No 1 / 2018
June

PERILS

Dear Reader,

Since our last Newsletter a year ago, we have produced no less than 17 loss reports. These reports covered eight European extratropical cyclones, two earthquake events in Italy, and one tropical cyclone in Australia. In addition, we have updated the PERILS Industry Exposure Database, i.e. the market-wide sums insured exposed to these natural catastrophes.

So, it has been a very busy 12 months. And not just for us, but also for our data providing companies, which we have approached many times to collect event loss and exposure data. We are as ever extremely grateful for their support. Without it we could not succeed in our mission to increase data availability for natural catastrophe insurance and thereby contribute to a better understanding of Cat risk.

The result of our common efforts is a continuously expanding database. This is good news, because natural catastrophe risk cannot be understood based solely on a few headline events. The broader the foundation for risk assessment, the more stable our understanding of such events will become.

This fact is also the reason why we cooperated with the United Kingdom's Met Office to produce a catalogue of European extratropical cyclones covering all significant events since 1979. The catalogue, together with the event loss and sums insured information provided by PERILS, represents a trove of data for actuarial analysis and hands-on results. We present some examples of these results in this Newsletter.

At the same time, we would like to stress that our main task remains to provide comprehensive and clear data to the insurance industry. We do this so that the clever people in the industry can then do clever things with that data. In this sense, what we present in this Newsletter shall merely serve as inspiration to do your own (and better!) analysis with PERILS data.

One example which illustrates the success of this approach is the use of PERILS data in risk transfer products. We provide the base data which the insurance industry can use to create new risk transfer products (see also the transaction stats in this Newsletter). The ultimate result is that there are more mechanisms for managing the financial risk from natural catastrophes.

This and other successes are very rewarding and motivate us to continue to expand into other territories and lines of business where PERILS data can trigger similar positive developments.

In conclusion, we would like to thank you all for your continued support. We are fully aware that without you, these developments would not happen. And if you have any feedback on our Newsletter (in its slightly revised format) we are very happy to hear it.

With my best regards,

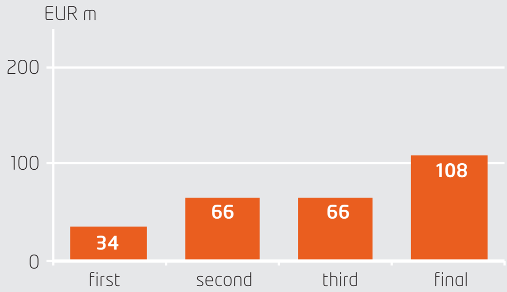
Luzi Hitz, CEO PERILS

Figures & Facts

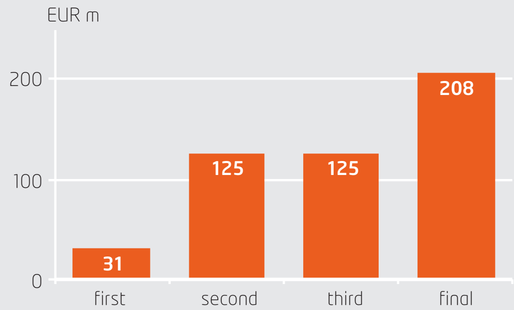
>65	PERILS overall market coverage as measured in % of property market premium
16	number of countries covered: AUS, AUT, BEL, CAN (loss data only), CHE, DEU, DNK, FRA, GBR, IRL, ITA, LUX, NLD, NOR, SWE, TUR
6	number of perils covered: bushfire, earthquake, extratropical and tropical cyclone, flood, hail
9	number of industry exposure databases released since 1 Apr 2010
30	number of captured qualifying events in the PERILS loss database
214	number of event gust footprints in the PERILS-UKMO European winter storm catalogue (more about this in the Special section)
233	number of PERILS-based transactions placed since 1 Jan 2010
33	number of PERILS-based transactions at risk per 31 Dec 2017
USD 14.9bn	total of PERILS-based limits placed since 1 Jan 2010
USD 3.4bn	total of PERILS-based limits at risk per 31 Dec 2017

Cat Events

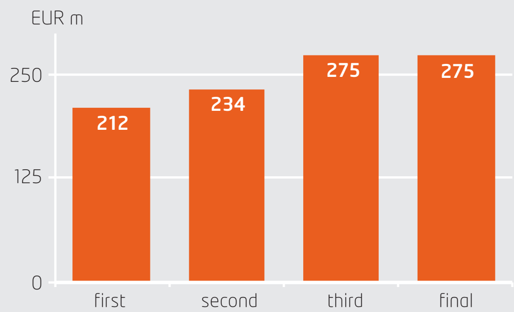
This section provides a summary of qualifying Cat events which have been captured or updated by PERILS since April 2017. It also provides an overview of the European extratropical cyclone activity during the winter 2017/2018.



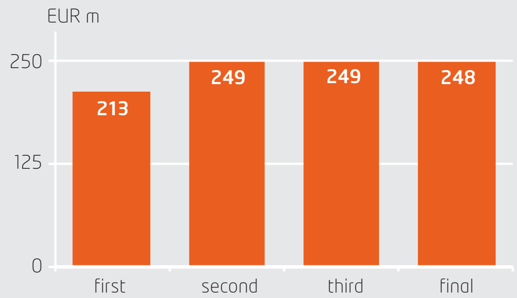
NAME	EARTHQUAKE CENTRAL ITALY
Start to end date	24 Aug 2016
Territories affected	ITA
Description	The Mw 6.0 earthquake had its epicenter near the borders of the Lazio, Marche and Umbria regions. It caused the deaths of 298 people, mainly in the small towns of Amatrice and Accumoli (Rieti province).
Market loss	EUR 108m (per 24 Aug 2017, final)



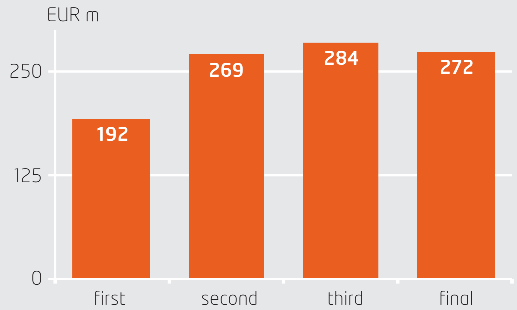
NAME	EARTHQUAKE SERIES CENTRAL ITALY
Start to end date	26 to 30 Oct 2016
Territories affected	ITA
Description	End October 2016 a series of three earthquakes (Mw 5.4, 5.9, and 6.5) affected many of the areas which had been struck by the earthquake from 24 August 2016.
Market loss	EUR 208m (per 26 Oct 2017, final)



