* (for full list see p32-33).

The drop-off included some assumptions regarding the asset base at Markel Catco, which had reported its AuM at above $6bn throughout 2018, including significant trapped capital.

Trading Risk discounted the manager's 2017 funds raised for recognised losses, to give an estimated $2bn level including its reinsurance strategies. However, its owner later put the figure closer to $3bn.

But Markel Catco was not the only manager to feel the impact of losses, trapped capital and redemptions in the latter part of the year.

Other leading ILS managers that have posted lower AuM figures since July include Credit Suisse Asset Management, down by $1bn to $8bn; Nephila, down by $600mn; Stone Ridge, which dropped by $500mn; and Securis, which contracted by almost $250mn.

The rest of the top 10 reported stable asset bases, with Leadenhall and Fermat adding capital.

As Markel Catco has been removed from the top 10 following *Trading Risk*'s calculations, RenaissanceRe's Underwriting Managers division has moved into the cohort after launching two new vehicles in 2018.

Outside the top 10, some new start-ups, such as Tangency and Merion Square, brought funds on board, while firms including Hudson Structured, Pillar and NB Insurance-Linked Securities (formerly Cartesian Iris) also continued to expand.

There was less change among the in-house reinsurer ILS managers, although these groups typically report on a lagging quarterly basis, so some changes are likely yet to show up.

But some reinsurers reported increased intakes. As well as the new vehicles at RenaissanceRe, Axa XL said it had raised funds to take New Ocean above $1bn. This may include some vehicles that had not previously been tracked under New Ocean's totals, such as its algorithmic strategy Daedalus.

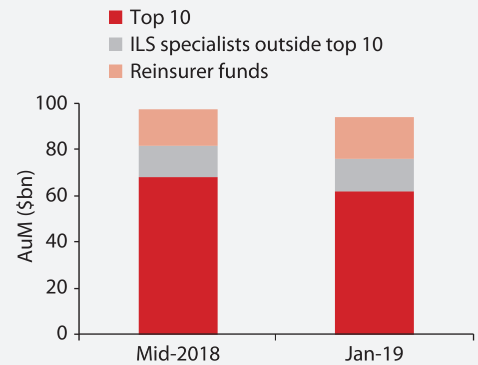
ILS M&A

On the corporate front, the latter part of 2018 brought two potentially transformational M&A deals for the industry: Nephila's sale to Markel in the fourth quarter, and AIG's acquisition of AlphaCat parent Validus in July.

Both deals will continue to keep ILS expansion into primary insurance at the front of the industry's agenda in 2019, as well as highlighting the importance of access to rated balance sheets.

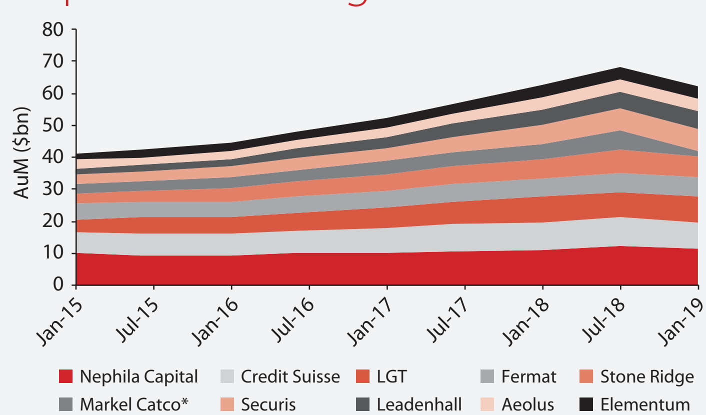
Other deals also included Cartesian's sale of Cartesian Iris Re to Neuberger Berman, offering a counterpoint to the insurer ILS acquisitions and showing an example of continued interest in the sector from asset managers.

2018 challenges reduce ILS capacity



Source: *Trading Risk*

Top 10 ILS managers' AuM



*As of January 2019 Markel Catco has been removed from the top 10, with Renaissance Underwriting Managers entering the list at number 8
Source: *Trading Risk*

Controlling a blazing risk

Before 2017, wildfire risk was largely considered as a minor peril by the ILS and greater reinsurance industry, but two years of deadly blazes have placed the peril firmly in the spotlight.

Insured losses from the peril have now exceeded $10bn for two years running, and the 2018 Camp Fire –which left 89 people dead and decimated the town of Paradise – is now considered to be the deadliest and most destructive in California's history.

In light of these events, the (re)insurance industry must completely reconsider how it views the peril, according to Chris Folkman, senior director and wildfire product management at modelling firm RMS.

"In the Western US, wildfire is a peak peril. The insurance industry must adapt to this reality just as it did with earthquakes and hurricanes three decades ago."

While the ILS industry remains interested in taking on the risk, it is now looking at ways to better manage its exposure.

"There has been more of discussion around the models and lots more discussion around where in the risk spectrum that investors will expose their capital," Paul Schultz, CEO of Aon Securities, told *Trading Risk*.

An increasingly risky peril?

A key question being asked in the wake of the events is whether wildfire risk is actually getting riskier.

Folkman says it is more a case of fire losses becoming more costly for insurers, as opposed to wildfires occurring more frequently.

"This is driven by three different factors: rapid exposure growth in fire-prone areas, a changing climate with warmer temperatures and more extreme weather conditions, and an aggressive 20th-century firefighting policy that led to an excess of burnable vegetation," he said.

A recent report from Aon Securities agreed that building in known fire-prone areas was one of the main drivers of the increasing losses.

These locations are becoming known as the wildland-urban interface – the area near the divide between urbanised and more rural forested areas.

Combined with changes in fire behaviour, increased intensity, further weather pattern variability, elongated fire seasons, and climate change-driven enhancements, these risks are only amplified, the report added.

It is not just the recent losses in California that are driving the market re-evaluation, according to William Dubinsky, head of ILS at Willis Towers Watson Securities.

Other fire events in Australia and Canada, including the Fort McMurray event in 2016, are also driving a focus on the risk.

Modelling wildfire risk

Modelling is one of the key areas to come under review following the fires, one ILS underwriter told *Trading Risk*.

"When you look at the model validation, there's a few things that it's clear that the models didn't take into account of very well."

While the models acknowledge the danger in known high-risk sloping areas such as canyons, they can underperform in certain situations, the underwriter explained. "If it was in a flat zone where there was lots of brush and you had an amount of conflagration, it seems that the models underperform for those types of scenario."

It is also important to consider the environmental conditions in the year preceding the fires, as well as wider global trends, he added.

"If you look at precipitation and average temperatures, historically 2018 had very low precipitation and had above average temperatures. The preceding winter had a lot of precipitation so you had a lot of vegetation growth followed by a very dry summer which dried out the fuel, so you put winds on that and you only need a spark – that changes the nature of the risk very dramatically."

RMS acknowledged in a recent statement launching its updated fire model that the recent wildfires have highlighted deficiencies in the way the risk has previously been modelled.

This included failures to account for structural vulnerabilities, the inability to highlight areas susceptible to urban conflagrations, and a lack of probabilistic insight.

"After three consecutive seasons with major cat events, it's clear that wildfire needs to be treated more like a peak peril and less like a simple matter of attritional loss," Folkman said in the release.

Wildfire is currently modelled through a 50,000-year big data simulation of wind, temperature and moisture in the US and Canada, Folkman told *Trading Risk*.

"This simulation yields millions of ignition points of wildfires, and a separate fire spread simulation determines how the fires travel based on local terrain, wind speed, and fuel patterns."

Wildfire also poses additional modelling challenges because, unlike other perils, there is an element of human risk.

"Most ignitions are human-caused, either directly (accidental or arson) or indirectly (by equipment failure or downed utility lines)," Folkman said.

Re-pricing?

While the events of the last two years have given the ILS industry more data to work with, it is important that investors are paid enough premium to compensate for remaining uncertainties, the ILS underwriter said.

"We need to charge enough margin to take account of the uncertainty of modelled output, especially when you are dealing with more primitive models."

There has been a push for higher margins as current pricing hasn't been enough to handle the volatility of fire risks, he added.

Aggregate cover has been a particular area of focus, according to Dubinsky, as it is more likely that ILS strategies have been impacted by fire losses on aggregate structures than for occurrence contracts.

People are starting to charge more for aggregate cover, the ILS underwriter agreed. "I wouldn't be surprised if that continues in the short term, whilst it is at the forefront of people's minds."

Although some price increase is likely in the wake of events, structural ways of taking on wildfire liabilities may also change, Schultz said.

"If we could share our preliminary assessment, it is that investors will continue to be interested in this type of risk, but will probably [participate] at a more remote attachment point."

> "The ILS market will get its arms around this"
> *Paul Schultz, Aon Securities*

They will be more interested in less frequent, more severe types of events, he added.

Terms and conditions have also come under the microscope, the ILS underwriter agreed.

How to define a single wildfire event – whether captured by radius or hours of coverage – became a point of controversy last year.

Some cedants were able to group their losses from the Camp and Woolsey blazes together to maximise reinsurance recoveries due to loose wording on how the distance between the two should be measured. While there will certainly be changes in how the risk is managed, wildfire is likely to remain within the ILS spectrum, Schultz said.

"I think that again there will be re-calibration about how investors expose themselves to wildfire, as well as more research being done on the models. But the ILS market will get its arms around this."

The fire losses and the ILS impact

In 2018, wildfires led to $18bn of insured losses, greatly outstripping the annual global average of $2bn between 2000 and 2017.

The Camp Fire, which swept across northern California in November, was 2018's costliest insured event, causing $12bn in losses.

The Woolsey Fire, which struck southern California at the same time, was also among 2018's 10 costliest disasters, with insured losses put at $4.5bn.

One of the ways wildfire losses have filtered through to investors is through cat bonds.

As well as Pacific Gas & Electric's $200mn Cal Phoenix cat bond – now expected to be a full loss – a number of aggregate bonds have also been impacted by the events.

While per-occurrence retrocession cover is largely considered to be unimpacted by the fires, aggregate deals are expected to have been hit, an ILS underwriter said.

Private placement treaty and sidecars will also have shared in the losses, he added.

Disconnect emerges in January renewals

Retrocession rate increases outpaced those in the US and European reinsurance renewals at 1 January, creating a disconnect between the two market segments.

