

JBA UK FLOOD MODEL EXECUTIVE BRIEFING.

Background

In the UK, one in five properties are at risk to flood and annual economic losses are estimated to be in the region of £500 million. In only 3 months, Storms Desmond, Eva and Frank generated £1.3 billion of insured losses alone (ABI, 2016¹), and the cost of flood is expected to increase across most of the UK under future climate scenarios.

As a global leader in flood risk management, we are continually investing in maps and models to bring the latest science and data to the forefront of flood risk management practices. This latest update to the JBA UK Flood Model provides a high-resolution model for assessing river, surface water and coastal flooding across the UK².

Competitive pricing through high-resolution analysis

Technological advances have enabled high-resolution model analysis on a national scale. Flood hazard intensity, and therefore loss, varies significantly over small spatial scales.

Portfolio analysis is now able to take full advantage of high-resolution hazard data, enabling better differentiation between adjacent risks. This creates a more accurate risk assessment while reducing model uncertainty.

Our UK Flood Model is underpinned by our market-leading 5m UK Flood Map, utilised by a large majority of UK insurers for risk selection and pricing.

The high-resolution model provides a breakthrough for flood risk assessment in the industry by enabling hazard analysis at building level. As illustrated in Figure 1, surface water flooding tends to be channelled along roads and pools in natural depressions, with

HIGHLIGHTS.

Consistent view of risk across entire risk transfer chain

Competitive pricing through high-resolution analysis

Realistic loss simulation

Results validated by stress testing and benchmarking against historic events

Climate change variant for proactive portfolio management

flood depths typically shallower at building locations. To account for this, our UK Flood Model only considers the flood water that directly impacts properties. This avoids inflated losses that are typically found with lower resolution analyses when deeper channelled flood water is taken into account.

Control the cost with advanced modelling techniques

Our UK Flood Model explicitly captures the extent and depth of flooding through advanced 2D modelling techniques, ensuring your risk assessment is complete.

The stochastic event set in the model simulates an average of 10.6 events per year and correlates all sources of flood risk, from river and surface water to coastal flood. The event set includes small, localised events to help account for attritional losses, the cost of which can be significant over the course of a year.

Events are modelled using a continuous rainfall simulation, capturing previous conditions where prolonged rainfall may cause the ground to become saturated. Seasonal changes in event type and severity are taken into account so that summer downpours are captured alongside winter storms.

¹ Association of British Insurers (2016) "<https://www.abi.org.uk/news/news-articles/2016/01/new-figures-reveal-scale-of-insurance-response-after-recent-floods/>"

² Excluding Isle of Man and Channel Islands

Figure 1



Realistic loss simulation

To realistically represent flood risk, extensive defence data from national authorities are meticulously incorporated with defence standards of protection.

During a flood event in the UK, flood defence structures may overtop. The model uses a sophisticated algorithm to account for this. Using an overtopping approach for realistic loss calculation is significant in the UK where 35% of properties at risk from flooding benefit from river defences.

The model captures uncertainty and ensures confidence in capital allocation and reinsurance pricing by calculating losses at the lowest possible level for every location, event, flood type and coverage.

MODEL FEATURES.

Correlation of river, surface water and coastal flood

Building level analysis

Seasonal changes in event type, frequency and severity

All UK coasts modelled for coastal flooding

Extensive defence data with sophisticated overtopping approach

Residential, commercial, industrial, agricultural and motor lines of business

The individual components of the model are validated against independent data sources, and the overall loss is validated against market loss estimates. A catalogue of the most significant flood events from the last two decades is included in the model which offers the opportunity for model evaluation against claims experience and portfolio stress testing for adequate capital allocation.

Historic events included in the model:

- **North Sea storm surge 1953**
- **Easter 1998**
- **Autumn 2000**
- **May 2007**
- **June 2007**
- **July 2007**
- **Xaver 2013**
- **Thames Valley 2014**
- **Storms Desmond, Eva and Frank 2015/2016**

Considering climate change for proactive portfolio management

In addition, JBA has developed a UK Climate Change Flood Model, offering a unique opportunity to assess the potential future impact of climate change on portfolios. This pioneering model provides an indication of loss estimates in 2040 under a realistic warming scenario.

Climate science, by its nature, is uncertain, in both climate projections and the realisation of global commitments to limit warming. With this in mind, JBA has selected a scenario that offers one possible future outcome for use in the UK Climate Change Flood Model. Aimed to provide a realistic view, it reflects warming consistent with a 2°C increase in global temperatures by 2100, in line with the Paris Agreement's long-term temperature goals set at COP21 in 2015.

