



Predicting the Unpredictable: Revolutionizing Hail Damage Prevention with AI



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Executive Summary

The threat posed by Severe Convective Storms (SCS) has risen dramatically in the recent past, with the number of billion-dollar disasters due to these storms rising over 70% in the last two years.¹ These disasters are impacting insurers directly, and the problem is exacerbated by rising repair costs and growing population density in hail-prone areas. The 5-year average for hail-related losses has more than doubled in recent years, with 2023 seeing a 40% increase over 2022. As severe weather, especially hail, continues to threaten policyholders, innovative strategies are needed to mitigate its financial and operational impact to insurers.

Excarta is using the latest advances in AI to help policyholders avoid hail damage, thus lowering hail losses for insurers. Excarta has developed a novel hail forecasting model that can predict when and where severe hail is expected to hit with dramatically better accuracy than existing hail forecasts. To make these forecasts truly useful and actionable, Excarta has conducted extensive research to determine the most effective way to communicate the threat of hail to policyholders, encouraging them to take action and reduce hail damage. In a test cohort, data shows that when accurate hail forecasts are paired with well-designed alerts, over 30% of auto hail claims can be avoided. This proactive approach not only reduces losses, but also fosters greater trust and satisfaction among policyholders.

This whitepaper outlines Excarta's innovative solution, demonstrating how advanced AI forecasts and optimized alerts can empower insurers to minimize hail damage claims, protect customers, and strengthen relationships in a rapidly evolving risk landscape.

Hail losses are costly

\$57 M

The cost of auto hail claims per one million insured drivers.²

and they're on the rise

+40%

Hail losses increased by around 40% in 2023 over 2022. The 5-year average for the value of hail claims has more than doubled in recent years.⁵

-30%

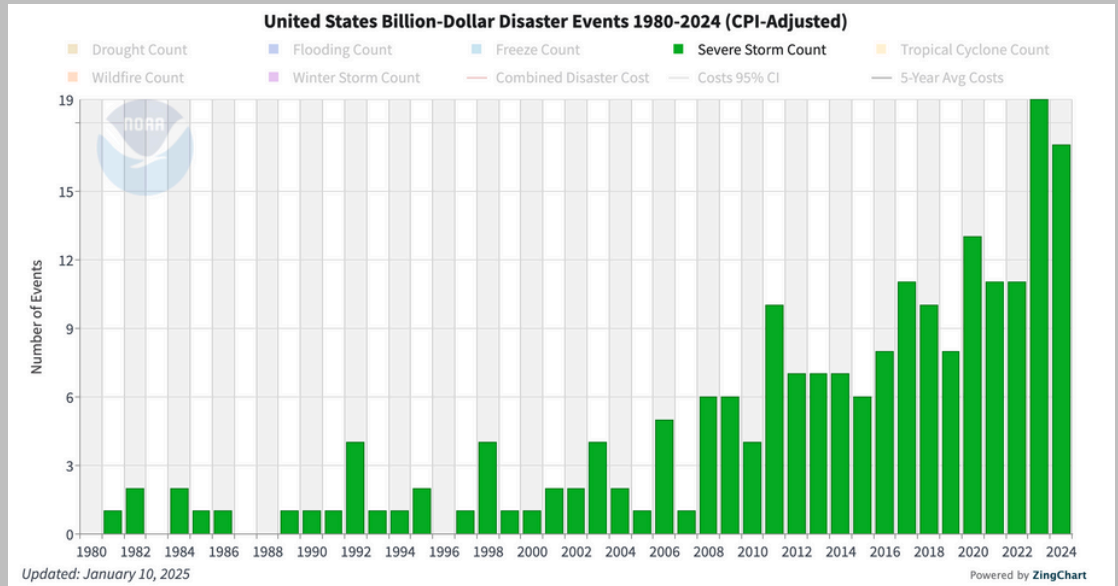
Reduction in auto hail losses

Excarta's research and testing has indicated that its AI-based forecasts paired with smart alerting of policyholders reduces auto hail losses by at least 30%.⁴ This translates to an estimated savings of **\$17M per 1 million insured drivers.**