However, underwriters say they are expecting steeper increases in renewal periods to come in April and June, when business impacted by disaster activity in Japan and Florida will renew.

A question also remains over whether reinsurers and ILS funds are prepared to absorb higher retrocession rates, which make it costlier for them to hedge their portfolios, or whether this will have a knock-on impact prodding up reinsurance rates.

The January renewal is focused on European reinsurance business, with some key US deals and a significant volume of retrocession (retro) business also renegotiated at that date.

Disaster losses hit the retro market hard in 2018, the second year running, as the California wildfires, hurricanes and typhoons produced losses to annual aggregate contracts and to quota share sidecars.

The market was further rocked by the news that major retro writer Markel Catco was being investigated by government authorities over its loss reserving practices in 2017.

The firm's ability to renew business was significantly constrained by losses, contributing to an overall decline in ILS capacity.

Key themes

- Overall flattish reinsurance renewal
- Increases to US loss-struck business failed to offset lower rates in Europe
- Retro rate increases outpace those in reinsurance market
- Terms of wildfire coverages a focus
- Structural changes enhance retro rates
- New sidecars emerge in challenging renewals

Property catastrophe rate change: Willis Re

	US loss-free	US loss-affected	UK loss-free	Europe loss-free	Australia/NZ loss free	Retro loss-free	Retro loss-affected
1-Jan-19	-2.5% to +5%	+5% to +20%	-7.5% to -2.5%	-5% to 0%	-1% to 0%	0% to +15%	+20% to +35%
Flashback to 1-Jan-18	0% to +7.5%	5% to +10%	0% to +5%	0% to +5%	0% to+2.5%	+5% to +15%	+10% to +30%

Source: Willis Re

Retro market main focus of rate change

It was clear leading up to the renewals that the retrocession market would be the main point of focus for the ILS market.

Structural changes and altered terms of cover had a notable role in producing higher rates for retro writers, rather than simple premium dollar increases, sources said.

Typically, cedants changed the levels at which cover triggers, in order to maintain prevailing rates-on-line in the 20 to 25 percent range for higher-risk and aggregate retro structures.

A term that moved in favour of retro writers was the inclusion of aggregate deductibles, with more use of "each and every loss" deductibles, rather than franchise deductibles.

Franchise deductibles allow cedants to claim ground-up losses from eligible events once above a set threshold, whereas "each and every loss" deductibles only transfer losses above the defined attachment – removing some of the noise from attritional losses and giving more incentive to cedants to manage losses down.

However, one underwriter said they had been disappointed to see "fringe" perils, such as marine and cyber, continuing to be included alongside pure catastrophe exposures.

Changes to terms and structures make it more likely that a wider range of views on how risk-

> "The industry is dealing with questions of pricing adequacy and where and to what degree adjustments might be needed"

adjusted rates changed will be seen. At the low end of the scale, sources put loss-free rates up 5-15 percent, with loss-hit and aggregate business rising by 20-35 percent.

Overall, this was in line with broker views. JLT Re put loss-free occurrence retro at flat to 10 percent up, with loss-hit layers up 10-20 percent, while Willis Re put the change at flat to 15 percent up on loss-free deals and 20 to 35 percent ahead on loss-impacted business.

The sidecar market, which also provides a source of retro support to reinsurers, also faced a challenging renewal. Major sidecar investor, Stone Ridge Asset Management, pulled back its capacity after facing a lump sum of investor redemption requests in November.

Reinsurance rates flat

Broker indices of catastrophe reinsurance rates hovered fairly flat at 1 January, as increases from the US failed to offset softening in European business.

Guy Carpenter estimated that global rates rose by 1.1 percent year-on-year, boosted by a 2.6 percent uplift in US rates.

However, JLT Re's rate index actually showed a 1.2 percent drop.

JLT Re noted that the modest decline, following a 4.8 percent increase in January 2018, left the index below levels recorded in 2016.

David Flandro, JLT Re's global head of analytics, noted that record levels of reinsurance capacity remained at year end 2018, despite losses and reduced deployable third-party capital.

Guy Carpenter vice chairman David Priebe said finding equilibrium had not been easy in the renewal. "The industry is dealing with questions of pricing adequacy and where and to what degree adjustments might be needed."

Wildfire and aggregate risks in particular were a focus in this regard.

Willis Re International chairman James Vickers highlighted that a differential in pricing was beginning to open up as traditional reinsurers undercut ILS funds which had trapped collateral.

"What we have seen is an element of trading going on where participations that some of the funds are able to offer are much smaller, unless the buyer is able to agree collateral releases, which most of them are not prepared to do," he explained.

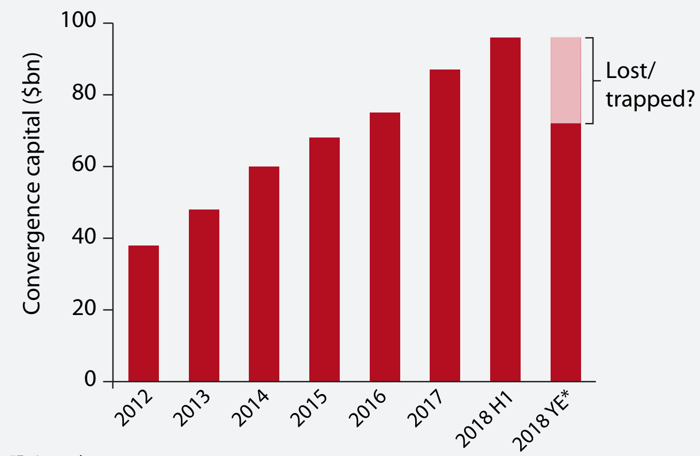
On the outcome of renewals, RenaissanceRe CEO Kevin O'Donnell noted that some reinsurers had been disappointed that a dislocated renewal did not materialise.

But he disagreed with reports that painted a picture of rates being flat to down.

"That is taking too broad brush in approach and not in line with our experience," he said.

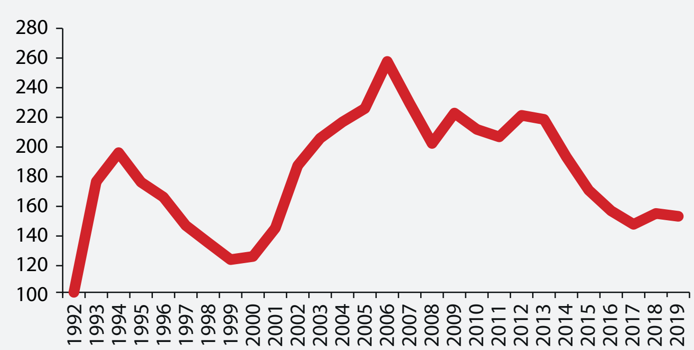
The California wildfires were, in O'Donnell's words, "the straw that broke the camel's back", especially for third-party capital investors.

ILS capacity pared back after expansive 2018



*Estimated
Source: Guy Carpenter

JLT Re property cat RoL index



Source: JLT Re

Liquid appeal: cat bond flexibility

There could be increased interest in cat bonds from ILS market operators in 2019, reflecting a new value for tradeable instruments after two years of high loss activity that has tied up some collateralised reinsurance capital, broker-dealers told *Trading Risk*.

Brokers forecast an average of $9.7bn in new volumes for 2019, after last year's issuance reached $10.1bn, excluding mortgage insurance deals.

With $6.7bn of maturities this year, the cat bond market will continue in growth mode should issuance hit or surpass the $7bn mark.

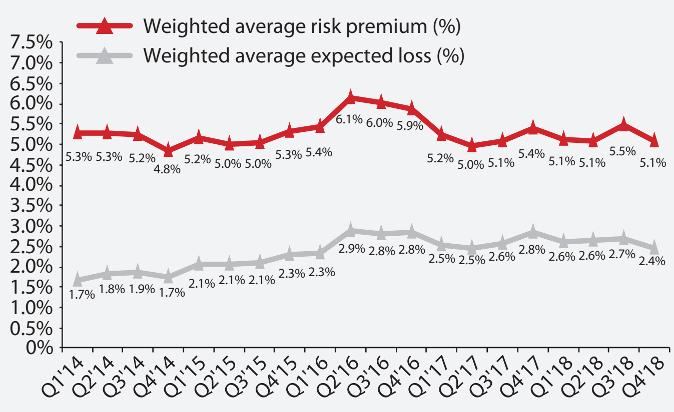
The tradeable part of the ILS market was worth a new record of just over $30bn in notional volume towards the end of 2018. It remains significantly smaller than the collateralised reinsurance market, which Aon Securities estimates at nearly $60bn in size.

However, investors may to some extent rebalance away from illiquid strategies in favour of cat bonds this year, said GC Securities global head of ILS origination and structuring Cory Anger.

Sponsor concerns around commutation of liabilities and investor worries about collateral lock-up could lead to less interest in collateralised reinsurance and more demand for bonds, said Swiss Re's global co-head of ILS Judy Klugman.

Aon Securities CEO Paul Schultz noted that cat bonds are less restrictive for ILS managers, as

New issuance cat bond spreads stable in 2018



Source: Willis Towers Watson Securities Transaction Database as of 31/12/2018 and may be subject to change. Expected losses calculated using higher of sensitivity or base-case modelling. Information based on sources believed to be reliable. No representation is being made as to the accuracy or completeness of such information

Broker-dealer issuance forecasts

Broker	2019 issuance prediction
Aon Securities	$7bn-$8bn
GC Securities	$9bn-$10bn
Swiss Re	Flat to 2018
Willis Towers Watson	Flat to +5%
Indicative average, using *Trading Risk* tally of $10.1bn for 2018	$9.4bn

Source: *Trading Risk*

they can sell out of positions, unlike collateralised reinsurance.

"You can sell at whatever the market price is, but you won't have capital which [is expected to be ultimately clear of losses] but which is not available to trade on."

Indeed, a number of ILS managers were offering cat bonds on the secondary market at year-end to free up cash, with selling pressure depressing prices.

On the new issuance market, average trailing 12-month cat bond yields have held relatively steady over the past year – hovering just above 5 percent on a gross basis, or just under 3 percent net of modelled expected losses, according to the WTW Securities rate-on-line index.