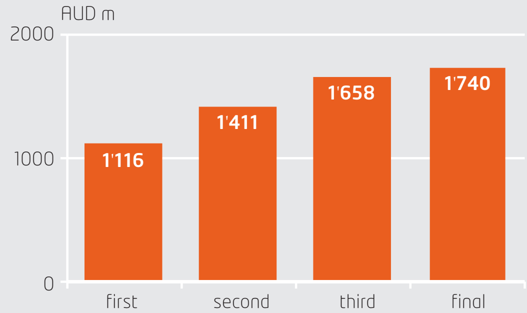
NAME	EXTRATROPICAL CYCLONE EGON
Start to end date	12 to 13 Jan 2017
Territories affected	DEU, FRA
Description	On 12 and 13 January 2017 Egon affected predominantly northern and central France, as well as central and southern Germany. The associated cold front resulted in heavy rain and snowfall.
Market loss	EUR 275m (per 12 Jan 2018, final)



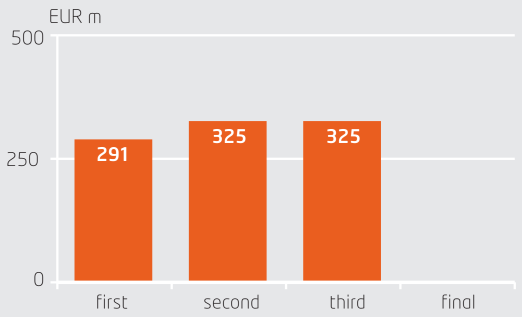
NAME	EXTRATROPICAL CYCLONE THOMAS
Start to end date	23 to 24 Feb 2017
Territories affected	BEL, DEU, GBR, IRL, NLD
Description	After impacting Ireland and the UK on 23 February, Thomas (Doris) moved southeast through Belgium, the Netherlands and Germany. Maximum gust values reached 152km/h over the British Isles in Capel Cruig (Wales).
Market loss	EUR 248m (per 23 Feb 2018, final)



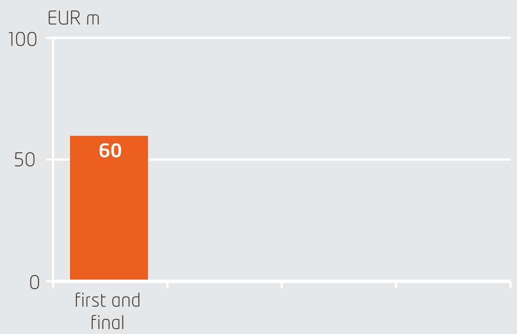
NAME	EXTRATROPICAL CYCLONE ZEUS
Start to end date	6 to 7 Mar 2017
Territories affected	FRA
Description	On 6 and 7 March 2017 Zeus affected a corridor running NW-SE across France, extending from Brittany to Nice. The highest gust value of 193km/h was recorded in Camaret-sur-Mer in Brittany.
Market loss	EUR 272m (per 6 Mar 2018, final)



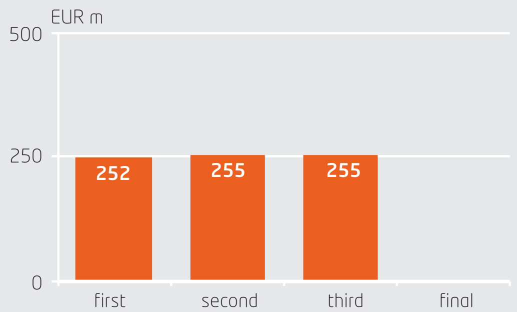
NAME	TROPICAL CYCLONE DEBBIE
Start to end date	28 Mar to early April 2017
Territories affected	AUS
Description	Tropical cyclone Debbie, Cat 4 per the BoM Tropical Cyclone Scale, made landfall on 28 March 2017 near Airlie Beach QLD, Australia. Debbie continued to impact the region into early April and caused significant wind and flood damages across QLD and NSW.
Market loss	AUD 1'740m (per 28 Mar 2018, final)



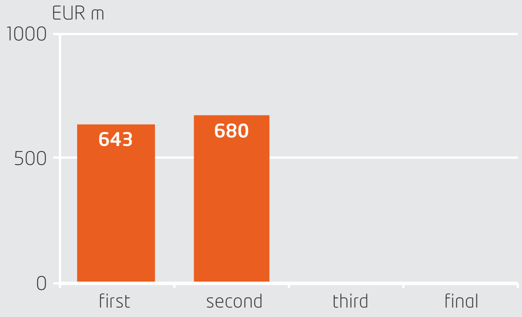
NAME	EXTRATROPICAL CYCLONE XAVIER
Start to end date	5 Oct 2017
Territories affected	DEU
Description	On 5 October 2017, Xavier caused significant damage in the northern half of Germany. Impacts were also felt in Poland and the Czech Republic – territories not covered by PERILS.
Market loss	EUR 325m (per 5 Apr 2018, third loss report)



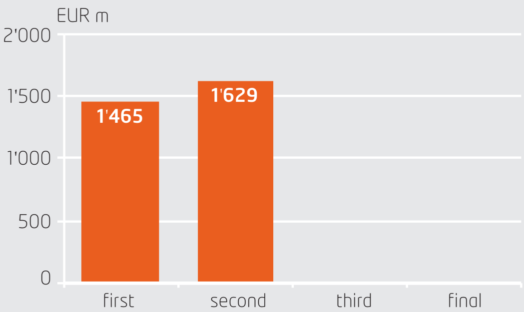
NAME	EXTRATROPICAL CYCLONE OPHELIA
Start to end date	16 to 17 Oct 2017
Territories affected	GBR, IRL
Description	On 16 and 17 October 2017, the remnants of Hurricane Ophelia caused damage across Ireland and the UK. In the aftermath of the event some reports suggested that losses could reach USD 1.8bn (!) in Ireland alone.
Market loss	EUR 60m (per 27 Nov 2017, final)