Situation Overview

Hail: A New Primary Peril

Severe convective storms (SCS), the primary drivers of hail, high winds, intense precipitation, and tornadoes, have steadily become more frequent and intense over the last two decades. The years 2023 and 2024 have respectively seen 19 and 17 severe convective storms that caused over \$1B worth of damage each, more than twice what was commonly seen a decade ago.¹



Cost of Auto Hail Claims in 2023

\$60B

\$60B of total losses from severe convective storms in 2023⁶

\$39B

Hail is responsible for ~65% of these losses on average⁷

Auto claims represent ~17% of all hail claims⁵

\$7B of auto hail losses in 2023

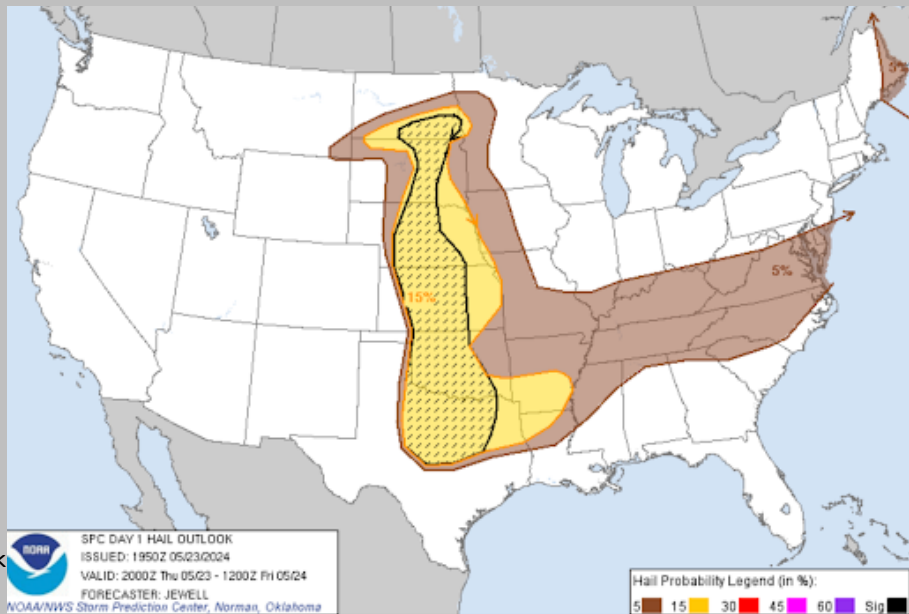
Within severe convective storms, hail is the primary source of loss, with Cape Analytics reporting that hail is responsible for 50%-80% of severe storm losses.³ In 2022, State Farm reported an increase of over \$1B in hail losses due to both a higher claim volume and rising cost of repairs.⁵ Roughly 17% of all hail losses were for auto claims.

Current Alerting Challenges

Despite advances in meteorology, physical weather models still struggle to accurately predict hailstorms, which are short-lived and often small in scale -- it's not uncommon for one side of town to be hit while the other side is left untouched. Due to inaccurate forecasts, current alerts often fail to be actionable, both in terms of scope and timing.

At the broadest level, the National Weather Service (NWS) issues daily Hail Outlooks to convey severe hail risk. While informative, these outlooks can cover multiple states, which reduces their utility for decision-making or planning.

When narrowed into the day of a severe hailstorm, the NWS may issue a “Severe Thunderstorm Watch/Warning” that could include a hail risk. While Watches are much narrower than a Hail Outlook, they still typically span multiple counties. Excarta’s research revealed that users perceived both Hail Outlooks and Watches as too broad to be actionable. Reviewing NWS alerts from 2023, a person in the Dallas, TX area would have received a Severe Thunderstorm Warning 33 times -- an average of more than once a week during hail season (March–September), despite the area only seeing severe hail three times that season.⁹



A National Weather Service (NWS) hail outlook⁸, which provides helpful information yet remains too broad to act on.