Pricing is likely to be more volatile in 2019, according to Bill Dubinsky, head of ILS at WTW Securities.

Relative to 2018, there is an expectation that the perception of risk will have changed for some lines, leading to increased prices, he added.

However, Anger said it was too soon to make price projections. She added that rather than a wholesale "repricing of risk" across all categories, impacts are tending to be limited to specific structures or perils or regions.

New cat bond sponsors are expected to enter the stage in 2019, while some large US insurers are tipped to return to the market.

Government de-risking will result in new sponsors and there are likely to be more takers from the corporate market, Schultz added.

Meanwhile, on the investor side of the market, fixed income giant Pimco has launched a new ILS platform, although it is not yet clear how far it will focus on the cat bond segment.

Allianz Re said it would partner with Pimco to source collateralised reinsurance and other catastrophe investments for the fixed income manager's new ILS business, led by former Mt Logan Re CEO Rick Pagnani.

Outperforming bond segment may draw more interest in 2019

Catastrophe bond spreads have experienced slightly increased volatility over the past two years – a far cry from what the market had become accustomed to. Since approximately 2012, spreads have largely gone in one direction, mostly due to an influx of new investors who were seeking uncorrelated returns in a compressing macro environment, as well as due to a drought of major insured catastrophic events.

The events of 2017 caused a minor temporary divergence from the spread tightening trend late in the year and into early 2018. However, the modest uptick was short-lived as, ironically, the expectations of a harder market had drawn large pools of money into the sector, leading to a supply and demand imbalance which ultimately counteracted the forces that were pushing the market wider. Even with record first-half catastrophe bond issuance in 2018, the market continued to trend tighter.

Heavy issuance uncharacteristically continued into the summer months, utilising some available investor capacity. Meanwhile, loss creep from the 2017 events, along with Typhoon Jebi in Japan and hurricanes Michael and Florence in the US, began to raise concerns among certain investors. The unease was then exacerbated by the record-breaking California wildfires.

Losses from these events, as well as the increased likelihood of additional trapped capital, permeated throughout the industry. The catastrophe bond market is expected to realise some loss from wildfires, as well as additional losses to a few of the aggregate bonds from the accumulation of events. The majority of the losses are expected to reside in the collateralised reinsurance and retro markets; however, since many of the large investors in the asset class are active across product types, the catastrophe bond market was not spared the pain from the losses of the other markets.

Secondary trading boost in late 2018

Rumours of a strained retro market and large investor redemptions led to a very active December in the secondary market for catastrophe bonds. December saw a handful of investors seeking to sell bonds into an already hesitant market. Much of the selling, rightly or wrongly, was believed by the market to be from bondholders, who were being forced to liquidate due to redemptions. Those sellers were thought to be facing large losses in their retro and collateralised reinsurance portfolios, and were therefore seeking liquidity through the tradeable bond market.

> "As the pipeline for first half 2019 issuance develops, we expect to see a levelling-off of spreads"

Towards the end of December and into the beginning of 2019, the picture on redemptions became clearer for many of the investors. Some who were previously on the sidelines, preferring to keep dry powder to account for the uncertainty, were now ready to deploy the cash back into the market. Additionally, we saw some new capital enter the market, as well as reallocation among strategies towards the bond market at some managers. The increase in buy interest has brought spreads back down, erasing much, though not all, of the widening experienced in early/mid December.

New equilibrium in 2019

As the pipeline for first-half 2019 issuance develops, we expect to see a levelling-off of spreads. Further, we expect to see continued a redistribution within the asset class towards catastrophe bond strategies.

We suspect that the performance of the catastrophe bond strategies relative to those in the more privately distributed, less liquid strategies, will nudge the end investors who were contemplating opportunities towards the outperforming bond funds.

We further anticipate investors to look to diversify within the risk profiles, and aim to build well-balanced portfolios across risk levels geographies and perils.

Author: **Paul Schultz,**
CEO, Aon Securities

Gauging the impact of side pockets

ILS side pockets have gotten a lot deeper in the past two years – something investors need to bear in mind when looking at track record data

After another active catastrophe year, many ILS managers are still operating significant side pockets in order to segregate assets that are exposed to possible claims.

These structures have been used to allocate losses to investors who held stakes in a fund at the time of a disaster event, as it will typically take many months for the level of claims to settle and for a manager to be certain about the size of their losses.

However, as the 2017-2018 side pockets develop, investment consultants say it would be useful to see a more uniform practice among the ILS industry in reporting track records incorporating the side pocket experience.

In the case of losses deteriorating, most often ILS managers will include that impact in the month it is recognised – although some firms restate the loss taken in the original month it was flagged.

Generally, funds will focus on the track record for original investors, but some also break out performance for side-pocketed funds.

Siglo senior analyst Ratana Tra said the firm would prefer managers to focus on showing track record performance incorporating the impact of side pockets – in other words, the track record of an investor from day one of the fund. Referring to side pocket performance in the small print is "not transparent," he argued.

The Open Protocol, a reporting framework adopted by the Standards Board for Alternative Investments, is pushing for standard practice to include ILS managers providing a breakdown within monthly returns of individual loss events.

It would also like to see returns from side pockets and the main fund reported separately, so that investors can determine their individual track record and composite exposures from their own holdings.

Mercer head of ILS Robert Howie sympathises with the challenges that ILS managers face in presenting these variables.

"It makes the pitch book horrible," he notes, adding: "It's great to see one performance number, but if there's a complexity behind it, I'd prefer to look at three tables."

Fee implications

Investors should also be aware of the fee structures in place for side-pocketed assets, which can vary widely between managers not only in headline rates but also in the basis on which they are calculated.

For example, it might seem like a good idea to have fee-free structures for frozen assets, but this could create an incentive to minimise side-pocketed assets through commutations that may be disadvantageous.

> "Side pockets are a practical way of handling uncertainty while settling reinsurance claims"

Finally, the process for winding up side pockets is also something to which investors should pay attention. If assets are returned to the main fund rather than being repaid directly to investors, how an ILS manager will deal with any claims beyond this point may vary. Some may have extinguished any underlying liabilities, but other firms may draw on the main fund's assets to meet claims.

This highlights the fact that, while side pockets are created by an ILS manager to protect investors, some of the underlying constraints that tie up collateral assets are out of their hands and determined by reinsurance counterparties.

These agreements on collateral lockup are often determined by a rote method of factoring up losses, with a generous initial buffer to allow for possible claims inflation.

But how ILS managers deal with drawing a line under these underlying reinsurance obligations varies, and became an industry talking point in 2018 as a result of rising Irma losses that raised fears among some cedants of being unable to claw back collateralised reinsurance payouts.

Ultimately, however, investors should recognise that use of side pockets within the ILS asset class is a beneficial feature, Howie said.

Although for some the term carries negative connotations from the 2008 financial crisis, they are a practical way of handling uncertainty during the drawn-out process of settling reinsurance claims.

MATTHEW SWANN

The Hiscox Re ILS principal says dealing with losses will unlock more variety in ILS structures

Q: What practical lessons do you think have emerged from the 2017-2018 losses?
Capital efficiency, price adequacy and climate change are all major themes.

In respect of capital efficiency, the frequency of capital being trapped has had a huge impact on the returns of fully collateralised structures. This is particularly true at the high-risk end of the ILS market where some poorly modelled perils may have caused surprise losses.

The argument that freeing up trapped capital is simply a timing issue has weakened in the past year. The asset class saw significant loss creep from Hurricane Irma, and Typhoon Jebi is now rising as well.

Fronting is one immediate solution for collateralised ILS players, which would let them use another reinsurer's balance sheet. This doesn't solve the valuation challenge, but it may offer a more efficient solution. In addition, broader access to reinsurance markets is possible.

One of the things that I think investors should be focussed on when it comes to their ILS managers' fronting partners is longevity and ensuring access to that business.

We would want to know that a fronting carrier has long-term, stable intentions for that service.

We like the fact that our fronting solution is integrated with Hiscox Re. Among a number of synergies, it can help us to limit the impact of trapped capital on investors through a more efficient, actuarial approach to locking up capital.

Q: As more reinsurers move to offer ILS vehicles, what should investors look out for here?
Investors should focus on governance and look for alignment of interests on multiple levels. Does the reinsurer share the same view of risk as its ILS unit? It's very hard to justify a two speed approach across different platforms. Can the reinsurer demonstrate that their ILS platform is a strategic partnership with investors and not a hedging strategy?

What level of independent oversight is applied – for example at board level, and for valuations?

> "We have an extraordinary framework in the shape of the catastrophe models"

Q: What are your expectations for the Florida renewals?
It's premature to predict pricing in Florida, but it's important for us to manage expectations – for example using price change scenarios to illustrate the potential impact on our portfolios.

We have seen some Florida insurers increase their Irma loss by a factor of three – that sort of thing should force a long hard look at whether Florida hurricane risk is adequately priced. Looking out in the market it's striking to see the Florida narrative shift from being the 'best paid reinsurance business', to where we are today.

I think investors should ask about how ILS managers deal with information asymmetry. There are so many links in the chain of information flowing from policyholder to reinsurer, that the quality of information can get diluted.

For example if you run a company's portfolio in another model than the one they used, you may get a completely different assessment of their risk.

It's not a criticism of the models – of course they're not perfect, but it's also a question of how they're used.

We use our own proprietary view of risk alongside Hiscox, factoring in actual loss experience and an understanding of how cedants behave, as well as the quality of the underlying data.

Q: How do you respond to concerns about the impact on climate change?
There used to be an argument within the reinsurance industry that climate change doesn't matter because we're taking risks on a 12-month basis. That's categorically wrong. As an industry we have an extraordinary framework in the shape of the catastrophe models. We need to start using the models to understand how century-scale climate projections may change the likelihood of extreme tail events in a much more amplified, and therefore more immediate way. We have the tools to grasp this challenge – it's a huge opportunity if we get it right.

AASHH PAREKH

New ways of accessing the cat bond market could bring in a wider investor base, says the managing director and portfolio manager at TIAA-CREF

Q: How long have you been investing in ILS?