NAME	EXTRATROPICAL CYCLONE HERWART
Start to end date	29 Oct 2017
Territories affected	AUT, DEU
Description	On 29 October 2017, Herwart caused damage in Austria and Germany. Herwart caused eleven fatalities - one in Denmark, four in Germany, two in Poland and four in the Czech Republic.
Market loss	EUR 255m (per 27 Apr 2018, third loss report)



NAME	EXTRATROPICAL CYCLONE BURGLIND
Start to end date	2 to 3 Jan 2018
Territories affected	AUT, BEL, CHE, DEU, FRA, GBR, IRL, LUX, NLD
Description	On 2 and 3 Jan 2018, Burglind (Eleanor) caused significant damage mainly in France, Switzerland and Germany. Gusts reached 138km/h in Freudenstadt (D) and 125km/h in Zurich (CH).
Market loss	EUR 680m (per 3 Apr 2018, second loss report)



NAME	EXTRATROPICAL CYCLONE FRIEDERIKE
Start to end date	17 to 18 Jan 2018
Territories affected	BEL, DEU, GBR, NLD
Description	On 17 and 18 Jan 2018, Friederike caused significant damage mainly in Germany and The Netherlands. Gusts reached more than 200km/h and there were 12 fatalities. Friederike occurred exactly eleven years after Kyrill (17 Jan 2007) affected a similar area.
Market loss	EUR 1'629m (per 17 Apr 2018, second loss report)

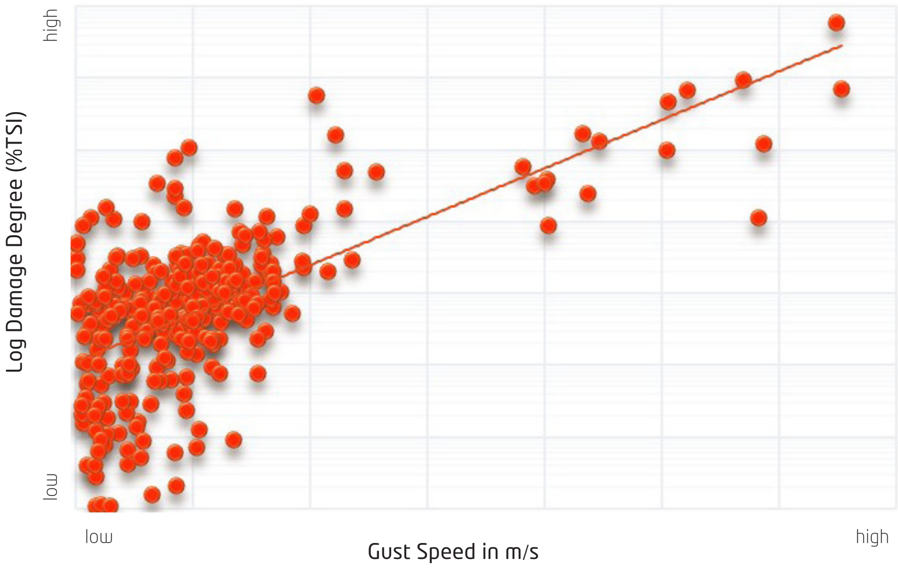


Figure 1, Tropical Cyclone Debbie:
The chart shows Debbie wind losses in terms of percentage of sums insured (vertical axis) versus gust speed (horizontal axis) for the residential property line of business. Each red dot represents the gust value and loss degree per postcode. This kind of damageability information is an essential component of any Cat risk model as it links the physical intensity of events with the insured losses. It can be readily derived from PERILS Industry Exposure and Loss data.

2017/2018 EU Windstorm Season

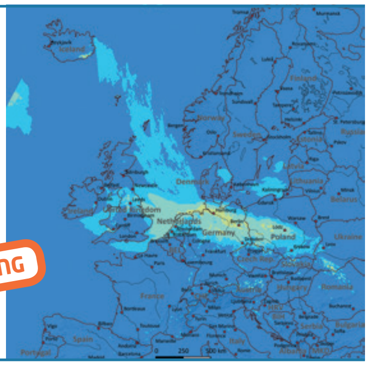
SEBASTIAN (AILEEN)

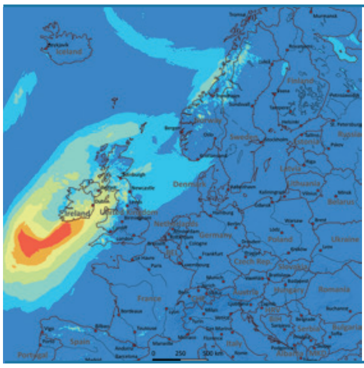
13 - 14 Sep 2017
Industry Loss < EUR 200m
Countries most affected: DEU, NLD

XAVIER

5 Oct 2017
Industry Loss = EUR 325m
(3rd Loss Report)
Country most affected: DEU

QUALIFYING





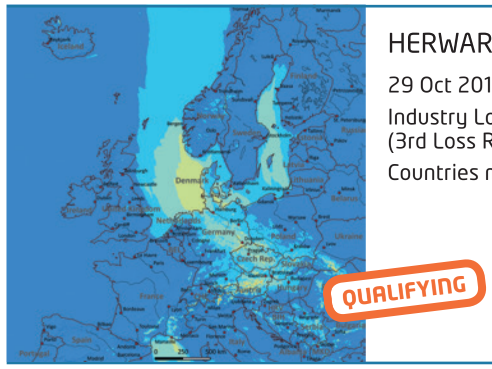
OPHELIA

16 Oct 2017
Industry Loss = EUR 60m
Countries most affected: GBR, IRL

< 80 km/h (<22m/s; <50mph)
80-100 km/h (<22-28m/s; 50-62mph)
100-120 km/h (28-33m/s; 62-75mph)
120-140 km/h (33-39m/s; 75-87mph)
140-160 km/h (39-44m/s; 87-99mph)
160-180 km/h (44-50m/s; 99-112mph)
> 180 km/h (>50m/s; >112mph)

Maximum gust speeds in km/h
Source: ICON-EU, DWD

2017/2018 Europe Windstorm Season



HERWART

29 Oct 2017

Industry Loss = EUR 255m
(3rd Loss Report)