On the other hand, local news alerts and radar visualizations deliver more precise information about the movements of storms. However, by this point the storm may be too close, and most users do not check the news unless prompted. This reduces the time available for people to take preventative measures like covering their vehicles and valuable assets.

Severe Thunderstorm Watch

Valid Until
11:00 PM CDT Sunday
September 24, 2023

Threat Information

HAIL
Scattered Hail Up To
Tennis Ball Size Likely

WIND
Scattered Gusts
Up To 70 MPH Likely

LIGHTNING
Frequent Lightning
Possible

Potential Exposure

Population: 10,064,241
Schools: 3003
Hospitals: 181

Severe Thunderstorm #695

Individuals also recognize the challenges of dealing with hail, and are looking for help. In a survey of over 1500 people across Hail Alley, **over 85% indicated that they’d like to receive hail alerts** for their neighborhood, and **over 80% expressed support for these alerts coming from their insurer** to help them protect their vehicles and other property. The need is present, but current hail forecasting and alerting systems haven’t yet been able to fill the gap.¹⁰

Advancements of AI Forecasts

AI-powered weather models can leverage vast amounts of historical and real-time weather data to identify complex patterns that conventional models often miss. These AI models can also process data more quickly and efficiently, issuing new forecasts as often as every 10 minutes. The result is a higher-resolution forecast that provides greater accuracy at a localized level, and updates frequently to capture rapidly changing conditions. By enhancing forecast precision and timeliness, AI-driven models are poised to unlock a new tier of hail forecasting precision and accuracy, helping insurers to take a proactive approach to minimizing losses and improving customer trust in alerts.

“
I get alerts all the time,
but I live in a huge
county in Texas and
most of the time the
storm is at least 50
miles away from me or
more. At this point I
just can't tell when to
take them seriously. -
Linda, TX
”

“
It was a sunny evening
and I went out to the
grocery store to pick
up a few things. It's
less than 10 minutes
from my house but on
my way home a storm
had blown in and my
car was pummeled
with hail. It came out
of nowhere! I had no
idea, otherwise I
definitely wouldn't
have been driving. -
Dan, CO
”

“
I've looked but never
saw anything for just
hail alerts. It always
takes me by surprise
and I've had my truck
banged up before, but
I guess it's just too
hard to predict. -
Jayden, MT
”

Excarta's Background

Excarta's mission is to use AI weather models to make businesses and people resilient to severe weather. Excarta's team brings experience from top-tier institutes like Google DeepMind, Microsoft, and Harvard University. With an initial focus on medium-term, 2-week weather forecasts, Excarta developed AI weather models that were independently evaluated and shown to significantly outperform globally leading weather models, validated through Google's [Weather Bench](#) project, where Excarta's forecasts continue to be rated among the top-performing models.¹¹

Recognizing the critical need for accurate predictions of severe weather events, Excarta identified hailstorms as a primary focus due to the dearth of existing quality hail forecasts, their large and worsening damage potential, and the ability of individuals to take cheap and timely protective actions. Building on this foundation, Excarta has developed advanced predictive models for hail and optimized alerting mechanisms to help individuals protect themselves and their property.

Excarta is also working closely with insurers to enable proactive alerts for policyholders. These solutions aid in loss mitigation, staffing decisions, and streamlined claims processing, offering a comprehensive approach to managing the rising challenges of severe weather events.

