Mandarin Re – Results Manual

Mandarin Re commissioned RMS to run an analysis on their global exposures to quantify their risk position for internal and external stakeholders, including rating agencies.

RMS has modelled as much of Mandarin Re's exposure as possible with its existing global Aggregate Loss Model (ALM) suite and deterministic (Accumulation) model for all the regions.

The outcome has been shared in the below report format:

Risk Assessment Report - Mandarin Re – ALM (Aggregate Loss Model)

Aggregate Loss Model is designed to use data with no per risk details, such as precise locations or building characteristics. Values are entered as exposed limit per line of business. ALM uses predefined assumptions to model the exposure data where only aggregate level information is available.

For Mandarin Re exposure, ALM has been used to analyze the exposure for the regions modeled by RMS for the perils of Earthquake, Windstorm (Hurricane/Cyclone/Typhoon) and Flood for Commercial, Industrial and Motor exposure.

The report consists of:

Assumptions (*Page no. 3***):** Data and modeling assumptions to perform the requisite analyses.

Wherever possible, we encourage clients to provide high resolution location data and information on occupancy, construction material, year built and height as well as accurate replacement costs and financial terms. Mandarin Re does not have high quality exposure data so we worked together to agree these assumptions for modelling work to be performed.

As data quality improves, uncertainty in model results reduces so clients receive a more accurate estimate of their risk. Note though, model results themselves may go up or down as better data means more accurate losses and not necessarily lower losses.

Exposure Overview (*Page no. 4***):** Summary of number of risks, locations and primary attributes provided for modeling. For ALM analysis, Construction, Occupancy, Number of Stories, Year Built and Coverages have pre-defined assumptions in-built in RiskLink.

Exposure overview by Country (*Page no. 5-6***):** Details out the total exposure for Facultative and Treaty Reinsurance provided by Mandarin for different countries. This tab also highlights modeled and non-modeled countries and corresponding exposure. It can be observed that 53% of the FAC exposure and 77% of the treaty exposure falls in the RMS modeled regions.

Loss Overview – Combined - **(***Page no. 7***):** Provides overall losses across all the modeled countries for Facultative exposure (FAC Combined), Treaty exposure (Treaty combined) and total exposure (FAC + Treaty Combined), separately for Earthquake.

The output perspectives consist for Ground Up, Gross, Reinsurance Gross and Net Loss Pre CAT which can be mapped to Mandarin exposure as below:

Loss Perspective	Mandarin Re Output
Ground Up	Total Loss
Gross	Post application of Mandarin Re’s share and per event loss limit
Reinsurance Gross	Mandarin Re’s Share of Loss i.e., Retention (FAC - $500K; Treaty Unlimited)
Net Loss Pre CAT	Losses ceded to Retrocession

Since entire Treaty exposure is retained by Mandarin Re, no Treaty loss is ceded to Retrocession, thereby rendering “Net Loss Pre CAT” as 0 for Treaty exposure.

The output Statistics provided for losses are:

- Exceedance Probability (EP) - It is the probability of exceeding specified loss thresholds. In risk analysis, this probability relationship is commonly represented as a curve (the EP curve) which defines the probability of various levels. EP is of two types: AEP and OEP losses which can be defined as
    - **AEP (Aggregate Exceedance Probability)** measures the probability that one or more occurrences will combine in a year to exceed the threshold
    - **OEP (Occurrence Exceedance Probability)** which measures the probability that a single occurrence will exceed a certain threshold.
- *Return Period Losses* - The return period for a loss refers to a point on loss curve that describes the likelihood of exceeding a loss threshold from the single largest event (OEP) or the aggregation of one or more events (AEP).
- *Average Annual Loss (AAL)* - Sometimes called pure premium or burn cost, is the expected value of the modeled loss distribution. It is the loss one would expect to see in a single year on average.
- *Standard Deviation* - The standard deviation associated with a mean loss value characterizes the secondary uncertainty associated with that mean loss value reflecting the volatility in the annual losses.
- *Coefficient of variation* - The spread of loss around the mean is represented by the coefficient variation, and it reflects the volatility in the annual losses.

For example, in Fac Combined Earthquake losses, the Reinsurance Gross loss (OEP) for 250 Year return period is ~ $3.2M which indicates there is 0.4% probability that loss from a single largest event affecting this exposure will exceed $3.2M in a given year.

Similarly, the Reinsurance Gross loss (AEP) for 250 Year return period is ~ $3.8M which indicates there is 0.4% probability that loss from all the events affecting this exposure will exceed $3.8M in a given year.