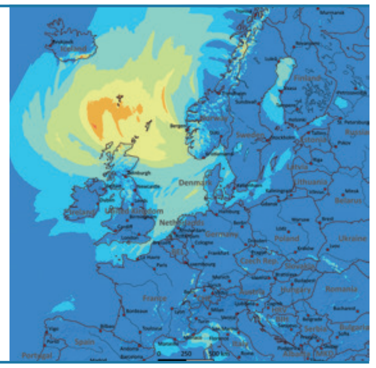
Countries most affected: AUT, DEU

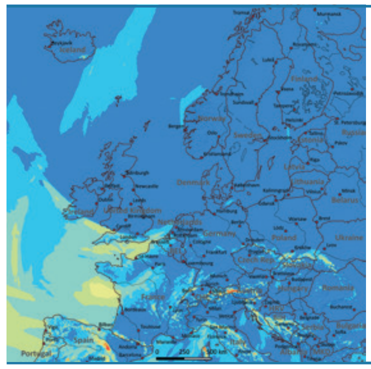
WALTER (CAROLINE)

7-8 Dec 2017

Industry Loss < EUR 200m

Countries most affected: GBR, NOR





XANTHOS-YVES (ANA)

10 Dec 2017

Industry Loss < EUR 200m

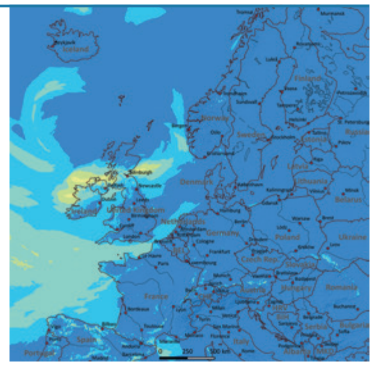
Countries most affected: AUT, BEL, CHE, DEU, FRA

HORST (DYLAN)

31 Dec 2017

Industry Loss < EUR 200m

Countries most affected: GBR, IRL

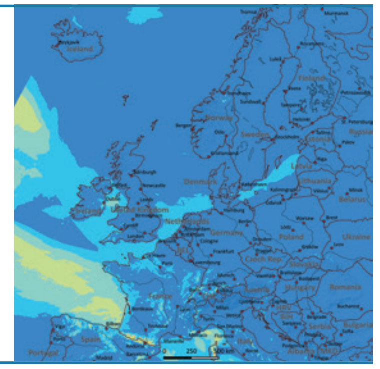


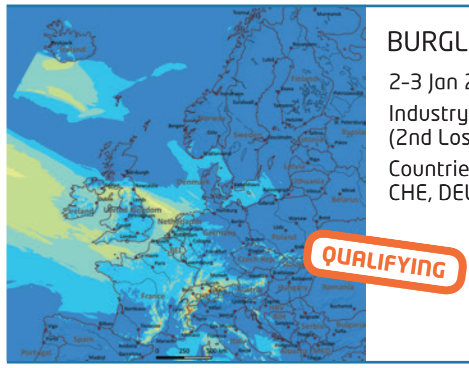
INGMAR (CARMEN)

1 Jan 2018

Industry Loss < EUR 200m

Countries most affected: FRA





BURGLIND (ELEANOR)

2-3 Jan 2018

Industry Loss = EUR 680m
(2nd Loss Report)

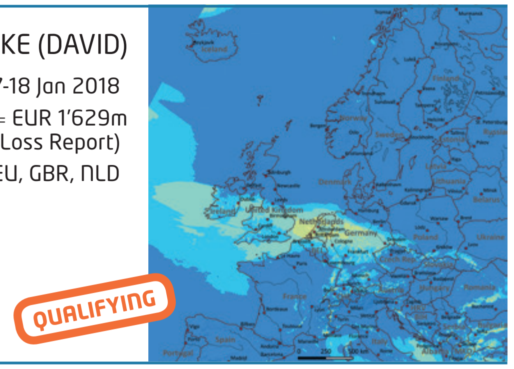
Countries most affected: AUT, BEL, CHE, DEU, FRA, GBR, IRL, LUX, NLD

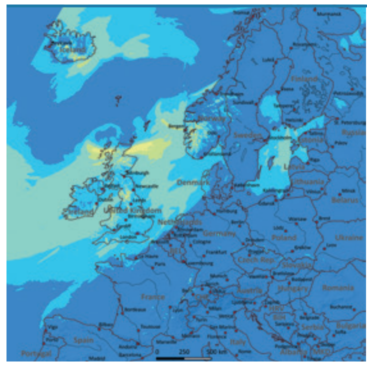
FRIEDERIKE (DAVID)

17-18 Jan 2018

Industry Loss = EUR 1'629m
(2nd Loss Report)

Countries most affected: BEL, DEU, GBR, NLD





HELENE (GEORGINA)

23-24 Jan 2018

Industry Loss < EUR 200m

Countries most affected: GBR, IRL, NOR

PERILS IED 2018

Release of the PERILS Industry Exposure Database 2018. The PERILS IED 2018 contains updated property market sums insured for 15 countries.

PERILS IED 2018	
In force date	1 Jan 2018
Content	– property sums insured – number of policies – information on prevailing limits, deductibles
Resolution	– CRESTA zone – property line of business (residential, commercial, industrial, agricultural) – coverage type (building, content, business interruption)
Methodology	TSI collected from scratch from >100 national and international insurance companies (approx. 67% market coverage) ➔ data anonymization ➔ data validation ➔ data aggregation ➔ extrapolation by CRESTA/LoB to 100% market
Release date	11 April 2018

NATURAL PERILS AND TERRITORIES	
Bushfire, Hail	Australia
Earthquake	Australia, Italy, Turkey
Flood	Australia, Italy, Turkey, United Kingdom
Windstorm	Australia, Austria, Belgium, Denmark, France, Germany, Ireland, Luxembourg, Netherlands, Norway, Sweden, Switzerland, United Kingdom

APPLICATIONS
– market share analysis – natural catastrophe model validation – structuring and risk assessment of risk transfer products (Cat bonds, ILW) – and more