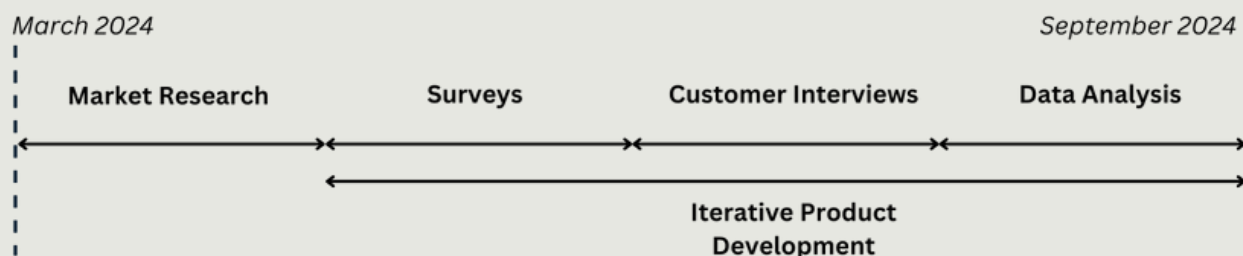
Better Information, Better Action

If done well, hail alerts can provide critical value by enabling individuals, businesses, and communities to take measures that protect themselves and their property during severe weather events. A good hail alert needs to balance several factors to be effective: the severity of the event, the time available for an individual to act, and the confidence in the prediction. Additionally, a good hail alert should provide actionable information, without overwhelming the people alerted. How do we strike the right balance?

Throughout the 2024 hail season, Excarta conducted a series of surveys and product tests among people living in "Hail Alley" (the large Midwestern swath of the US ranging from Colorado to Illinois, and Texas to Minnesota that is most prone to severe hail). These surveys and tests helped determine which combination of timing, language, event certainty, alerting radius, and information channels led to the greatest engagement and satisfaction with hail alerts. These learnings led to the development of Excarta's hail forecasting and alerting system, which now provides trustworthy hail alerts to policyholders, to help them take action and avoid damage.

In undertaking this research, Excarta defined two primary metrics to evaluate viable solutions- *alert quality* and *alert engagement*. Alert quality relates to the forecasting side of the equation- did the alert accurately correspond with a severe hail event? Conversely, alert engagement relates to the action side of the equation- did the person receiving the alert actually absorb the information and take preventative action? Excarta's research aimed to inform both sides of this equation, and guide the development of both the model and the alerting system with the explicit goal of helping policyholders avoid damage.

Research & Methodology



Excarta's best practices for hail alerting are derived from a mix of qualitative and quantitative data gathered from research and experimentation performed during the 2024 hail season (March - September). Qualitative data was gathered through market research, surveys, and customer interviews, and translated iteratively into Excarta's public-facing hail alerting service. With this hail alerting service actively alerting customers across Hail Alley, additional quantitative data on alert efficacy and engagement could be gathered.

Methodology	# of Participants (N=)	Notes
Insurance industry expert interviews	7	Interviews with insurance industry professionals (underwriting, claims, and reinsurance).
Surveys	2873	Completed in two rounds- 1) initial round of 1500 from across Hail Alley in June 2024. 2) Another ~1500 survey participants from location specific surveys. These surveys were completed in the days following severe hail events in participants' regions during July & August 2024.
Customer interviews	14	Interviews with users of Excarta's prototyped hail alerting system.
Product development & data analysis	256	Excarta developed and deployed a hail alerting system serving 256 test users during the summer of 2024. Excarta analyzed the alert effectiveness and engagement iteratively and concluded at the conclusion of the test that ~30% of alerts resulted in proactive action being taken.

Summary of Key Learnings

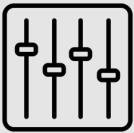


Demand for better hail alerts:

- 60% of survey respondents had experienced hail damage of some kind, and **40% had experienced auto damage.**
- 40% of the people who experienced auto damage from hail reported that it was because **they didn't know it was going to hail.**
- **90% of survey respondents reported wanting to receive text message alerts** in advance of a hail storm.
- 85% of survey respondents were supportive of these alerts **coming from their insurers.**

“
 Weather forecasting is so difficult to begin with that I would appreciate ANY advanced warning. I also drive between my home and Denver a great deal, and being forewarned about dangerous weather conditions would inform my decisions on when I should leave (or IF). The freeways and interstates here are extremely hazardous in bad weather
 ”

“
 Just being alerted at all would have been nice. We rarely get hail storms where I live and out of nowhere we were pummeled with baseball sized hail for 10-15 minutes straight. Our car was literally totaled and we had to get a new roof. Nobody knew anything about it beforehand. It wasn't in our weather forecast.
 ”



Customers' alert preferences:

Timing



- While surveys showed a range of preferences for timing of alerts, 90% of interviewees reported needing about **30 minutes to take preventative measures** like move their car into a garage or get back home.
- Several interviewees also reported appreciating an update if the forecast changed or if the threat passed.