Except for a brief hiatus during the financial crisis, Nuveen [a TIAA-CREF subsidiary] has been investing in ILS since the inception of the market in the mid-1990s – that's when the first catastrophe bonds came to market following the aftermath of Hurricane Andrew. The market has evolved since then and has become quite a bit more sophisticated relative to those early days.

Q: Why did you decide to invest in the ILS asset class?

We are investors in ILS for the same fundamental reason we invest in any asset class. We see attractive long-term risk adjusted returns in the space. Market conditions fluctuate over time but the long-term value proposition looks intact.

Q: Have your ILS investments performed in line with your expectations?

Yes, returns over a longer period of time have generally met our expectations. That said, the large influx of so-called alternative capital we have seen post-crisis has compressed returns in recent years. This dynamic has compelled traditional market participants to rethink the way they operate in this space.

Q: What was the biggest challenge for you in dealing with the ILS sector?

The challenge of dealing with compressed spreads in recent years has been a significant headwind for ILS returns. Much of this is attributable to alternative capital flooding the market. As a result, the reinsurance industry has been compelled to rethink its business model.

Some traditional reinsurers moved into asset management as a way to maintain returns. The current buyer base is a shifting mix of traditional reinsurers, dedicated fund managers, hedge funds, private equity and asset managers, like Nuveen.

> "The challenge of dealing with compressed spreads in recent years has been a significant headwind for ILS returns. Much of this is attributable to alternative capital flooding the market. As a result, the reinsurance industry has been compelled to rethink its business model"

It's fair to say that the current environment in ILS is both full of excitement and challenge.

Q: What advice would you give to investors considering their first allocation to ILS?

There are a couple of things. ILS returns exhibit low correlation relative to traditional equity and fixed income returns. As such, an allocation to ILS can make almost any portfolio more efficient.

Manager selection is also important and this is evidenced by the differentiated investment returns across the space. Investors should pay attention to this.

Also, ILS losses are event-driven and investors should expect they will happen. ILS investing should be a longer-term commitment.

Q: Were there any surprises in the results from the 2017 and 2018 losses?

There were a couple of items that got our attention during the 2017-2018 loss years. One of them is the loss development story in Florida mostly due to the assignment of benefits (AOB) challenge in that state.

The combination of higher loss revisions and longer loss development timelines in this area has been a challenge. AOB risk needs to be mitigated otherwise rate increases will continue to be passed through to policyholders. This is a challenge for both reinsurance and ILS.

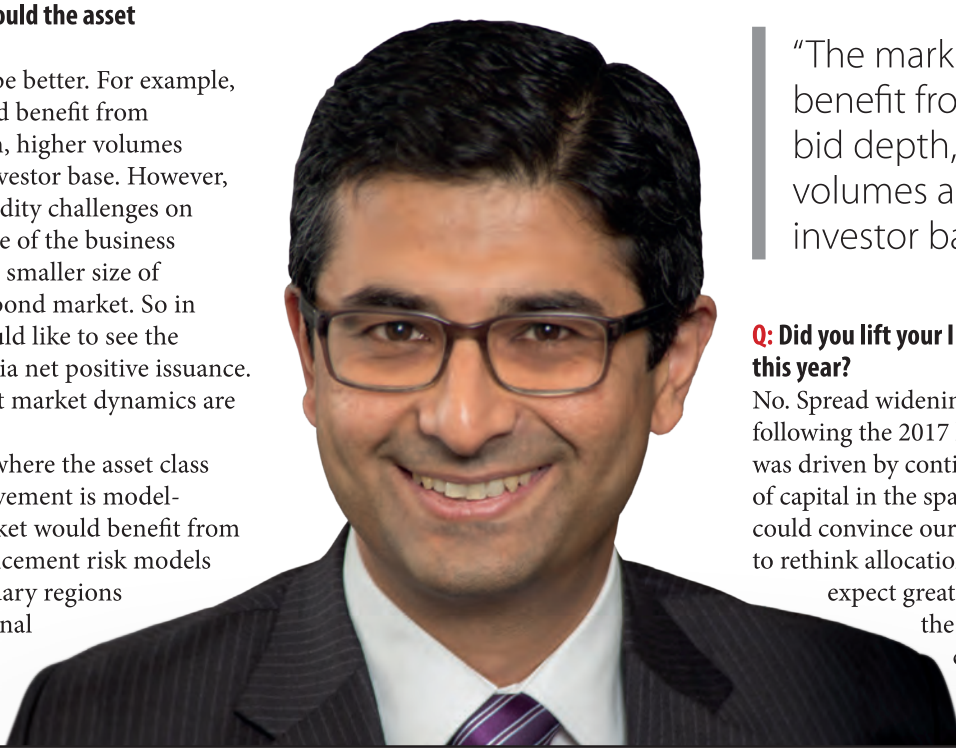
The other issue is the size and scope of wildfire losses in California. For a couple of years now, conditions on the west coast have been ripe for wildfire. This has materialised in the form of higher insured losses across the space. In particular, the Tubbs Fire in late 2017 is noteworthy because of the higher value properties that were damaged as well as the uneven market shares across primary insurers in that part of the state.

Q: In what ways could the asset class improve?

Liquidity could be better. For example, the market would benefit from greater bid depth, higher volumes and a broader investor base. However, some of the liquidity challenges on the securities side of the business are related to the smaller size of the catastrophe bond market. So in addition, we would like to see the market expand via net positive issuance. We think current market dynamics are supportive.

Another area where the asset class could use improvement is model-related. The market would benefit from continued enhancement risk models related to secondary regions and non-traditional perils, such as South America and flood. These models are developed by third-party consulting firms and utilised throughout the industry.

Additionally, the continued proliferation of platforms that simplify execution of private cat transactions and lower their cost would expand the investor base. Cedants should be thinking about how these vehicles can help them access a broader set of investors.



> "The market would benefit from greater bid depth, higher volumes and a broader investor base"

Q: Did you lift your ILS allocation this year?

No. Spread widening was mixed at best following the 2017 loss year and this was driven by continued availability of capital in the space. Higher yields could convince our current mandates to rethink allocations. Investors should expect greater returns following the last two major consecutive loss years – 2017 and 2018.

Select pension funds invested in ILS

Pension fund	Domicile	Current ILS allocation ($mn)	% ILS allocation	Strategies/managers employed	Date of initial allocation
PGGM	Netherlands	4,500	1.8%	Employs Fermat, LGT, Nephila, Elementum, Munich Re, New Ocean and AlphaCat	2006
PKA	Denmark	1,370	4.1%	Twelve Capital ($150mn 2011), Nephila, Markel Catco	
RBS	UK	1,230	2.2%	Includes an insurance litigation funding investment as well as ILS holdings with Nephila and Leadenhall	2012
Pennsylvania Public School Employees' Retirement System	US	650	1.1%	Nephila ($250mn 2011), Aeolus ($200mn 2012), RenaissanceRe ($200mn 2015)	2011
AP2	Sweden	639	1.7%	Fermat, Credit Suisse, Elementum	2012
State of Michigan Retirement Systems	US	538	0.8%	6% of Real Return & Opportunistic Fund at 31/12/17	
West Midlands Pension	UK	397	2.0%	Markel Catco, Credit Suisse, Coriolis (latter holding not disclosed in 2018)	
MLC	Australia	392	0.5%	AlphaCat Managers	2010
PK SBB	Switzerland	384	2.1%	Not disclosed	2013
AP3	Sweden	325	0.9%	In-house and external allocations	
Teacher Retirement System of Texas	US	300	0.2%	Target a 5% allocation of the $5.6bn Stable Value Hedge Fund portfolio	2013
MassPRIM	US	250	0.4%	Aeolus ($100mn), Markel Catco ($150mn)	2017
IBM UK	UK	229	3.0%	Nephila, Securis	2013
Ontario Teachers' Pension Plan	Canada	223+	0.2%	In-house and external allocations; $150mn+ in Da Vinci Re and Hudson Catastrophe Fund (in-house vehicle)	2005
NZ Superannuation	NZ	203	1.7%	Elementum Advisors, Leadenhall	2010
Maryland State Retirement and Pension	US	200	0.2%	Nephila	2014
Oregon Investment Council	US	146	0.2%	Nephila ($100mn 2011)	2011

Source: *Trading Risk*

Measuring the risk of a string of losses

As losses mount from the 2017 and 2018 catastrophes, aggregate ILS products have not fared as well as their occurrence counterparts.

On the more visible cat bond market, some 58 percent of the 17 deals impaired as a result of 2017 events were aggregate contracts, according to Lane Financial.

Of the cat bond transactions hit by 2018 events, four out of five are aggregate in nature.

However, while there are particular challenges to modelling aggregation of risks, RMS argues that there are no systemic issues with such models.

> "Modelling uncertainty for the smaller events is higher because there is a large uncertainty over which risks or properties may be damaged"
> *Tom Larsen, CoreLogic*

"[But] there is a perception that the loss potential of certain perils and certain structures has been underestimated [and] therefore not fully accounted for in the pricing in the past," said RMS consultant Theresa Lederer.

Some perils are better captured by aggregate modelling than others.

Earthquakes and hurricanes are simpler to model for aggregate covers because there are fewer of them, according to Tom Larsen, content strategy principal at CoreLogic.

There are only around 10 large earthquakes per year, usually distant from insured exposures, while the frequency of a $10bn-plus hurricane is far less than one per year.

But aggregate reinsurance contracts may also cover other higher frequency perils, including regional events which may not be categorised as industry catastrophes. These perils include wildfire, flood, severe convective storm, winter storm and icing.

There are thousands of tornadoes in the US every year and millions of acres hit by damaging hail, Larsen noted.

"Modelling uncertainty for the smaller events is higher because there is a large uncertainty over which risks or properties may be damaged, and the damage is usually a small fraction of the exposed limit.

"Because these perils are not solvency-threatening… insurers often invest less in staffing and expertise to align their models with their experience, when compared to the large, solvency-threatening perils like hurricane and earthquake," he explained.

There can be significant challenges to valuing a portfolio if the underlying aggregate exposures are not known, according to RMS' Lederer.

Timely disclosure of aggregate loss amounts is critically important to both a robust risk quantification throughout the life of a contract and also calculation of its fair value, she added.

