FloodAUS

Risk Rating Data

FloodAUS risk ratings enable insurers to:

- Assess flood risk by individual address, street, postcode or urban area
- Manage portfolio risk
- Estimate potential portfolio losses

FloodAUS risk ratings provide estimates of the Average Recurrence Interval of flooding at ground level (GL), 1 metre above ground level, and 2 metres above ground level.

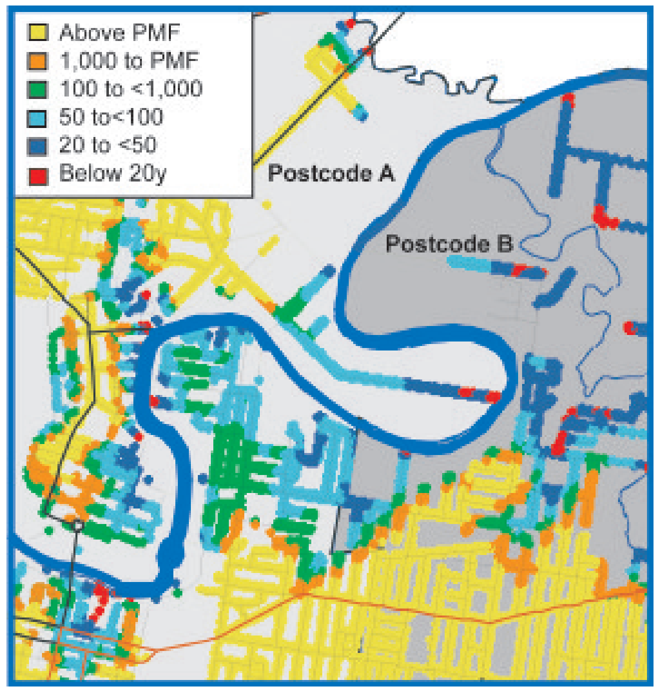
FloodAUS is a GIS-based risk assessment methodology developed by Risk Frontiers to estimate mainstream flood risk address-by-address using:

- Best quality digital terrain models
- Flood surfaces from the most recently available flood studies
- Proprietary street address databases

FloodAUS coverage:

- 29 urban areas
- 196 postcodes
- 1.3 million addresses

FloodAUS risk ratings may be purchased by postcode or urban area. Alternatively, Risk Frontiers offers a consulting service to analyse company portfolios. Risk Frontiers can extract maximum benefit from the data to quantify the flood risk for your portfolio.



Spatial distribution of address risk ratings

Locations of the 29 urban areas with FloodAUS risk ratings

Address	Postcode	River	ARI		
			GL	GL+1m	GL+2m
4 Which St	4999	Blue River	10001	10001	10001
6 Which St	4999	Blue River	10001	10001	10001
8 Which St	4999	Blue River	6314	10001	10001
10 Which St	4999	Blue River	2185	3925	5132
12 Which St	4999	Blue River	1108	1826	3704
14 Which St	4999	Blue River	801	1119	1856
16 Which St	4999	Blue River	736	996	1542
1 That St	4999	Blue River	301	596	887
3 That St	4999	Blue River	164	224	355
5 That St	4999	Blue River	126	159	215
7 That St	4999	Blue River	74	128	163
9 That St	4999	Blue River	50	73	128
11 That St	4999	Blue River	38	49	71

Sample FloodAUS database

Email riskfrontiers@els.mq.edu.au for data prices and quotes for consulting services.

- Risk Frontiers sponsors are eligible for substantial discounts
- Single purchases of data from more than four areas attract a discount

For further information about **FloodAUS** check out the Risk Frontiers website:
http://www.es.mq.edu.au/NHRC

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Return on investment in *FloodAUS* for managing flood risk

This Issue

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In this article we examine the financial benefits of using *FloodAUS* data to facilitate the introduction and provision of household flood insurance, and demonstrate that it is a very good investment indeed. Investing in *FloodAUS* data to introduce flood insurance in an informed manner yields strongly positive Net Present Values and large Benefit Cost Ratios. We also identify the range of outcomes that are possible depending on: firstly the spatial make-up of the portfolio, and secondly, the extent to which the portfolio is modified to reduce the number of high-risk policies.