Scope



- 45% of users who opted out of Excarta's alerts did so because they felt they were inaccurate, despite severe hail actually falling within 25 miles in 85% of these cases. From interviews with this cohort of users, Excarta determined that cultivating trust in these alerts was of paramount importance, which corresponded to severe hail hitting closer to a user's location. When pushed to define this, these interviewees **all requested an alert radius of around 5-10 miles.**

Certainty



- Survey responses indicated a wide spread of user preferences for what level of certainty they'd like to be alerted on, with 75% of people requesting a certainty of **50% or above.**
- People expressed a desire to conservatively have a "heads up" at around 50% likelihood, and then be updated if the threat became more likely, needing them to act. This lends itself to a concept of **alert severity tiers**, which is further elaborated on in the product overview section.

Channel



- **93% of interview participants prefer to have text message** based alert because they "get too many notifications from apps and actually pay attention to texts." While people suggested having an app is nice as well, text message was the most requested format for receiving information.
- Several survey respondents and interviewees requested **a link to live radar** to help them understand the storm's movements. *"The first thing I do is check the radar."*



Excarta's alert accuracy:

- >70% of alerts were considered "quality alerts". That is, hail actually hit within 10 miles of the alert receiver within the next 3 hours.



Excarta's alert engagement:

- Of the 256 enrolled test users, 94 received alerts. Of these 94, 33 (35%) were confirmed to engage with the text alert. From interviews with engaged customers, 88% were primed to take protective actions. This implies that, for this study, $88\% * 35\% = 31\%$ of those alerted would avert auto hail damage. Of the 40% of customers who opted out, 50% did so due to unhappiness with the service, either due to too many alerts or not feeling as though the alerts were accurate. Excarta made adjustments to the product with all of this feedback throughout the experiment, which informed the final product design.

Given these learnings, Excarta determined that a successful hail forecasting and alerting system must:

- **Define an "actionable" geographic scope and timeframe, then optimize for accuracy within these constraints.** Based on Excarta's research, people reported an actionable geographic scope as "neighborhood-sized", or around 5-10 miles (9-16 kilometers), and actionable timing as at least 30 minutes of advance notice. People also initially experience low trust to a new alerting service, requiring a higher bar for accuracy.
- **Provide helpful context to aid decision-making.** People have varying tolerance for false alarms, but lose trust quickly if they are told to take action without any threat materializing. A successful solution will convey the confidence in a forecast with appropriate alert language and severity. When the threat is possible but not certain, the alert should be a simple nudge to stay alert, and escalate only if the forecast's confidence of a severe hailstorm is high. A quality solution will also include a user interface that clearly communicates the broader picture through easy-to-interpret graphics and live radar to support the forecast and alert.

Putting it all together: Excarta's solution

Practically speaking, these objectives broke down into technical and behavioral requirements for a solution. To be successful, Excarta would need to (i) optimize an AI-based hail forecast with more accurate predictions than previously possible, and (ii) translate that forecast into trustworthy alerts that lead to the desired behavior change in users. This section breaks down how each of these pieces was achieved.

Based on user research on what makes an alert actionable, a good hail forecasting model would need to predict severe hail (size >1") accurately within 5-10 miles of a location. In addition to predicting the size of hail, the model also needs to predict how likely severe hail was to identify when the threat is marginal, or highly likely. The model should also provide forecasts that update very frequently, but extend multiple hours in the future, as thunderstorms often form and evolve rapidly and can persist for several hours.