Aggregate Exposure Data - Earthquake Turkey - in National Currency Low-Resolution CRESTA Format									
					Total Sum Insured per Coverage			% in TSI	
CRESTA ID		Property LOB		Number of Risks	Buildings Value	Contents Value	BI Value	Loss Limits	Deductibles
TUR_01	Adana	COMMERCIAL	TRY	22'256	9,517'882'266	15'798'117'613	1'715'820'763	99.00%	2.70%
TUR_01	Adana	RESIDENTIAL	TRY	209'632	15'998'989'905	1'003'390'450	6'062'348	99.00%	2.00%
TUR_02	Adiyaman	COMMERCIAL	TRY	1'596	1'112'482'228	1'027'467'451	108'043'878	99.00%	2.70%
TUR_02	Adiyaman	RESIDENTIAL	TRY	32'119	2'538'905'677	76'566'101	69'657	99.00%	2.00%
TUR_03	Afyonkarahisar	COMMERCIAL	TRY	3'881	2'462'146'074	3'408'333'660	138'092'024	99.00%	2.70%
TUR_03	Afyonkarahisar	RESIDENTIAL	TRY	59'961	4'008'230'553	189'496'222	96'479	99.00%	2.00%
TUR_04	Agri	COMMERCIAL	TRY	1'104	230'300'363	320'655'469	14'293'970	99.00%	2.70%
TUR_04	Agri	RESIDENTIAL	TRY	13'971	957'471'314	14'843'551	13'303	99.00%	2.00%

Table 1, IED Turkey 2018: *The table shows an extract of the updated Industry Exposure Database 2018 for Earthquake Turkey. The IED is updated annually which ensures that the quality of the database is continuously enhanced. Subscribers to the PERILS database have access to the data at full granularity: per CRESTA zone, per property line of business and per coverage type.*

PERILS Transaction Statistics

PERILS industry exposure and loss data are used for the risk assessment and as triggers of industry-loss-based risk transfer products. Transaction forms include Cat Bonds (144A ILS), Industry Loss Warranty (ILW), or Risk Swaps.

PERILS-based Risk Transfer per 31 December 2017	
Limits at Risk, total	Total: USD 3'425m ILW: USD 787m (23%) ILS (Cat Bonds 144A): USD 2'638m (77%)
Geography[1]	Europe: USD 3'334m Australia: USD 1'546m Turkey: USD 227m
No. of Transactions at Risk	Total: 33 ILW: 26 ILS: 7
Average Transaction Size	ILW: USD 30m ILS: USD 377m
% Limits with Structured Triggers[2]	92%
Retrocession vs. Reinsurance	Retrocession: USD 3'194m (93%) Reinsurance: USD 231m (7%);
Placed via Broker vs. Direct	Broker: USD 3'120m (91%) Direct: USD 305m (9%);
Total issued since 1 Jan 2010	USD 14'867m
Total no. of Transactions since 1 Jan 2010	233

1: per end March there were USD 45m exposed to Canada
2: % limits with CRESTA-, country-, and/or LOB-weighted triggers

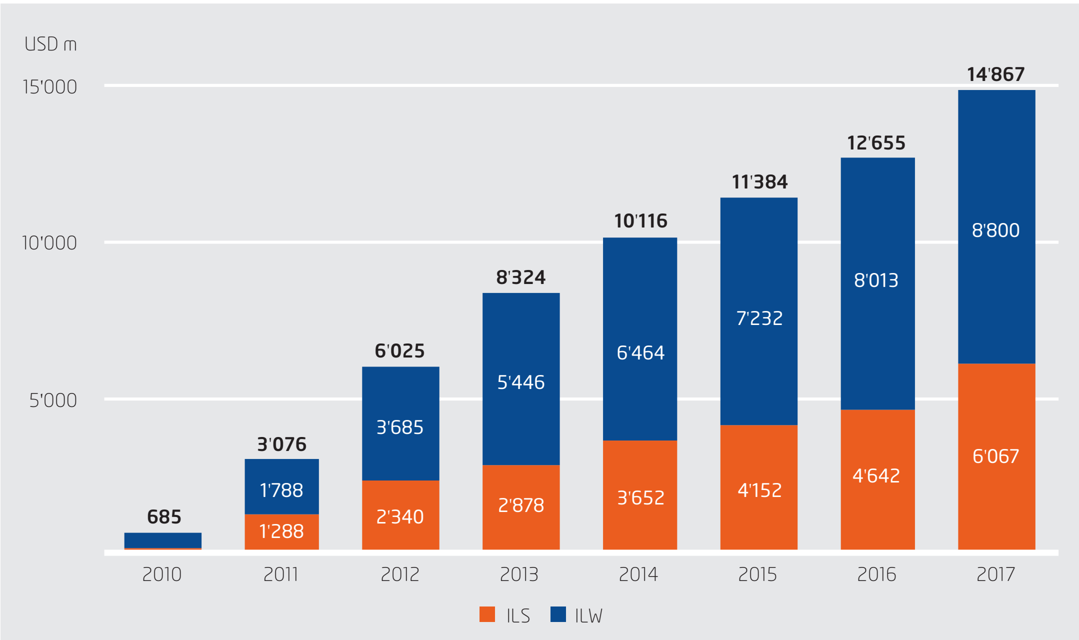


Figure 2, Aggregated PERILS-based Limits per 31 Dec, in USD m: *On a cumulative basis, PERILS data have facilitated close to USD 15bn in Cat risk capital. It is a good example of how increased data availability benefits the risk transfer market.*

PERILS-UKMO Storm Catalogue

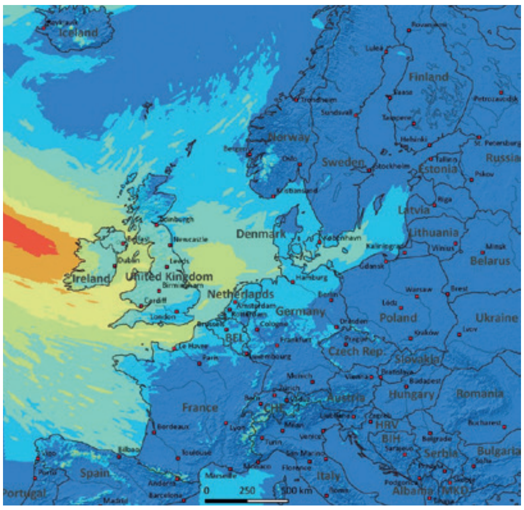
Learning from history –
Release of gust footprints of 214 European Extratropical Cyclones since 1979.