In terms of ability to price aggregate risk, having good data to hand will also help transactions, said Nathan Schwartz, head of analytics at TigerRisk Partners.

"There have been some people who have underestimated aggregate risk and that became more apparent in 2017 and 2018," he said.

At the end of 2018 and beginning of 2019 there was a "little bit of overreaction" and the price of aggregate risk increased, Schwartz continued.

"There is some room for it to move back to where it was, but if you have good data and you present a risk people can get [their] heads around, then people are willing to treat it fairly."

Modellers strive to reduce unknowns in their models. But the recent increase in loss severity of attritional catastrophe perils, such as severe convective storm and wildfire, has come as a surprise.

The rise in the potential for wildfires has been attributed to the rapid expansion of communities built next to natural vegetation in the US.

In California, wet winters led to a growth in vegetation, which then turned to tinder during dry summers.

"Models need to be carefully calibrated to account for such changing risk landscapes in order to ensure robust pricing decisions," noted Lederer.

It is important to ensure that model output is "fit for purpose" when it comes to understanding and pricing aggregate structures – and that where it is not, there is full transparency, she added.

Will climate change drive clusters of disasters?

One issue dividing opinion in the insurance industry is how much climate change might impact aggregation.

Is it becoming more likely that catastrophe events stack up or occur more closely together given global warming?

Karen Clark & Company (KCC) said its own analyses and other scientific studies have shown that climate change could be causing tornado outbreaks to be more severe.

The impacts of climate change are captured in the KCC model, because it uses the physics of the atmosphere to simulate daily weather and losses.

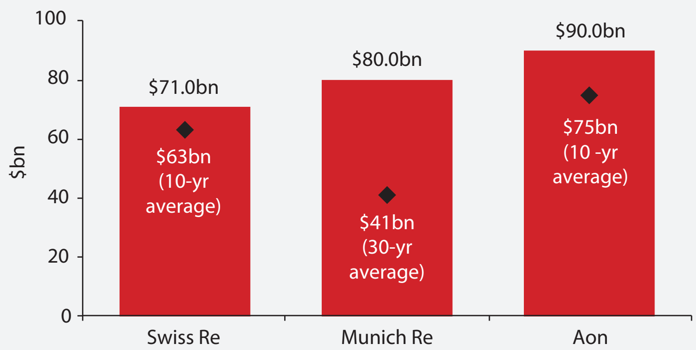
But to date, there is no evidence that climate change is causing hurricanes to occur in closer proximity to each other, KCC said.

CoreLogic's Larsen said there are loose climate correlations to climate change in various weather basins around the world.

But CoreLogic's studies have not shown the outcomes to be significant, so the firm has not included basin correlations in its models.

"There is a perception that the loss potential of certain perils and certain structures has been underestimated [and] therefore not fully accounted for in the pricing in the past"
Theresa Lederer, RMS

2018 losses: how far above average?



Source: Agencies as cited, *Trading Risk*

What would it cost: a trio of disasters

Last year now stands as the fourth most expensive for insured catastrophe losses – despite the fact that none of the 2018 disasters individually cost the industry more than $20bn.

While there was no singular "mega" catastrophe in 2018, there were 42 billion-dollar events which aggregated to a slightly above-average year and total insured losses of $90bn, Aon calculated.

This made 2017 and 2018 the highest back-to-back years for insured losses with a combined total of $237bn.

As a result, the industry's ability to model the aggregate risks from a string of events – not just individual occurrences – has come into focus.

To examine the variation, *Trading Risk* asked modelling agencies to estimate the total industry loss from a year containing several sizeable catastrophe events – a 1-in-10-year California wildfire, a 1-in-30-year US hurricane and a 1-in-15-year Japanese typhoon.

The overall results varied from $66.9bn to $113.2bn.

The RMS estimate of $113.2bn factored in a $6.7bn occurence Japanese typhoon loss, a $104bn aggregate hurricane loss and a $2.5bn occurrence Californian wildfire. The agency noted that a 1-in-10-year wildfire season would produce higher losses of $4.6bn.

At the lower end of the scale, CoreLogic's $66.9bn total comprised a $3.5bn wildfire estimate, a $5.4bn typhoon loss and a $58bn hurricane hit based on assumptions of higher hurricane activity.

$80bn hurricane?

Trading Risk also asked modelling firms what they thought the probability was of one or more hurricane events reaching $80bn in any given year.

Here the results also varied from an event that might recur once every 20 years to once every 39 years.

At the higher end of the scale, RMS said the probability of US hurricane losses exceeding $80bn represented about a 1-in-20-year return period.

This estimate was made using standard modelling assumptions about loss amplification, coverage leakage and partial flood coverage for the industry, the firm said.

CoreLogic estimated the probability of one or more hurricane events reaching $80bn in any given year at 1-in-58 years using its long-term frequency model and 1-in-39 years using its model based on warmer sea surface temperatures.

Karen Clark & Company put the return period for $80bn in annual aggregate US hurricane losses at 30 years. In contrast, the firm pegged the likelihood of a single hurricane event producing an $80bn loss at a 1-in-50-year chance.

Catastrophe loss estimates for 2018 range from Swiss Re's figure of $71.0bn to Munich Re's $80.0bn tally and Aon's $90.0bn forecast.

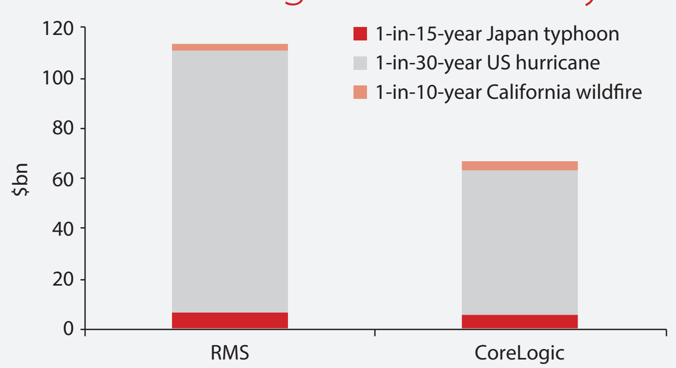
These tallies include losses for Hurricane Michael (averaging at $8.1bn) and Hurricane Florence (averaging at $3.8bn), as well as wildfire losses (averaging at $14bn) and Typhoon Jebi losses (averaging at $6.5bn), according to data compiled by *Trading Risk*.

The chance of hurricane losses reaching $80bn

CoreLogic	1 in 20
Karen Clark & Company	1 in 39
RMS	1 in 30

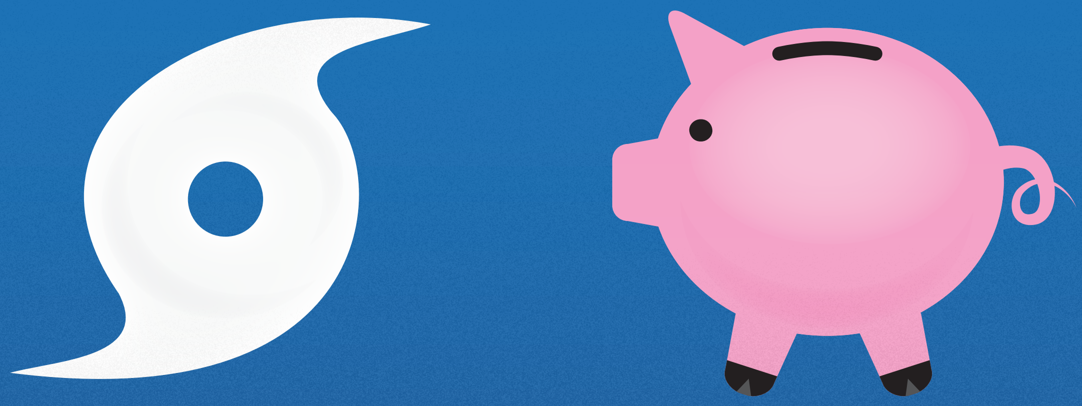
Source: Modelling agencies as cited

The costs of a global disaster year



Source: Modelling agencies as cited

ILS market primer: from disaster frontline to pension portfolio



What is the insurance-linked securities (ILS) market? As the name suggests, it consists of financial instruments that provide insurance cover.

But don't conflate this industry with a standard burglary or fire insurance product. If you're investing in the ILS market, your risk antennae instead need to be tuned to the kind of natural disaster that might take over CNN screens – US hurricanes or Japanese earthquakes, for example.

The ILS market first emerged in the mid-1990s but it wasn't until after the 2008 financial crisis that it began to take off.

This surge was driven by its major selling point as a source of diversifying, or non-correlating risk

Why ILS?

- Diversification from financial market risks
- Catastrophe models provide a framework for analysing risk and quantifying exposures
- Purer access to insurance risks – avoiding investment exposure on the balance sheets of major (re)insurers
- Cushions against inflation risks, as premiums include a floating rate return from cash pledged against insurance liabilities
- Short-term liabilities (largely one- to three-year contracts, some tradeable)

ILS primer: Market timeline

1996 – George Town Re, widely cited as the market's first cat bond, is launched by St Paul Re, followed a year later by the first Residential Re deal from USAA and a Swiss Re deal

1997 – Nephila Capital, which is now the industry's largest asset manager, is founded

2005 – The hurricane season of Katrina, Rita and Wilma sets off a spike in reinsurance rates and a spate of new start-ups

2008 – Lehman Brothers collapses – it had managed collateral for four cat bonds that defaulted – cat bond structures shift to invest collateral largely in Treasury money market funds

2011 – A heavy international loss year produces three full cat bond defaults due to the Japanese earthquake and US tornadoes

2017 – Hurricanes Harvey, Irma and Maria along with US wildfires make 2017 the ILS market's biggest loss year to date

– acts of God that won't be triggered by financial market turmoil.

The ILS market has largely made its home within the reinsurance sector – a wholesale industry that provides insurance to insurers to help them bear claims when disasters produce a spike in losses.

The ILS sector is sometimes labelled the "alternative" reinsurance market, and contrasted with the so-called "traditional" reinsurance market, which refers to rated balance sheet companies such as Swiss Re or Munich Re, to cite two of the longest-standing industry brands.

That's because the emergence of ILS market asset managers has given investors an alternative entry route into reinsurance risk, instead of just buying equity.