The Reinsurance Gross OEP for EQ has a mean of 436,871 which can be interpreted as expected average loss in a year would be ~$440K and this would be the premium required minus expenses, non-modeled loss, profit, or risk load. The coefficient of variation is 1.4.

It can be observed that even though the mean is ~$440k, there is a 1% chance the loss exceeds $2.6m and a 0.1% chance it exceeds $4.0m in the next year.

This tab also highlights the Top 5 loss generating events.

The subsequent tabs provide similar loss exhibits as:

- **Combined losses for Windstorm and Flood (*Page no. 8-9*):** For combined, there are no flood losses as there is no flood exposure for modeled regions.
- **Fac losses by Country by Peril (*Page no. 10-17*):**
  - In case the return period losses are below USD 500K, all losses will be covered under Mandarin Re retention, and nothing will go to retrocession (i.e., Net Loss Pre CAT). *Example: Argentina for Earthquake*
  - In case the return period losses are above USD 500K, Mandarin Re's losses (i.e., Reinsurance Gross loss) will be limited to USD 500K retention and rest of the losses will be covered by retrocession. *Example: 500 Year and above OEP loss for Belize for Earthquake*.

    In case more than one risk is present for a country, the Reinsurance gross loss is getting limited accordingly. *Example: OEP Losses for EL Salvador*

  - Since OEP represents the losses from single largest event and AEP represents the aggregated losses from all the events in a given year, it can be observed that OEP Reinsurance Gross losses will be limited at 500k while the AEP results are higher than 500k, for example Belize Windstorm losses.
- **Treaty losses by Country by Peril (*Page no. 18-26*):**
  - Since all the losses are retained by Mandarin Re, there will be no losses ceded to Retrocession (i.e., Net loss Pre CAT for Treaty exposure will remain 0) and entire Mandarin Re retention will be reflected in Reinsurance Gross loss.
- **FAC + Treaty losses by Country by Peril (*Page no. 27-38)***
  - For Countries with Fac losses below USD500K or Treaty only exposure, there will be no Net loss Pre CAT losses in the combined view. *Example: Argentina*
- **AAL By Cedant (*Page no. 39-41)***
  - Average annual loss for each cedant by peril separately and combined for FAC and Treaty business

Note: In some cases, it may be observed that though the reinsurance Gross Loss is lower than USD 500K, still some loss can be observed in Net loss Pre CAT (for example: Fac losses for Bolivia EQ on page 10). Such rounding differences are due to the way secondary uncertainty distributions are propagated through the probabilistic modeling. However, it has no material impact on the results, or any conclusions drawn from the report.

Mandarin Re - Accumulation Results

Accumulation analysis has been carried out for the entire set of exposure including the exposure (*For example: Marine Hull*) and countries not modeled by ALM. An accumulation is an analysis option that analyzes exposure information in order to identify areas of concentrated exposure, called accumulations. Accumulations calculate exposed limit, which is the maximum possible loss to an insurer or reinsurer from a single deterministic event. Use accumulation analyses to assess worst case scenarios. The report consists of:

Accumulation Summary – Combined for FAC + Treaty by Country (*Page no. 2)*: This provides the Maximum exposed limit for each country for Ground Up, Gross, Reinsurance Gross and Net Loss Pre CAT which can be mapped to Mandarin exposure as below:

Output Perspective	Mandarin Re Output
Ground Up	Total exposed Limit
Gross	Post application of Mandarin Re's share and per event loss limit
Reinsurance Gross	Mandarin Re's Share of Loss i.e., Retention (FAC - $500K; Treaty Unlimited)
Net Loss Pre CAT	Losses ceded to Retrocession

Accumulation Summary – Facultative by Country (*Page no. 3)*

- Exposed limits for each country for Facultative Business. For countries with single risk, total Fac retention will be limited to USD 500K, example Belize. Similarly for countries with more than one risk, Fac exposed limit will increase accordingly, for example, Singapore.

Accumulation Summary – Facultative by Cedant by Country (*Page No. 4-5*)

- Exposed limit for each cedant by country

Accumulation Summary – Treaty by Country (*Page no. 6)*

- Exposed limits for each country for Treaty Business. Since all the Treaty losses are retained by Mandarin Re, Net loss Pre CAT exposed limit is 0.

Accumulation Summary – Treaty by Cedant by Country (*Page no. 7)*

- Exposed limits for each cedant by country