Hail forecasts from existing sources met only some of these requirements. Some NWS models, like the HRRR model¹², provide forecasts for several hours ahead, but these update only once an hour. Their infrequent updates prevent them from exploiting real-time information from radar or satellite networks, and reduce the quality of their hail forecasts. On certain days with high storm activity, a separate system called Warn-on-Forecast System (WoFS) is used to make more frequent predictions (every 5 minutes).¹³ However, the WoFS is extremely expensive to run, and as a result is run only on specific days, and only for small regions of the US.

Where AI Models Shine

AI models are orders of magnitude faster and cheaper than conventional models, allowing them to be run as often as desired. As a result, AI models can ingest real-time data from radar and satellite networks and provide high-quality predictions for the entire US and not just small regions of the US. Further, AI models can be trained to predict the *likelihood* of severe hail, and thus used to make hail forecasts of low, medium, and high confidence.

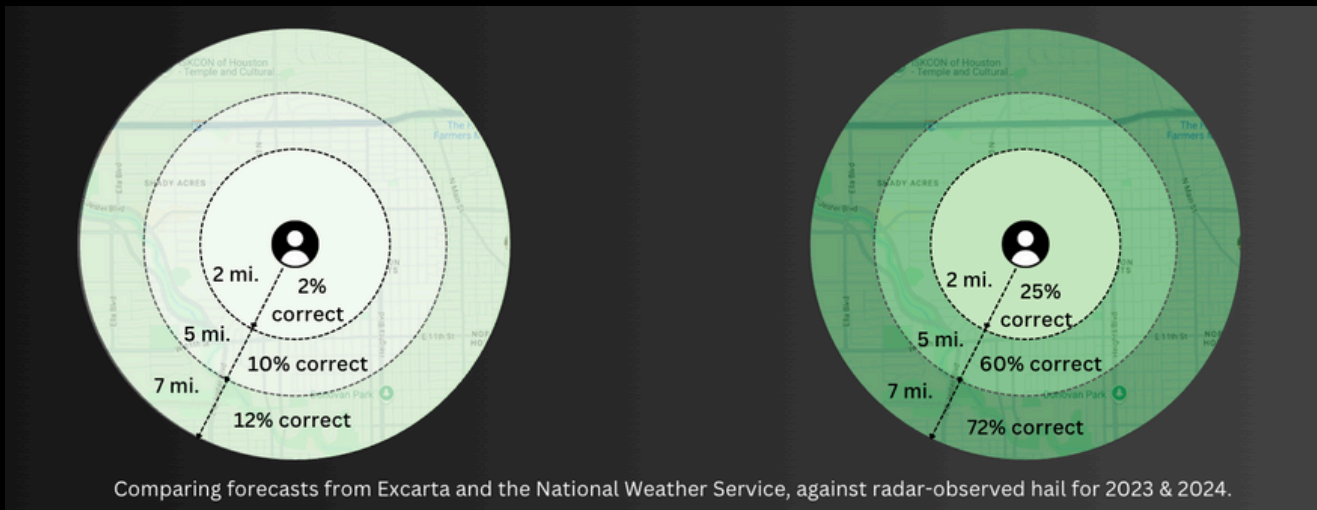
Excarta's AI hail forecasting models are trained on several years of data from conventional models like HRRR, as well as actual observations from radar and other sources. This vast amount of data gives Excarta's AI models the ability to learn how severe weather evolves in 10-minute increments across the entire US. Exploiting the low cost and high speed of AI models, Excarta is able to run these AI hail forecasting models 24/7, producing high-resolution forecasts for the entire US – bridging the gap left by conventional sources of hail forecasts.