Extratropical cyclones pose one of the biggest threats to the European insurance industry. Losses resulting from these windstorms can reach billions of Euros. It is therefore vital to gain a better understanding of the frequency and severity of such events.

PERILS started to systematically collect loss information from European windstorms in 2009. Since then, we have captured more than 20 events, each causing insured property damage of EUR 200m or more. This data set forms a solid base from which to build a better understanding of the relationship between windstorm strength and insured losses.

However, the time period since 2009 is too short to derive any reliable conclusions about the frequency of damaging European windstorms, especially for large and consequently rarer events.

This is why PERILS worked with the UK Met Office (UKMO) to compile a catalogue of European Windstorms covering the period since 1979. This catalogue contains the wind gusts of more than 200 significant events affecting Europe (Figure 3 depicts Windstorm "Undine" of 4-6 January 1991). It forms an ideal platform upon which to extend the PERILS database further back in time and develop new insights into the frequency / severity distribution of losses caused by European extratropical cyclones.



< 80 km/h (<22m/s; <50mph)
80-100 km/h (<22-28m/s; 50-62mph)
100-120 km/h (28-33m/s; 62-75mph)
120-140 km/h (33-39m/s; 75-87mph)
140-160 km/h (39-44m/s; 87-99mph)
160-180 km/h (44-50m/s; 99-112mph)
> 180 km/h (>50m/s; >112mph)

Figure 3, Windstorm "Undine" (4-6 January 1991): *Undine is one of the events contained within the PERILS-UKMO Windstorm Catalogue. The catalogue covers all of the European windstorm seasons since 1979/1980. It contains gust speed information for more than 200 individual events.*

To conduct this analysis, the historical wind speed information needs first to be translated into insured losses. One can readily do this by deriving the relationship between insured losses and gust speeds from the 20+ events where PERILS has collected the loss foot-print data. For each event a damageability function can be generated which relates the observed damage as a percentage of insured values to the gust speeds (Figure 4a). These damage-ability functions can then be tested by applying them to the entire set of the 20+ historic wind fields, i.e. replacing the gust values with the corresponding damage degrees and applying these damage degrees to the insured values.

The result is a modelled loss footprint which can be compared to the actual loss footprint collected by PERILS. Further refinement can be made to the vulnerability function until a satisfactory fit is found for all events where PERILS provided loss data. Equipped with such a scenario loss model (Figure 4b), the PERILS-UKMO windstorm catalogue can then be run for a given portfolio of insured values.

By conducting this exercise using the PERILS Market Exposure 2018, we have been able to derive the event losses of the past 39 wind-storm seasons (79/80 to 17/18) as if they would affect today's insured values (Figure 4c).

a: Vulnerability Assessment

b: Scenario Loss Model

c: Modelled Loss History

Figure 4, Conversion of the PERILS-UKMO Windstorm Catalogue into a 39-year event loss history as-if-2018:
The first step involves assessing the vulnerability using the PERILS Industry Exposure & Loss DB and PERILS-UKMO gust speed data. Next, the gust speed information for each event is run through a scenario loss model with the PERILS Industry Exposure 2018 while also using the vulnerability functions derived from step 1. This procedure is repeated for all events in the catalogue resulting in an event loss history as-if-2018 for the past 39 windstorm seasons.

What are the key findings of this loss history for European extratropical cyclones?

The biggest single event loss is from windstorm Lothar which occurred in December 1999 and which would have resulted in a loss of EUR 9.9bn if it occurred today. The worst season is 1989/1990 with a total loss burden of EUR 19.2bn, primarily from windstorms Daria, Herta, Judith, Vivian and Wiebke. The most benign season is 2012/2013, with total losses below EUR 100m. The average annual loss costs are EUR 2.6bn, translating to approximately 0.0048% of insured values. There are 39 events which exceed a EUR 510m loss level implying that this loss level is reached or exceeded on average once a year (see Table 2). These numbers comprise the following countries: Austria, Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway, Sweden, Switzerland and the United Kingdom. The equivalent information per country is available on request.

How Often, How Severe?

A list of 'as-if-2018' event losses from the last 39 windstorm seasons provides a perfect dataset for an insurance actuary.

Most loss histories follow a certain pattern which can be estimated using a distribution function such as Pareto or Lognormal to name just a few. By doing this and combining the loss distribution with the excess frequency for a defined loss threshold, it is possible to replace the staircase pattern of losses with a smooth curve. This curve then represents what is generally referred to as an exceedance-probability or EP curve in the Cat model jargon. It allows you to determine the return periods of loss levels and to calculate the average annual loss burden.

We have conducted this exercise and generated the results shown in Table 3. We used modelled losses up to a return period of around 20 years and the average shape of the EP curves from four vendor models to extrapolate our findings up to the 50-year return period.

PERILS-UKMO Key Findings as-if-2018	
Largest Single Event	Windstorm "Lothar", EUR 9.9bn
Worst Season	1989/1990, EUR 19.2bn
Most Benign Season	2012/2013, below EUR 100m
Average Annual Loss Costs	EUR 2.6bn
Average Annual Loss Costs in % TSI	0.0048%
Event Loss Level Reached or Exceed Once a Year	EUR 510m

Table 2: *Key findings of the past 39 windstorm seasons as if they would affect today's insured property values in Europe.*

Windstorm Property Occurrence Market Loss in EUR bn (forex as of 1 Jan 2018)							
Return Period	DEU	FRA	GBR-IRL	DNK-NOR-SWE	BEL-NLD-LUX	AUT-CHE	ALL
1 year	0.2	0.1	0.1	< 0.1	< 0.1	< 0.1	0.5
5 years	0.9	0.6	0.4	0.2	0.3	0.1	3.2
10 years	1.6	1.5	0.9	0.5	0.7	0.3	5.5
25 years	2.9	3.2	1.9	0.9	1.6	0.6	9.7
50 years	4.4	5.1	3.6	1.5	2.8	1.0	14.6

Table 3, Market loss levels in billion Euros to be reached or exceeded at a given return period: *By using actuarial loss fitting based on the 'as-if-today' event loss history for the past 39 windstorm seasons, the loss levels to be reached or exceeded at pre-defined return periods can be estimated.*

It is important to note that every actuary / Cat modeller will come up with different modelled losses from the PERILS-UKMO Catalogue, and will likely apply different loss fitting techniques and extrapolation methods. As a consequence, the results might be quite different. We therefore strongly recommend that you conduct your own analysis of the provided information to truly "own" the results.