Risk Frontiers' *FloodAUS* data provide flood risk ratings on an individual street address basis for about 1.3 million street addresses in 29 catchments in the eastern states of Australia (see RFQN Volume 1 Issue 4 and Volume 2 Issue 1 for further details). The risk ratings are expressed as the average recurrence interval, in years, of flooding at ground level and one metre and two metres above ground. *FloodAUS* data can help insurers:

- Quantify their flood exposure
- Manage the introduction of flood insurance cover for domestic dwellings
- Identify high-risk policies
- Engineer portfolios to mitigate potential losses

One Australian insurer has integrated *FloodAUS* data into its portfolio management software and now offers full flood cover on domestic policies. It uses the flood risk ratings to progressively improve the flood risk profile of its portfolio when assessing new business and as existing policies come up for renewal.

In this analysis ten versions of a hypothetical portfolio of 12,000 policies each (combined building and contents) were developed by randomly selecting addresses from the *FloodAUS* address database for the Georges River catchment in Sydney. Different random number sequences were used, so each portfolio version has the same number of policies, the same total insured value, but different flood risk profiles because of the different locations of individual policies within each sample. It was assumed that each address had a fully insured house on it and that 85% of houses were single storey and 15% double storey. A building sum insured of $185,000 and contents sum insured of $60,000 was allocated to each house giving a total insured value of $2.94 billion for each portfolio. This represents about 10% of the market in the Georges River catchment.

For perils such as windstorm or burglary the location of individual polices within a small geographic area such as postcode or river catchment is not important; for flood it is critical and can have a large influence on the risk to which the insurer is exposed and the responsiveness of the portfolio to loss mitigation strategies. It is likely that many insurers don't really know whether they have a concentration of policies in flood prone areas or not; i.e. they don't know what their risk profile would look like if they were to insure riverine flooding.

Risk Frontiers has developed software that estimates the cost of flood damage based on the address-by-address flood risk data from *FloodAUS*. The software utilises Risk Frontiers' stage-damage curves, which relate the cost of damage to above-the-floor water depth. The curves were derived from comprehensive analysis of claims from the 1998 Katherine and the

1974 Brisbane floods; the best flood claims datasets in Australia. The damage estimation software simulates individual floor heights from a floor height distribution function. Five thousand iterations are performed to allow results to converge. In this analysis we used the floor height distribution from a survey of properties near Prospect Creek, a tributary of Georges River. Portfolio-specific flood losses are estimated for particular return period events such as the ARI 20, 50 and 100 years floods and the corresponding average annual damage cost (AAD) is also calculated. The loss estimates include external damage, clean-up costs, alternative accommodation and GST.

If an insurer is to provide flood cover it needs to be able to identify which policies are at greatest risk of flooding. These are the ones that will, in the long term, make the most frequent and large claims and so contribute disproportionately to the average annual cost. It is also important to be able to identify the lower risk properties and to decide what level of risk is acceptable. Having determined this, a strategy for optimising the portfolio with respect to flood losses can be developed. An example might be to decline new and renewing policies below a threshold such as the ARI 20 year flood level, decline new business below the ARI 100 year level and/or apply a loading to the premiums for policies located between the level of the ARI 20 and ARI 100 year floods (perhaps in the hope that the insured will look elsewhere for cover).

A range of approaches are possible, and the details will of course depend on the particular insurer. For this exercise we investigate loss mitigation scenarios without specifying how the changes to the portfolios came about. The scenarios are based on reductions in the number of policies below the ARI 100 year flood level by the following proportions: 5%, 10%, 25%, 50% and 70%.

The AAD for the 10 base portfolios was calculated using the abovementioned loss estimation software. As the policies were progressively removed at random from below the ARI 100y flood level the AAD was recalculated for each portfolio at the scenario levels noted above, i.e. reduction of 5%, 10%, 25% etc. For each portfolio the reduction in AAD, or the theoretical average annual amount in payouts saved due to declining to insure (voiding) the risky policies, is easily calculated. This can be used as a measure of the benefit of using *FloodAUS* data to optimise a portfolio that is insured for flood compared with offering flood cover without knowledge of the magnitude and spatial dimensions of the risk.

The gains from the reduction in the average annual damage from using the *FloodAUS* data for this one catchment need to be discounted back to the present using an appropriate discount rate (r). Since these gains accrue indefinitely, we can calculate the Present Value of the after-tax gains as a perpetuity:

$$PV(\Delta AAD) = \Delta AAD.(1\text{-taxrate})/r \qquad (1)$$

where the company tax rate is 30% and r is the discount rate.