However, since its early days, any simplistic distinction between the two segments has eroded as the ILS segment has broadened and melded into the wider reinsurance markets.

For one, many traditional reinsurers have set up asset management platforms to compete with ILS managers, while a number of ILS managers have set up or are closely tied to rated reinsurance vehicles, giving them more freedom to take on a broader range of underwriting risks.

In recent years, the ILS market has expanded into segments such as marine and energy and aviation reinsurance. It has also delved into catastrophe-exposed property insurance, a step down the business chain. And for a select group of managers, life (re)insurance risk is a major part of their business.

Despite its blurring boundaries, ILS still offers investors a distinct route into taking reinsurance risk while skirting the equities market.

Perils: US risks dominate

The ILS market portfolio is heavily skewed towards the US, led by tropical storm/hurricane risks. Other major perils are US earthquake and Japanese earthquake, with small elements of European wind or Australian catastrophe.

That's because these are historically the most lucrative products for reinsurers. Florida, in particular, is their peak zone of exposure, meaning more capital must be held against these potential liabilities, attracting higher rates in turn.

They are also the most well-studied risks, with third-party statistical models available to help quantify hurricane exposures.

This combination of higher rates and strong data laid the foundation for ILS managers to target catastrophe risks in their early days, since for their pension fund capital providers, hurricane risk was a minor source of diversifying income to their own peak peril of equity market risk.

As ILS managers grabbed more market share in the property catastrophe market, the ensuing competition eroded much of the premium previously attached to hurricane risk.

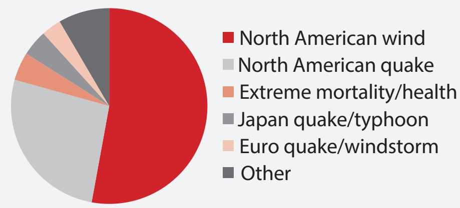
However, it remains the market's peak exposure with a corresponding price advantage compared to the types of catastrophe business that diversify a reinsurer's portfolio.

Continental European catastrophe margins are often said to be little better than break-even, which is one of the reasons why ILS market participation in this sector is relatively limited – cash collateralising limit for such margins would be highly inefficient.

Outside the catastrophe bond market, however, ILS managers are likely to be exposed to a wide range of catastrophe risks beyond the specific perils discussed here.

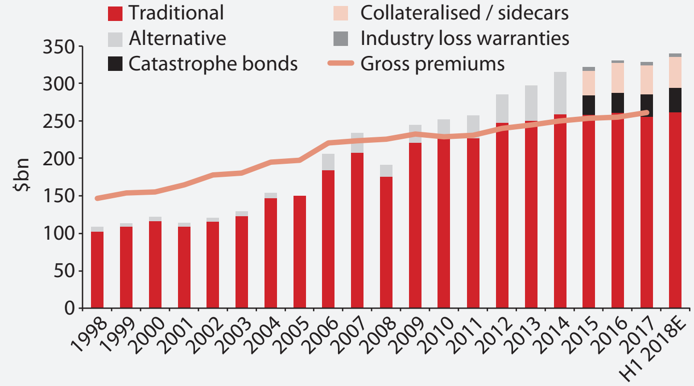
They typically offer "all natural peril" catastrophe cover, which may involve exposures that are unmodelled or less well-modelled – such as wildfires or floods.

2017 cat bonds by peril



Limit of peril volume by contribution to expected loss
Source: *Trading Risk*

Dedicated reinsurance sector capital and gross written premium



Source: JLT Re

Sizing up the market

Estimates vary, but ILS now makes up almost 20 percent of an overall $427bn reinsurance capital base, according to year-end 2017 figures from Guy Carpenter and AM Best.

But what exactly does the ILS market's $82bn-$89bn of capacity represent? There are several distinct segments within this total.

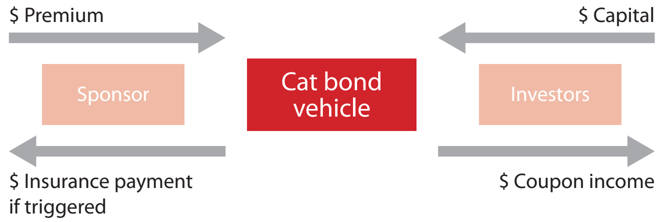
The catastrophe bond market attracts a wide range of investors looking for liquidity, although it typically presents a lower risk, lower return opportunity within the ILS world.

The niche industry loss warranty market is also relatively commoditised and easier to access, with a variety of risk-return options.

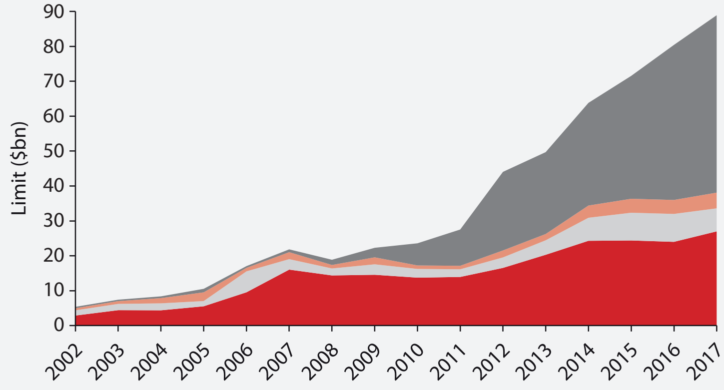
In contrast, the collateralised reinsurance segment is more specialised and difficult to access, but also provides a range of risk-return targets.

What is a cat bond?

A catastrophe bond transaction involves a sponsoring insurer paying investors a premium for reinsurance cover against defined catastrophe losses. If a cat bond triggers, investors' capital is used to reimburse a sponsor's losses. There is no requirement for insurers to later repay such sums to investors. However, if no qualifying event occurs, then investors recoup their capital at the end of the transaction (typically three to four years).



ILS market components



Source: Aon Securities Inc

Catastrophe bonds
The most liquid section of the ILS market. Reinsurance in tradeable form, typically providing slightly narrower terms of cover for specified perils.

Collateralised re
Effectively just traditional reinsurance contracts, providing indemnity cover for a buyer's losses, across a broad range of perils. ILS managers pledge cash collateral to back their liabilities, hence the name.

Industry loss warranty
Contracts that trigger not on a buyer's actual losses, but on the insurance industry's overall loss from specified disasters, e.g. a $5bn Florida hurricane.

Sidecar
Vehicles run by reinsurers in parallel to their balance sheets. Typically involve a reinsurer ceding a share of a set portfolio of risks to investors (via "quota share" reinsurance). Some are "market-facing", akin to a fund, where a reinsurer writes a specific portfolio for the vehicle.

Finally, other small niches such as retro business can provide higher-octane strategies, while sidecars offer the chance to leverage off rated balance sheets and may introduce a range of diversifying risks.

Weighing up returns

So far during its short history the ILS market has delivered strong returns for investors, although margins have softened significantly in recent years.

Before 2017-18, its most difficult years had been 2011 and 2005, as a result of the Tohoku earthquake in Japan and Hurricane Katrina, respectively. These were both testing, but by no means worst-case, catastrophe scenarios for the largely Florida-exposed market. Even 2017, with its trio of hurricanes, could have been much worse had Irma taken a less favourable track over Florida.

There are a couple of benchmarks of returns that are often cited within the industry, although neither is without its limitations. The Eurekahedge ILS Advisers tracks the performance of 34 ILS funds all equally weighted, which cover a wide range of strategies from high risk-return retro vehicles down to low-risk cat bond-only funds. Its worst year to date was 2017, when it lost 5.60 percent.

Meanwhile, the Swiss Re Cat Bond Total Return index – which solely tracks performance of the cat bond segment – returned 2.81 percent last year.

ILS returns, 2006-2018

Annualised return (%)	4.58
Sharpe ratio (X)	0.76
2018 return (%)	-3.92
Return since 2006 inception (%)	79.72

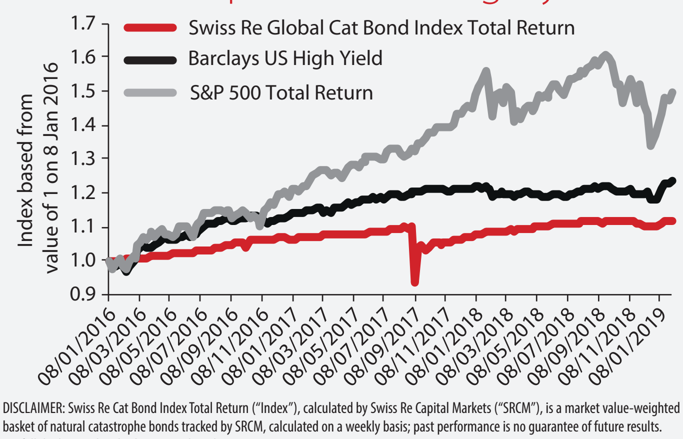
Source: Eurekahedge ILS Advisers index, data as of February 2019

Quantifying risks

Cat bond investors are typically given the "expected loss" of a deal to measure their risk levels, a figure that expresses the likelihood of capital loss in any given year. For example, a 1 percent expected loss means investors could lose that amount of their principal in any year – or looked at another way, is roughly similar to the prospect that a 1-in-100-year disaster would wipe out all their capital.

Cat bond spreads are often cited as a multiple of the deal's expected loss, which is an easy way of referencing the margin of premium earned in relation to potential losses. Typically, cat bonds in the 1-2 percent expected loss range now offer investors around a 2x multiple (or spreads of 2-4 percent), depending on the risk profile.

Cat bond performance 2016-present: HIM losses tip ILS below high-yield



DISCLAIMER: Swiss Re Cat Bond Index Total Return ("Index"), calculated by Swiss Re Capital Markets ("SRCM"), is a market value-weighted basket of natural catastrophe bonds tracked by SRCM, calculated on a weekly basis; past performance is no guarantee of future results. For full disclaimer details please see Bloomberg.