Testing Probabilistic Vendor Models

For Europe, there are at least four probabilistic vendor models available to assess the risk from extratropical cyclones. While these models are largely based on similar science and methodologies, the results can vary significantly from one model to another. This begs the question, which model is best suited for a given territory?

Models are often validated by modelling an individual historic event and comparing the modelled loss with the indexed historic loss. This method ignores the occurrence probability of the event, which is all important for pricing and the determination of adequate reinsurance cover.

A better way to test catastrophe models is therefore to run a large number of scenario losses of which the occurrence probability can be determined from the time period covered by these events. This corresponds precisely to the approach which we described earlier. The resulting EP curve can then be compared with the EP curves of the vendor models.

This allows you to develop your own view on which model fits best based on the insight gained from the loss activity of the past, and hence which model is best suited to assess the risk from European windstorms in a given territory. We have conducted the comparison for the territories shown in Table 3 and use the example of France to illustrate the results.

The left-hand chart in Figure 5 shows four vendor model EP curves for France. They are roughly grouped into two sets, one which is more conservative (e.g. a 50-year loss of around EUR 7bn) and one which is more optimistic (a 50-year loss of just above EUR 4-5bn).

When looking at the horizontal axis the differences are even more extreme, namely a EUR 4bn market loss reached or exceeded every 18 years in the most conservative view versus once every 42 years in the most optimistic view. For reinsurance pricing purposes (catastrophe excess of loss treaties), these are dramatic differences. In one model, the attachment probability of a layer in excess of EUR 4bn is 5.6% whereas in the other it is 2.3%. It is therefore vital to have a means of determining which model is more appropriate.

The right-hand chart in Figure 5 shows the same vendor model EP curves with the EP curve derived from the PERILS-UKMO Catalogue superimposed. Using the latter measure, it seems that the more optimistic models tally better with the loss history of the past 39 years.

It is noteworthy that over all territories considered, there is no systematic deviation for a given vendor model. Some are more conservative in one territory while more optimistic in others. Over Europe as a whole, the models therefore show fewer differences and compare rather well with the 39-year loss history.

But are historical loss records, even if corrected for exposure growth, really suitable for model validation given the fact that the climate is changing? In the final section, we try to answer this question.

European Windstorms and Climate Change

It is a fact that the atmosphere is heating up and that the climate is changing. It is a question of probabilities as to what extent this is linked to human activity and how it affects the weather pattern. The latter is unfortunately exploited by politicians who often fixate on one side of the probability spectrum and push their agendas accordingly.

An alternative is to adopt the all-encompassing position "nobody really knows", which is a fair statement, but it applies to any probability-linked outcome and has nothing to do with prudent risk management.

Looking at the loss history of the past 39 European windstorm seasons, corrected for exposure growth, is likely inadequate

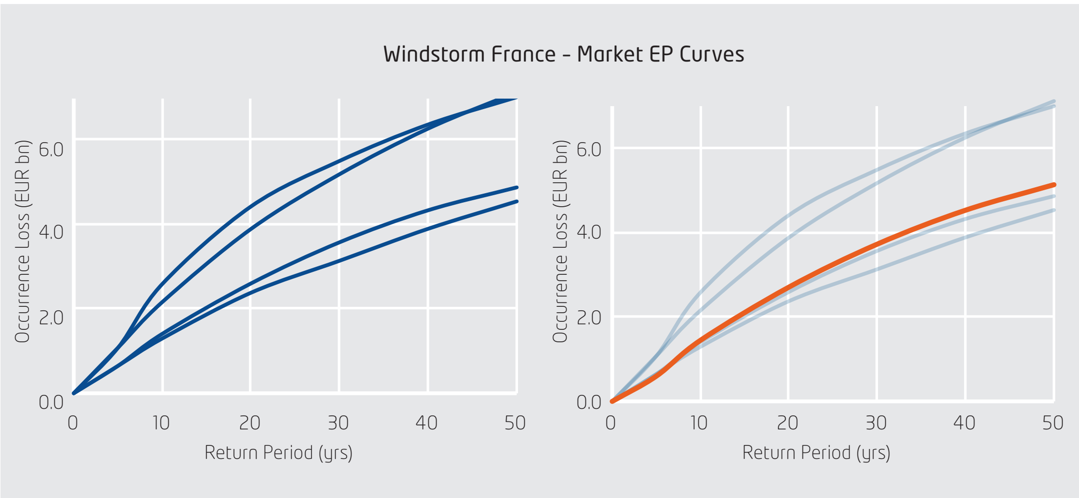


Figure 5, Vendor model testing using the PERILS-UKMO Windstorm Catalogue: *The left-hand chart shows the exceedance-probability curves (EP curves) of four vendor models for the French property insurance market. The right-hand chart shows the same EP curves with the EP curve derived from the PERILS-UKMO Catalogue superimposed.*

to bring decisive clarity to the discussion. The time period is short and loss trends can be heavily influenced by statistical outliers. But it can be seen as a first step (an early indicator) and with each additional year, the frequency and severity trends of losses should become statistically more viable.

When filtering for windstorm event losses in excess of EUR 200m (on average 2.5 per year), and testing sensitivity by analysing three different time series, namely (1) all seasons, (2) all seasons but excluding 1989/1990 as an outlier, and (3) all season but excluding seasons 1989/1990 and 1999/2000 as outliers, the following observations can be made (Figure 6).

Aggregate Loss per Year: If we include all seasons, the linear trend of the annual lost costs is downwards. Leaving out the 1989/1990 season reverses this trend to slightly upwards. The slight upwards trend remains when leaving out both, seasons 1989/1990 and 1999/2000. This illustrates that the all-seasons trend is very much driven by the 1989/1990 season.

Average Event Loss per Year: If we include all seasons, the linear trend of the average event loss in excess of EUR 200m is slightly upwards. This slight upwards trend is accentuated in the two time series which exclude season 1989/1990, and seasons 1989/1990 and 1999/2000, respectively.

Number of Events per Year: In all three time series, the linear trend over time of the yearly event frequency is downwards.