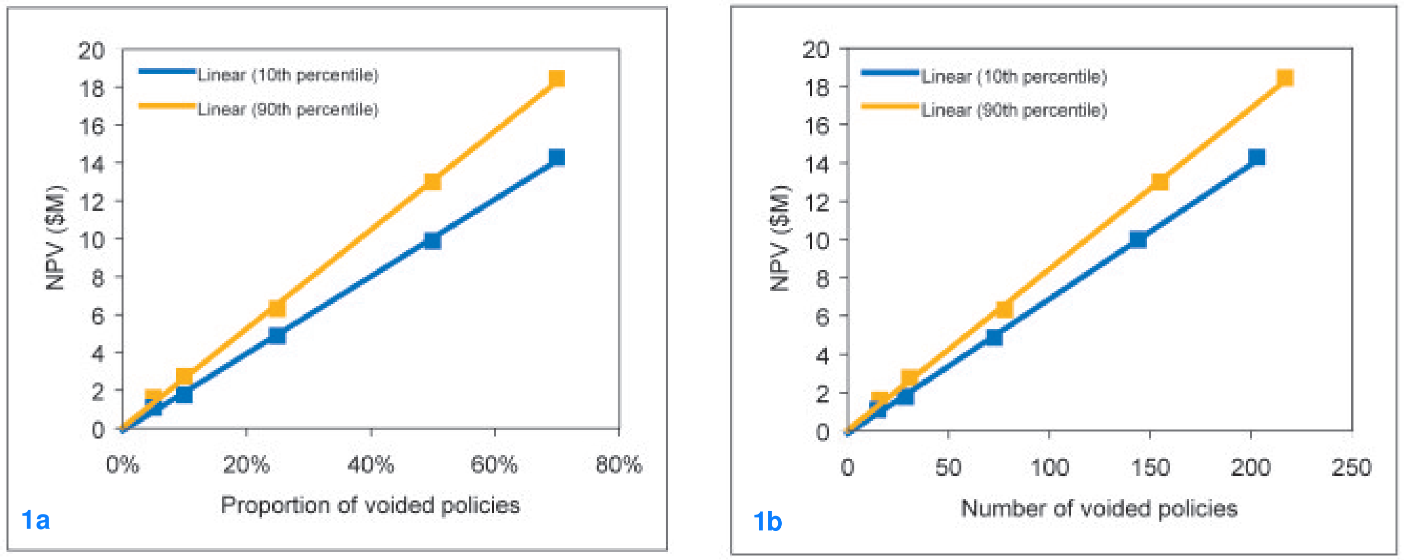
The Net Present Value of the investment in *FloodAUS* is:

$$\begin{aligned} NPV &= PV(\Delta AAD) - C \qquad (2)\\ &= PV(\Delta AAD) - \$100{,}000 \end{aligned}$$

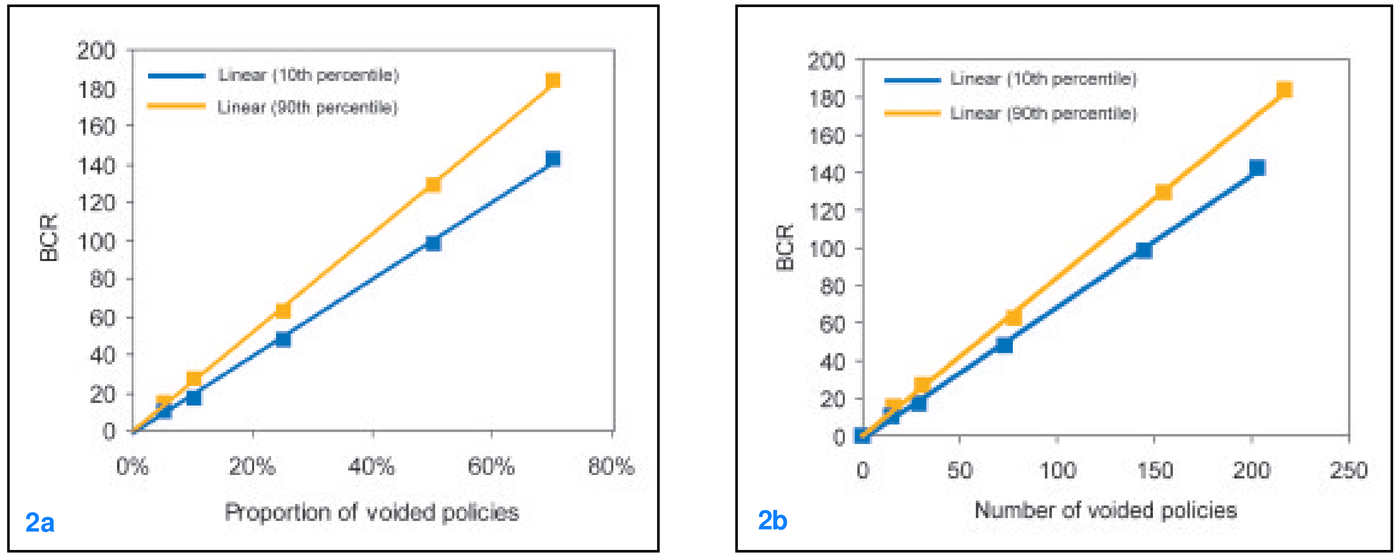
and the Benefit Cost Ratio is:

$$\begin{aligned} BCR &= PV(\Delta AAD)/C \qquad (3)\\ &= PV(\Delta AAD)/\$100{,}000 \end{aligned}$$

where $100,000 is the cost of the *FloodAUS* risk rating data for the Georges River catchment.



Figures 1a & 1b: Net Present Value of the savings in average annual flood damage payouts made by using FloodAUS data to void policies below the level of the ARI 100y flood.



Figures 2a & 2b: Benefit Cost Ratio of the savings in average annual flood damage payouts made by using FloodAUS data to void policies below the level of the ARI 100y flood.

By avoiding insuring properties at risk from flood, the gains accrued are risk-free and therefore the correct discount rate is the risk-free rate. This is taken here as the yield for long-term (10-year) government debt ~ 5.81% at the end of 2003.

This is a nominal rate and as our annual average losses have not been adjusted for inflation, we must correct the discount rate using the Fisher formula:

$$\begin{aligned} r_{real} &= (r+1)/(1+CPI) - 1\\ &= (1.0581/1.02) - 1\\ &= 3.74\% \end{aligned}$$

assuming that the long-term averaged CPI is 2%.

Applying Equations 1 and 2 and the discount rate calculated above to each of the five scenarios yields relationships between NPV and the proportion and number of policies voided for each portfolio. Only the best and worse cases are shown in Figure 1a and 1b. Since ten portfolios were modelled, the best can be considered the 90th percentile result and the worst considered the 10th percentile. Similarly, applying equations 1 and 3 yields relationships between BCR and the proportion and number of voided policies (Figure 2a and 2b).

The analysis includes a number of simplifications:

- The calculations are conservative because there is no consideration of increased premiums for retained high-risk policies
- No account is taken of the costs of incorporating the *FloodAUS* data into existing systems and operationalising the loss mitigation strategies
- Only a single portfolio is considered

These factors don't affect the first obvious conclusion – that using *FloodAUS* data to facilitate the introduction of riverine flood insurance for households and to optimise the insured portfolio is an extremely good investment. In this example of a synthetic portfolio representing about 10% of the market in the Georges River catchment, simply removing 5% of flood-prone policies (15 policies) results in a Net Present Value of savings of at least 1 million dollars. Eliminating 50% of the policies below the level of the ARI 100-year level results in savings with a Net Present Value of about $10 million. The cost of the *FloodAUS* data is only a small fraction of the potential financial benefits they produce. If *FloodAUS* data were used to optimise portfolios in the 29 flood-prone areas for which the information is available, the savings from just one or two of those areas would most likely cover the cost of the data and implementation systems for all the areas.

The second conclusion is that the exact value of the benefits will depend on the spatial structure of the portfolio. As Figures 1 and 2 show, the value of the savings can vary by up to 20% for portfolios with the same number of policies and same total insured sums – purely because of the different spatial distribution of risk. It is therefore also important that insurers contemplating the introduction of flood cover know how their policies are physically distributed with respect to the flood hazard.

Direct insurers contemplating introducing domestic flood insurance in an informed manner might like to contact Roy Leigh or John McAneney to discuss a portfolio-specific analysis of the value of using *FloodAUS* data.

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