Manager list

Manager by type	Total AuM in ILS $mn (estimated)	AuM within UCITS funds if applicable	AuM within '40 Act funds if applicable	Notes	ILS strategies	Established in ILS	Base
Specialist ILS manager							
Nephila Capital	11,600			Acquired by Markel in Q4 2018	Various multi-instrument funds and single-investor mandates, also invests in weather	1998	Bermuda
Credit Suisse Asset Management	~8,000			Bank's ILS asset management team offers Iris suite of ILS funds	Various funds with different risk levels; manages two rated reinsurers	2003	Switzerland
LGT Insurance-Linked Partners	8,000	650		Former Clariden Leu ILS team moved to Swiss alternatives manager in 2012. Team of 50	Various funds and bespoke mandates; manages rated reinsurer	2005	Switzerland
Securis Investment Partners	6,480	63.8		Independent ILS manager; Northill Capital owns majority stake	Life, non-life and mixed strategy funds	2005	UK
Fermat Capital Management	6,300	1,800		Independent ILS manager	Cat bond focus	2001	US
Stone Ridge Asset Management	6,177		6,177	US mutual fund manager; net assets as of 4 January 2019	Invests principally in cat bonds and sidecars	2013	US
Leadenhall Capital Partners	5,500	340		London-based manager now majority-owned by Japanese insurance group Mitsui Sumitomo	Non-life and mortality funds, life/non-life mandates	2008	UK
Renaissance Underwriting Managers	4,125			Reinsurer subsidiary	DaVinci rated sidecar $1.1bn; Medici cat bond fund $450mn; Upsilon retro/reinsurance funds $975mn; $200mn Fibonacci; Langhorne life reinsurer $800mn; $600mn Vermeer Re joint venture		Bermuda
Aeolus Capital Management	4,000+			Began as private reinsurer; transformed into fund manager in 2011. Now majority-owned by Elliott Management	Retro and collateralised re	2006	Bermuda
Elementum Advisors	4,000			Independent ILS manager; managing ILS funds since 2002 under prior entities and team investing since 1995	Multi-instrument funds	2009	US
AlphaCat Managers	3,491			Part of AIG's Validus reinsurance business. AuM from 1 July 2018 as no longer disclosed publicly	Lower- and higher-risk funds, cat bond tracker fund, direct mandates	2008	Bermuda
Markel Catco	3,000			Subsidiary of insurer Markel	Retrocession writer	2011	Bermuda
Schroders (Secquaero Advisors)	2,907	1,197		Schroders owns 50.1% of Secquaero, which advises it on ILS management. AuM from 31 Dec	Five funds: two cat bond and three multi-instrument, of which two include life risk. Four segregated mandates	2008	Switzerland
Twelve Capital	1,677			Independent ILS manager, spun out from Horizon21; team in ILS since 2007	Cat bond and multi-instrument ILS funds (insurance debt fund not tracked)	2010	Switzerland
Pioneer Investments	1,650			Amundi subsidiary offers one ILS vehicle and invests multi-strategy funds in ILS	Pioneer ILS Interval fund & others; invests in cat bonds, sidecars & other instruments	2007	US
Hiscox Insurance-Linked Strategies	1,600			Hiscox-owned asset manager; Hiscox capital $55mn	Two commingled diversified funds; single-investor funds; one insurance sidecar	2014	Bermuda
Scor Investment Partners	1,412			Asset management affiliate of reinsurer; established 2011	Multi-instrument	2011	France
Axa Investment Managers	1,231	178		Affiliate of insurer; invests third-party funds only	Various funds and mandates, new UCITS fund added 2017	2007	France
Pillar Capital Management	~1,100			Previously known as Juniperus; part-owned by reinsurer TransRe	Collateralised re focus, runs two funds and fund-of-one mandates	2008	Bermuda
Mt Logan	1,046			Reinsurer sidecar	Quota share of Everest Re book		
Axis Ventures	1,045			Reinsurer subsidiary; also oversees $600mn Harrington Re joint venture not tracked here	$1.0bn for property cat support; largely private sidecars	2014	Bermuda
Hudson Structured Capital Management	1,000			Independent manager led by Michael Millette; backing from Blackstone	Reinsurance AuM listed; transport fund not included. Flagship strategy invests across catastrophe, life/health, casualty, other risks and various instruments. New funds for 2018 include catastrophe-based opportunities fund and $75mn InsurTech venture fund	2016	US/Bermuda
NB Insurance-Linked Securities (Iris)	1,000			Acquired by Neuberger Berman from Cartesian Capital in Nov 2018	Focus on index strategies via ILWs, cat bonds & other ILS. Investment vehicles include: open-ended funds in Cayman Is and Delaware, Luxembourg SICAV, Bermuda-listed shares of segregated account and managed accounts	2009	Bermuda
New Ocean Capital Management	1,000			Subsidiary of reinsurer Axa XL, which bought out minority partners in Nov 2018	Moving to quota share focus. Also offers Daedalus algorithmic strategy	2014	Bermuda
Coriolis Capital	765	35		Independent ILS manager. Team operating since 1999; established after MBO from Societe Generale	Multi-instrument including weather	2003	UK
Tokio Marine Asset Management	725			Insurer's asset management arm	Largely ILS/cat bonds		Japan
Aspen Capital Markets	650			Reinsurer subsidiary	Runs managed accounts, commingled funds and sidecars including Peregrine		
Arch Underwriters	600			Reinsurer subsidiary	Underwrites for rated $1.13bn casualty-focused Watford Re, not tracked here	2014	Bermuda
Kinesis Capital Management	500			Lancashire subsidiary established mid-2013	Kinesis Re I vehicle writes multi-class reinsurance and retro. Wrote $340mn limit	2013	Bermuda
TransRe Capital Markets	500			Reinsurer subsidiary	Pangaea Re and other sidecars		
PG3	450			Largely family office funds, may take third-party capital	Family office; invests in quota share sidecars, ILWs and ILS across wide range of reinsurance – nat-cat, non-nat-cat, life and health, legacy		Switzerland
Plenum Investments	430	400		Independent asset manager	Cat bond focus, long-only strategies	2010	Switzerland
Munich Re	400			Reinsurer; has won mandate from PGGM but main sidecar assets not tracked here	Also manages internal cat bond fund of up to $1bn; current size not known	2006	Germany
Oppenheimer Funds	366		332	Mutual fund manager; runs ILS vehicle and invests via multi-strategy funds	OFI Global Cat Bond Strategy open to external investors	1997	US
ILS Capital Management	350			Independent ILS manager backed by Don Kramer	Specialty focus	2014	Bermuda

Manager by type	Total AuM in ILS $mn (estimated)	AuM within UCITS funds if applicable	AuM within '40 Act funds if applicable	Notes	ILS strategies	Established in ILS	Base
Blue Capital Management	350			Sompo International subsidiary; runs listed fund, private funds and private sidecars	Collateralised reinsurance (regional focus)	2012	Bermuda
Swiss Re	335			Internal ILS portfolio, invests in cat bonds, ILWs and swaps. Estimated AuM larger than stated but not disclosed	Sidecar assets not tracked here		Switzerland
PartnerRe	262			Reinsurer offering quota share sidecars	Lorenz sidecar of largest accounts $195mn; global net cat risk Torricelli $67mn		US
Eskatos Capital Management	260			Azimut Group subsidiaries Eskatos and Katarsis Capital Advisors manage and advise the ILS fund respectively	One fund: Eskatos AZ Multistrategy ILS fund; small longevity exposure	2008	Luxembourg
Lutece	250			BTG Pactual Asset Management bought in July 2018 after January 2018 launch by former reinsurance broker Erik Manning and ex-Ariel CFO Angus Ayliffe	Initially a focus on retrocession	2018	Bermuda
Lombard Odier	195	150		Swiss private bank launched ILS fund in 2016	Cat bond funds	2016	Switzerland
Merion Square	150			Joint venture between Rewire Securities and life insurer Vida Capital		2019	US
Leine Investments	150			Reinsurer Hannover Re has seeded the fund with up to $150mn	Cat bonds and collateralised re		
Sussex Capital	102			Sidecar run by Brit Insurance	Writes some business in its own name and takes quota share of Brit portfolios	2018	UK
Tangency Capital	100			Independent manager launched by trio of reinsurance execs	Quota share retrocession portfolio	2018	London
Sumitomo Mitsui Asset Management (Tokyo)	100			Advised by Mitsui Sumitomo Insurance	Diversified, low-risk portfolio with JPY currency hedge	2014	Japan
Tenax Capital	58			Independent asset manager launched UCITS ILS fund in May 2017 with EUR50mn capital	Cat bond funds	2017	London
Eastpoint Asset Management	50			Backed by Japanese manager Asuka Asset Management	Cat bond focus	2012	Bermuda
Mercury Capital	45			Independent manager with seed funding from Lloyd's insurer Ark	ILW tracker fund	2013	Bermuda
Entropics Asset Management	25			Independent ILS manager	ILS	2015	Sweden
Context Insurance Strategies	Not disclosed			Independent firm set up by ex-Magnetar reinsurance execs Andrew Sterge & Pete Vloedman	Sub-adviser to mutual fund investing in liquid ILS and insurance debt/equity	2018	US
IBI ILS Partners	Not disclosed			Joint venture between Roman Muraviev & IBI Investment House		2017	Israel
Solidum Partners	Not disclosed			Independent ILS manager	Cat bond and multi-instrument funds	2004	Switzerland
Total	**94,407**						
Note: This total will include some double-counting of assets as several ILS vehicles are heavily focused on quota share partnerships with reinsurers and are arguably akin to fund-of-funds vehicles. Other reinsurers also take third-party capital via sidecars but if no clear fund management framework in place, these are not included here							
ILS fund of funds							
K2 Advisors	915			Hedge fund of funds manager; $11.6bn AuM	Invests with multiple ILS funds; buys cat bonds directly	2003	US
City National Rochdale	345	45		$45mn held in the firm's Select Strategies ILS fund, which allocates to Iris Re. Another $300mn allocated to other ILS managers		2017	US
ILS Advisers	330			Index tracker fund tracking ILS Advisers index	Fund of funds	2014	Bermuda
GT ILS fund	230			Texas based advisory firm offering ILS fund of funds solution	Securis and others		US
Altair Reinsurance Fund	78			Operated by wealth adviser First Republic Securities	Feeds into Hudson Structured ILS funds	2018	US
AIM Capital	20			Finnish fund of funds manager	AIM Insurance Strategies fund	2011	Finland
Total	**1,918**						
Multi-strategy investors (directly active in ILS; but not offering external strategies)							
Aberdeen Asset Management	41			8% of £427.5mn Diversified Growth fund at end Q1 18; reinvested $33mn in Catco post-loss			UK
AP3	325			Swedish pension fund	$319mn (2.7bn kronor) "other" assets as of year-end 2015		Sweden
Baillie Gifford	500			Scotland-based asset manager; one multi-asset fund invests in ILS – much less active in ILS through 2015 than 2014	Buys ILS directly. Also holds stake in listed ILS funds Catco/DCG Iris		
Blackstone Alternative Asset Management				$266bn asset manager; allocates to Nephila Capital through mutual fund	Blackstone Alternative Multi-Manager Fund		US
BlueMountain Capital	100			$21bn alternatives asset manager; employed Al Selius to manage ILS portfolio		2017	US
BNP Paribas	Not disclosed			Internal ILS fund			
DE Shaw	Not disclosed			Has $40bn+ total AuM; ILS holdings not disclosed	Writes collateralised re/retro	2007	US
Man Group				Invests in cat bonds via Man AHL Evolution Frontier fund			
New Holland Capital	Not disclosed			Hedge fund of funds manager for Dutch fund manager APG			US
Ontario Teachers' Pension Plan	300+			Invests via third-party ILS managers and through internal team	Stakes in DaVinci Re, Catalina	2005	Canada
Quantedge	360			Hedge fund with $1500mn overall AuM	Invests in cat bonds, collateralised re, sidecars, ILWs and cat bonds	2013	US
Tiaa-cref	Not disclosed			Manages $800bn overall AuM	Buys cat bonds directly		US
Total	**1,626**						