In summary, if one considers all past 39 windstorms seasons, the trend is towards lower annual loss costs driven by lower annual event frequency. If one considers the time series excluding season 1989/1990, or excluding seasons 1989/1990 and 1999/2000, the trend is towards slightly higher annual loss costs driven by increasing event severity at decreasing event frequency. Many of the observed trends are, however, rather weak and therefore sensitive to extreme values.

Climate change models for the 21st century generally predict a northward shift of the extratropical cyclone tracks and a decrease in the number of storms (medium confidence). Changes in storm intensity are less well understood and forecasts show a large range of outcomes dependent on the particular geographical region.

Which leads us to the conclusion that given the rather uncertain trends in loss patterns and the range of the predicted effects of climate change on extratropical cyclones, one can neither deny nor conclude that the loss trend of European windstorms over the past 39 years is closely linked to climate change.

Catastrophe losses are by definition rare events. A 39-year time period is therefore likely to be too short to depict reliable loss trends. The longer the time period considered, the more robust the statistical conclusion will become. Which leaves us at PERILS with a clear reason to continue our work as a loss and exposure aggregator for natural catastrophe events, so that one day we will have a much clearer understanding than we have today.

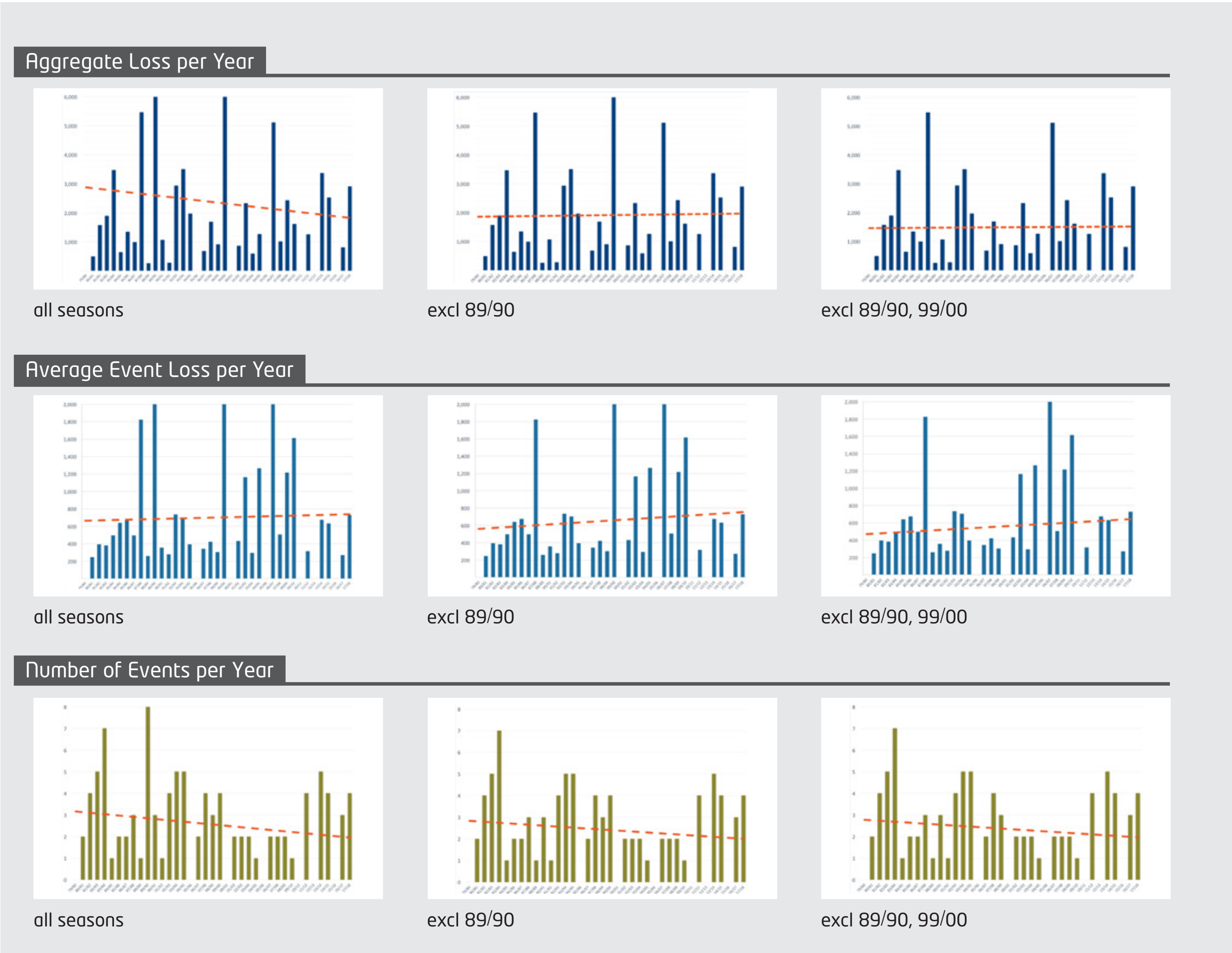


Figure 6, Loss trends for three time series: *When filtering for windstorm event losses in excess of EUR 200m (on average 2.5 per year), and analysing (1) all seasons, (2) all seasons but excluding 1989/1990 as an outlier, and (3) all season but excluding seasons 1989/1990 and 1999/2000 as outliers, the above trend observations for the aggregate loss per year (top row), average event loss per year (middle row), and the number of events per year (bottom row) can be made.*

Outlook

The outlook is for busy times ahead. We will produce the detailed loss footprints of windstorms Friederike and Burglind. This should result in very interesting new insights into the damageabi-lity of insured properties at very high wind speeds, in particular for Germany, Holland, and Switzerland.

We will also produce an update of Wind-Jeannie, our real-time loss forecasting platform for European windstorms, while at the same time working on a beta-version for Wind-Jeannie Australia.

In addition, we will be undertaking a series of new projects, including the potential addition of new territories, as well as the possible introduction of a new line of business to be covered by PERILS. We will provide more concrete information once we are sure we can deliver.

As mentioned, there are busy times ahead – but we don't mind, because we like what we do.

We thank all of you for your continued support and welcome any feedback you may have on the issues and points we have raised in this issue, or more generally on the work that we do.

With our very best regards,

Your PERILS Team

Zurich, June 2018