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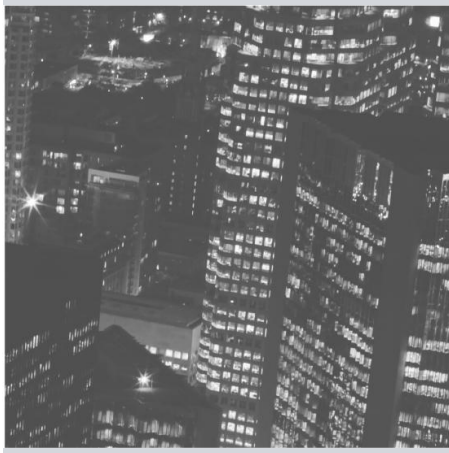

RMS Event Response

Paradex and Cat Updates

RMS®

INTRODUCTION

Following a major catastrophe, RMS issues Cat Updates industry loss estimates as well as Paradex parametric loss indices. Cat Updates and Paradex are distinct products, meeting different needs within the market. Each type of estimate has a distinct purpose and covers different elements of the event losses. This paper outlines the intended purpose of each service, and how the differences in underlying methodologies may lead to variations in loss results.

Cat Updates

Cat Updates industry loss estimates provide a basis for clients to assess losses to their own portfolios. Estimates incorporate non-modeled losses, and provide insight into the sources of both modeled and non-modeled loss. Cat Updates estimates are a range of losses based on hazard parameters, expert judgment, real-time damage reports, and reports from RMS field reconnaissance. Published ranges include estimates of non-modeled sources of loss (such as inland flooding in the case of hurricane), as well as modeled loss estimates based on a range of stochastic events and wind field footprints, reflecting RMS' best judgment as to the range of hazard values within which observed measurements are taken. The Cat Updates service is a global service that may issue industry loss estimates for catastrophe events worldwide.

Paradex

The Paradex parametric loss index is a purely parametric, model-driven index designed for transactions placed in the capital markets that require a fully automated (and therefore objective) loss calculation process. Paradex industry index values are based only on the hazard values recorded during the event, and only account for losses captured by the model. For each event, Paradex issues one overall industry index value with breakdowns by region and line of business. Paradex offers coverage for regions with the highest demand for transactions placed in the capital markets—currently U.S. earthquake and hurricane, Europe windstorm, and Japan earthquake.

When discrepancies between the losses issued by Cat Updates or Paradex arise, the most significant factors are the inclusion of losses from non-modeled areas and lines of business, and secondary perils in Cat Updates loss estimates; and differences in the data parameters used to generate the hazard footprints.

PARADEX AND CAT UPDATES: CALCULATION PROCESSES

Paradex Calculation Process

After a catastrophe event, Paradex index values are calculated through the following process. RMS requests hazard data from independent third-party entities as specified in the model-specific Paradex technical documents.[1] To ensure objectivity, the hazard values are determined based on a set of event definitions specific to each peril. The hazard values define the hazard footprint for the event. The values in the footprint are interpolated to determine values at a set of calculation locations corresponding to postal or city code centroids.[2] The interpolated hazard values are then aggregated over a lower resolution geographic region if necessary (county for U.S. perils and CRESTA zone for Europe windstorm) and then referenced on lookup tables to determine industry index values by region and line of business. The total index value is obtained by aggregating all the regional values.

RMS issues a preliminary Paradex event bulletin within 2 business days and a final event bulletin in which the final Paradex index value is published no later than 40 business days after the event.

Cat Updates Calculation Process

The RMS Cat Updates industry loss estimate range represents RMS' best estimate of the total range of insured losses expected from a catastrophe. It includes estimates of both modeled and non-modeled sources of loss. The modeled elements are based on the analysis of a set of modeling parameters against the RMS® Industry Exposure Database (IED) for the region. For all major events, RMS deploys reconnaissance teams consisting of specialist vulnerability engineers to conduct on-site damage assessments, providing event-specific data to inform the modeled estimate.

RMS aims to release an initial industry loss estimate range within 3–7 days after an event, depending on the complexity of the event and uncertainty in the hazard reconstruction. The initial estimate is updated as more information becomes available and uncertainty decreases.

[1] Available at https://www.rms.com/CapitalMarkets/ParametricSolutions/
[2] For the U.S. and Europe indices, Paradex calculation locations are postal code centroids; for the Japan indices, city code centroids.

PARADEX AND CAT UPDATES: METHODOLOGY COMPARISON

Paradex and Cat Updates both use the latest commercially available models from RMS and the most recent Industry Exposure Databases (IED) to derive industry loss estimates. However, the methodologies differ in fundamental ways, and variations in the Cat Updates and Paradex event loss estimates may be attributed to factors including, but not limited to, the following:

- **Covered area:** The Paradex index value only includes losses from areas covered by the IED and the RiskLink®-DLM software platform. Cat Updates may issue loss estimates for any region worldwide.
- **Secondary perils:** Paradex wind indices only include losses arising from wind damage. Secondary perils such as storm surge or inland flooding are not considered. Paradex earthquake indices include losses arising from fire following the earthquake and sprinkler leakage (U.S. only); however, insured losses following an earthquake event can also arise from numerous factors not directly related to the shaking of the event, such as landslides triggered by the earthquake, tsunami damage, or flood damage caused by broken dams, etc. The Cat Updates industry loss estimate range aims to account for all secondary perils.
- **Vulnerability:** The Paradex lookup tables are based on the IED and are fully consistent with RiskLink-DLM software. The lookup tables represent aggregated vulnerability curves for each line of business and geographic area. The indices have been developed to represent the expected loss for a large set of events rather than an exact estimate for each individual event. The aggregated nature of the vulnerability curves underlying the Paradex loss estimates means that local variations in vulnerability during an event may not be fully represented by Paradex. Additionally, the Cat Updates industry loss estimate considers real-time damage reports and reports from the RMS reconnaissance teams which are factors outside of the parametric framework of Paradex.
- **Line of business:** Losses occurring to lines of businesses not in the IED will not be included in the Paradex index values; for example, the RMS® Europe Windstorm Industry Exposure Database does not include automotive exposures. The Cat Updates industry loss estimate aims to capture all affected lines of business.
- **Hazard data:** The hazard data underlying the Paradex index values and the Cat Updates estimates is subject to careful quality assurance checks—in the event of a power outage or interruption in the observational record, that particular weather instrument is excluded from the wind field generation process. However, Paradex index values are based on hazard data provided by approved independent third-party entities, potentially forming a subset of all hazard data available for the event. The Cat Updates industry loss estimate may include additional hazard data, where available and deemed fit. Another source of difference can occur as Paradex treats hazard according to event definitions, whereas the RMS industry loss estimate is not bound by the Paradex definitions.
- **Wind hazard footprint:** Cat Updates produces a range of hazard footprints that reflect RMS' best estimate of the uncertainty in storm track and intensity as a storm moves inland. Paradex uses only the reported parameters from third parties to produce a single footprint, without adjustment.

Because the Paradex index calculation process is automated, Paradex index values for an event in the U.S., Europe, or Japan are derived within 40 business days and finalized at that point, whereas the Cat Updates industry loss estimate typically evolves as more information about the event is gathered, and is not bound within a fixed time frame. The first Cat Updates industry loss estimate for the affected regions is typically released within 3–7 days after a catastrophe event, although depending on the event location and information on insured values at that location, release dates may vary. Cat Updates estimates may continue to be revised as more information becomes available and claims are reported, particularly for complex events with evolving decisions regarding claims settlements.

Example: Event Loss Calculation for Hurricane Ike

Hurricane Ike made landfall in Galveston, Texas on September 13, 2008 as a strong Category 2 hurricane with a large wind field. Ike moved inland, clipping Houston before tracking north-northeast to cause damage across Arkansas, Illinois, Indiana, Kentucky, Missouri, Ohio, and Pennsylvania. RMS issued a Paradex U.S. Hurricane index value of US$6.2 billion for Hurricane Ike for losses occurring in Texas, Mississippi, and Louisiana. The Cat Updates service released an Ensemble Footprint consisting of 300 event reconstructions to model the damage from wind and storm surge, producing a final industry loss estimate range of $13–21 billion. The difference between the two estimates is due to the different components of loss included in each estimate.

The Cat Updates combined wind and storm surge loss estimates within the area covered by the RMS® U.S. Hurricane Model range from $9.5–14 billion,. Estimated losses for offshore energy platforms in the Gulf of Mexico range from $1–3 billion. Non-modeled losses fall into three categories: $1.5–2 billion from wind damage in states not covered by the U.S. Hurricane Model, e.g., Ohio, Kentucky, and Indiana; $0.5–1 billion from inland flooding; and $0.5–1 billion from non-modeled wind and storm surge losses in coastal states such as extended power outages and political decisions, e.g. the evacuation of the Galveston area.

The wind-only loss estimate for Paradex of $6.2 billion is only comparable to the wind only portion of the Cat Updates total loss estimate which equates to between $6.5–10.3 billion. The difference between these wind-only loss estimates for Hurricane Ike is due to the following factors:

- **Data sources:** To maintain objectivity, Paradex U.S. Hurricane only uses wind speed data from the WeatherFlow network and the Florida Coastal Monitoring Program (FCMP). Cat Updates uses additional data sources, including expert judgment regarding the feasibility and accuracy of station readings during the event.
- **Methodology:** Different methodologies are used to generate the wind field footprint. Cat Updates uses a range of wind fields that account for uncertainty in track parameters and therefore the actual intensity of the storm inland, particularly as it clipped Houston—a key source of uncertainty in the actual losses sustained due to its high exposure concentration (a small percentage difference would equal a large loss amount). Paradex's prescribed footprint generation process results in the development of a single footprint.
- **Non-modeled loss:** The Cat Updates estimate incorporates non-modeled losses such as contingent BI, and the impact of very extensive and long-lasting power outages. Paradex does not consider non-modeled loss.
- **Super Cat effects:** The Cat Updates estimate also considers non-modeled localized Super Cat effects caused by the forced evacuation of the Galveston area. The evacuation caused the business interruption (BI) and additional living expenses (ALE) losses to increase beyond the modeled estimates.

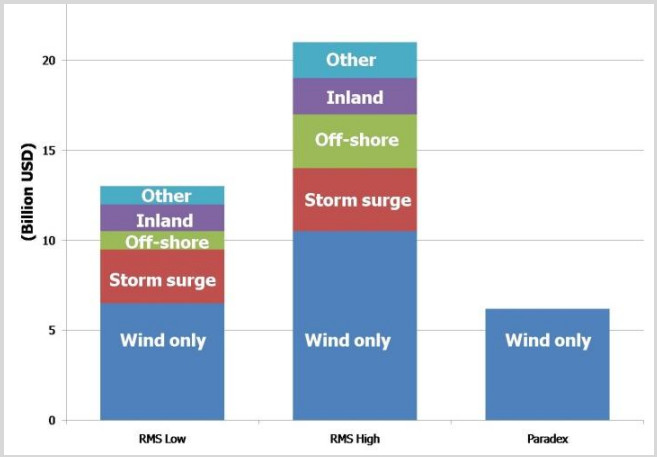

Figure 1: Hurricane Ike industry loss estimates