Source: *Trading Risk*

COSTLY FIRES DRIVE 2018 TO TOP 5 DISASTER LOSS YEAR

WILDFIRE (CAMP FIRE)
DATE: 8-25.11.2018 **FATALITIES:** 86
COUNTRY/ REGION: United States
OVERALL LOSSES (US$ m): 16,500
INSURED LOSSES (US$ m): 12,500*

FLOOD, LANDSLIDE
DATE: 5-9.7.2018 **FATALITIES: 224**
COUNTRY/ REGION: Japan
OVERALL LOSSES (US$ m): 9,500
INSURED LOSSES (US$ m): 2,400

HURRICANE FLORENCE
DATE: 10-27.9.2018 **FATALITIES:** 53
COUNTRY/ REGION: United States
OVERALL LOSSES (US$ m): 14,500
INSURED LOSSES (US$ m): 5,000*

HURRICANE MICHAEL
DATE: 8-10.10.2018 **FATALITIES:** 45
COUNTRY/ REGION: United States, Cuba
OVERALL LOSSES (US$ m): 16,000
INSURED LOSSES (US$ m): 10,000*

TYPHOON JEBI
DATE: 1-6.9.2018 **FATALITIES:** 17
COUNTRY/ REGION: Japan, Taiwan
OVERALL LOSSES (US$ m): 12,500
INSURED LOSSES (US$ m): 9,000

WILDFIRE (WOOLSEY FIRE)
DATE: 8-22.11.2018 **FATALITIES:** 3
COUNTRY/ REGION: United States
OVERALL LOSSES (US$ m): 5,200
INSURED LOSSES (US$ m): 4,000*

● Highest-ranking insured losses ● Highest-ranking fatalities

* Figures include the loss estimation based on Property Claim Services (PCS)

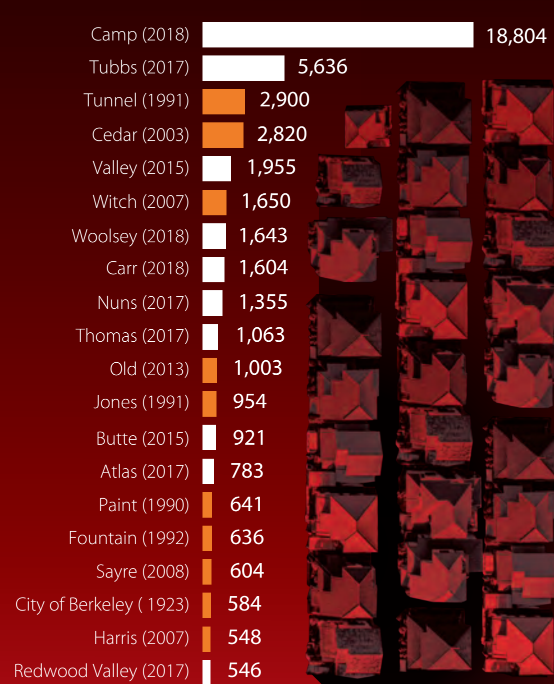
Source: 2019 Münchener Rückversicherungs-Gesellschaft, NatCatSERVICE

Six of the ten most destructive fires on record in the state were registered during a 16-month stretch from July 2017 to November 2018. These six fires alone are estimated to have cost the insurance industry nearly **$32 billion** in claims payouts. California rains have historically begun around October 1; however, in recent years, the rainy season has been delayed by several weeks, Aon noted.

10 MOST DESTRUCTIVE CALIFORNIA WILDFIRES

Source: Reinsurance Market Outlook, Aon

TOP 20 CALIFORNIA WILDFIRES



Source: Aon Impact Forecasting

GLOSSARY OF TERMS

KEY PHRASE	DEFINITION
Aggregate exceedance probability (AEP)	Probability of total annual losses of a particular amount or greater
Alternative risk transfer	Transferring risk through methods other than traditional insurance or reinsurance, for example utilising capital markets capacity through the issuance of insurance-linked securities
Attachment point	The point at which excess insurance or reinsurance protection becomes operative; the retention under an excess reinsurance contract
Attachment probability	Likelihood of losses exceeding the attachment point over the course of a one-year term
Administrator	Assumes all operating and reporting protocols for a special purpose insurer/entity
Basis risk	Risk that losses in a non-indemnity trigger differ from indemnity losses
Capacity	The largest amount accepted on a given risk or, sometimes, the maximum volume of business a company is prepared to accept
Catastrophe bond	Securities that transfer catastrophe risks from sponsors to investors
Cedant	Party to an insurance or reinsurance contract that passes financial obligation for potential losses to another party
Collateralised reinsurance	Reinsurance contract that is fully collateralised to the limit
Earned premium	The portion of premium (paid and receivable) that has been allocated to the (re)insurance company's loss experience, expenses and revenue
Excess of loss	System whereby a (re)insured pays the amount of each claim for each risk up to a limit determined in advance, while the (re)insurer pays the amount of the claim above that limit up to a specified sum
Exhaustion probability	Likelihood of losses exceeding the exhaustion point, causing a full loss on a reinsurance layer
Expected loss	The expected loss is the modelled loss within the layer divided by the layer size
Extension period	Time period after the scheduled maturity used to calculate losses for events which took place during the risk period
Extension spread	Spread paid during the extension period (typically a reduced rate from the initial risk spread)
Gross premiums	Premium before subtracting direct costs
Indemnity trigger	Type of trigger that most closely resembles the traditional market ultimate net loss cover, and offers ceding insurers (a.k.a. sponsors) the ability to recover based on actual losses
Industry loss index trigger	Type of trigger where payouts are determined by a third party estimate of industry losses
Industry loss warranty (ILW)	Form of reinsurance or derivative contract that covers losses arising from the entire insurance industry rather than a company's own losses from a specified event
Incurred losses	The total amount of paid claims and loss reserves associated with events from a particular time period
Insurance-linked security (ILS)	Financial instruments whose value is affected by an insured loss event
Limit	The maximum amount of (re)insurance coverage available under a contract

KEY PHRASE	DEFINITION
Loss ratio	Incurred losses divided by earned premiums (earned premiums include reinstatement premiums)
Modelled loss trigger	Type of trigger where payouts are determined by inputting event parameters into a predetermined and fixed catastrophe model to calculate losses
Net premiums	Premium less direct costs
Quota share	Reinsurance where the cedant transfers a given percentage of every risk within a defined category of business
Occurrence exceedance probability (OEP)	Probability that any single event within a defined period will be of a particular loss size or greater
Parametric trigger	Type of trigger where recoveries are triggered by a formula that uses measured or calculated parameters of an actual catastrophe event (e.g. wind speed, magnitude of an earthquake)
Peril	A specific risk or cause of loss covered by an insurance policy
Probable maximum loss (PML)	The anticipated maximum loss expected on a policy
Profit commission	A provision that provides the cedant a share of the profit from business ceded
Proportional reinsurance	System whereby the reinsurer shares losses in the same proportion as it shares premium and limit
Rate on line	Reinsurance premium divided by reinsurance limit
Reinsurance	A transaction whereby the reinsurer, for a consideration, agrees to indemnify the ceding insurer against all or part of the loss which the insurer may sustain under a policy or policies that it has issued
Reinsurer	Company that provides financial protection to an insurance company
Reset	Adjusting a layer of a multi-year catastrophe bond to maintain a bond's probability of loss at the level defined at issuance
Retention	The net amount of risk the ceding company keeps for its own account
Retrocession	A transaction whereby a reinsurer cedes to another reinsurer all or part of the reinsurance it has previously assumed
Risk period	Time period for which a reinsurance agreement covers events taking place
Sidecar	A structure to allow investors to share in the profits and losses of an insurance or reinsurance book of business
Special purpose insurer/entity (SPI/SPE)	A company created by (but not owned by) a (re)insurer for the purpose of raising capital for a specified programme
Treaty	An agreement between a cedant and a reinsurer stating the types or classes of businesses that the reinsurer will accept from the cedant
Underwriting profit	Earned premium minus incurred losses and incurred commissions (earned premiums include reinstatement premiums)
Variable reset	Adjusting a layer of a multi-year catastrophe bond up or down within a pre-defined range of probability of loss, with a corresponding update in risk spread
Vendor models	Software that estimates expected loss and probability of occurrence for specified exposure sets and predefined peril scenarios. The three largest vendors by market share are AIR Worldwide, Risk Management Services and Eqecat
Written premiums	Premium registered on the books of an insurer or a reinsurer at the time a policy is issued

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