To develop this model, climate change allowances available from the UK Climate Change Risk Assessment 2017 and UK Climate Projections 2009 are applied to the JBA UK Flood Event Set to adjust the hazard intensity of events. Each event in the stochastic event set is defined in terms of the return period of the hazard intensity (of river flow, rainfall or sea level) at all affected gauges. The allowances denote the expected change in river flow, rainfall and sea level under the chosen scenario and are used to adjust the return period of river, surface water and

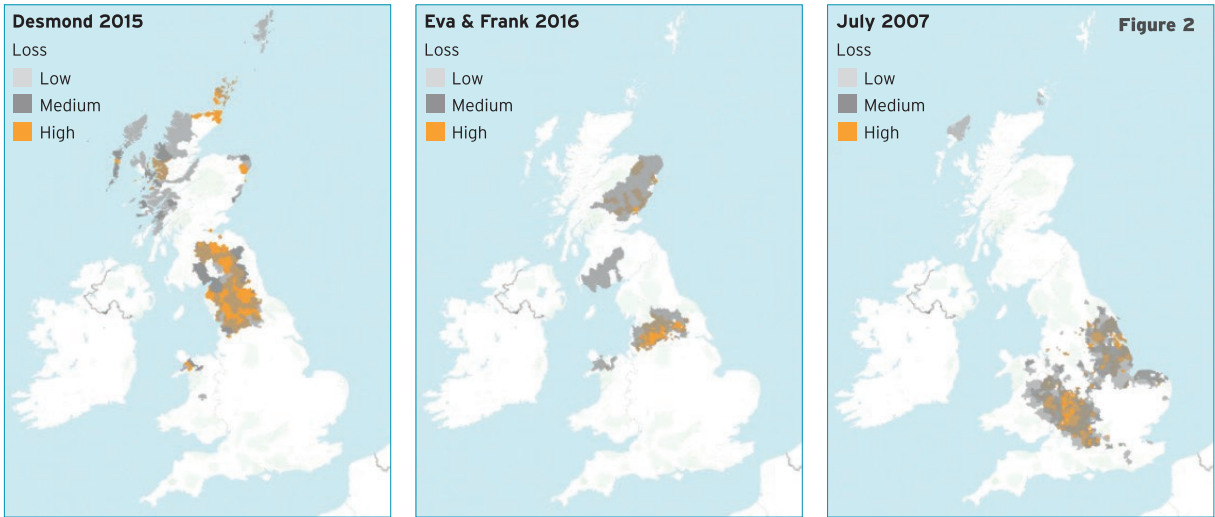


Figure 2

coastal flooding, respectively. The impact on events varies geographically - 200-year events are up to five times more severe in 2040 than 2018 across most of the UK, but up to two times less severe in the south-east.

The model enables users to understand the magnitude of change in flood risk associated with a realistic climate change scenario and identify areas which may be more or less susceptible to flooding under a warmer climate. Losses from the climate change model will aid proactive management of portfolios most susceptible to climate change-induced

flood risk, allowing for the future planning of portfolio diversification to less susceptible areas.

To quantify the potential impacts of climate change against present-day losses, the JBA UK Climate Change Flood Model is used in conjunction with our UK Flood Model.

Model access

The UK Flood Model and the UK Climate Change Flood Model can be accessed via portfolio analysis services provided by JBA, or our catastrophe modelling platform, JCalf®.

The models can also be accessed via ELEMENTS, Oasis and ModEx.

About JBA Risk Management Limited

Established in 2011, we are a global leader in flood risk management. Affectionately known as The Flood People, our flood maps, catastrophe models and analytics are used by some of the world's largest insurers, reinsurers, financial institutions, property companies and governments. We're experts in translating complex, scientific data into useful information, using sophisticated hydraulic approaches and models to provide cutting-edge flood risk intelligence.

As part of the JBA group established over 20 years ago, we work closely with leading academic institutions in the field of flood risk. We also support our independent charity, JBA Trust, which enables research, education and training in the water environment sector.

Our commitment to continuous improvement and detailed research and development is what makes us the number one choice for many insurers, reinsurers, financial institutions and governments.

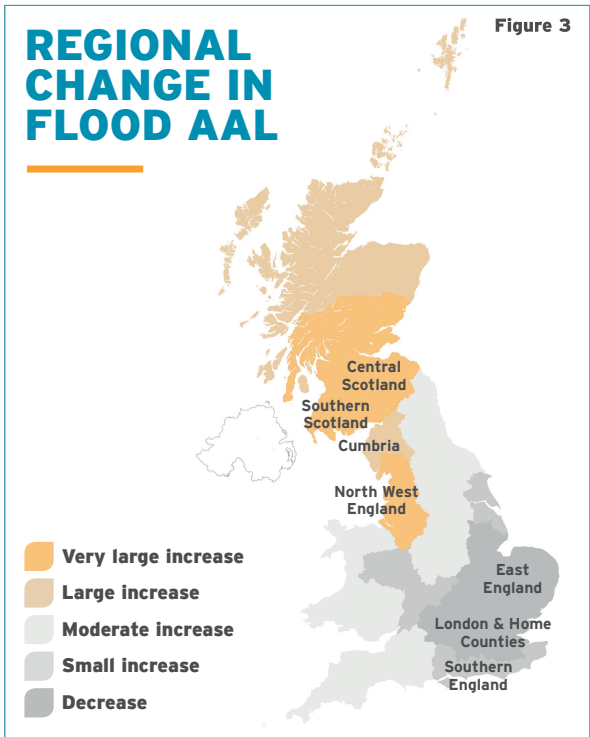


Figure 3

GLOBAL LEADERS IN FLOOD RISK MANAGEMENT.

Get in touch

hello@jbarisk.com

UK

+44 1756 799919

USA

+1 510 585 8401

EUROPE

+49 8092 2326756

SINGAPORE

+65 968 62 968

www.jbarisk.com

@jbarisk

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