Building a Better Model

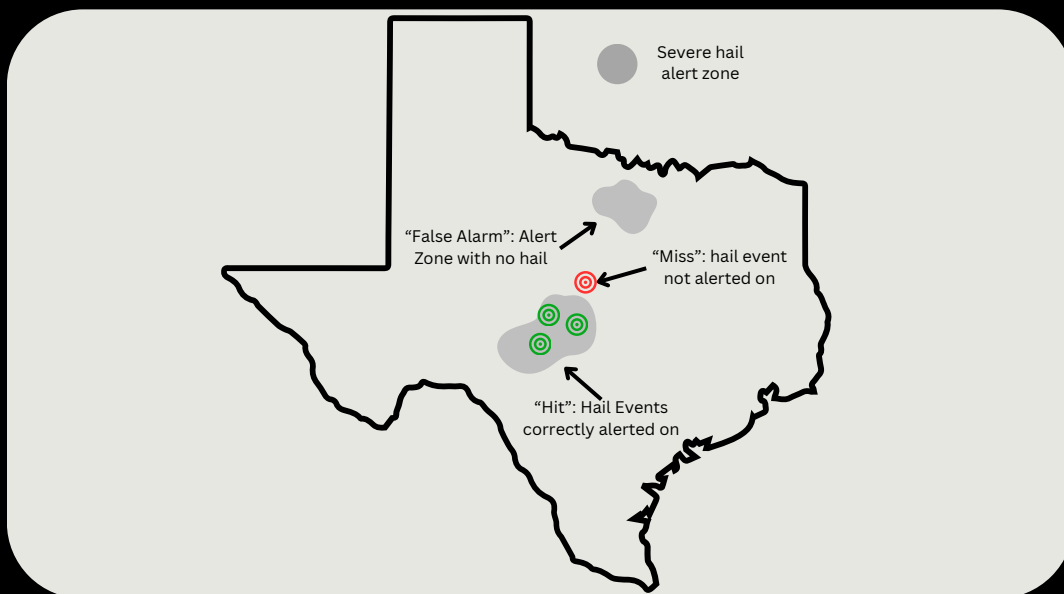
When evaluated for accuracy – that is, whether or not severe hail actually hit after a prediction was made – Excarta's hail forecasting model, providing users a 1 hour warning, saw dramatic improvements at each level of alert radius: a 23% improvement for severe hail striking within 2 miles of the user, a 50% increase for within 5 miles of the user, and a 60% increase for within 7 miles of the user.

HRRR Model Performance

Excarta Model Performance



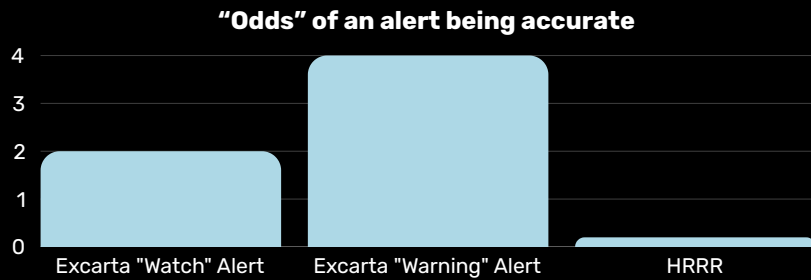
While the forecast quality showed strong potential, it needed to be transformed into an alerting system that effectively met user needs. The key challenge was striking the right balance between false alarms (false positives) and missed events (false negatives). Frequent, unnecessary alerts could erode user trust, making it crucial to minimize “crying wolf”.



A simplified view of hits, misses, and false alarms. (i) Hits are hail events that users received alerts for, (ii) Misses are hail events that users did not receive alerts for, and (iii) False alarms are alerts that did not correspond to any hail event.

As discussed above in the *Research & Methodology* section, the majority of users preferred to receive an alert if there was at least a 50% chance of hail in their area, at which point they would remain vigilant. Notably, this threshold aligns with National Weather Service (NWS) guidance for issuing a Severe Thunderstorm Watch, which is triggered when there is a 50% likelihood of severe weather. Similarly, users wanted to be notified if the threat escalated to an 80% likelihood, at which point they would take protective action. This threshold aligns with NWS guidance for issuing a Severe Thunderstorm Warning, which is activated when severe weather reaches an 80% probability¹⁴.

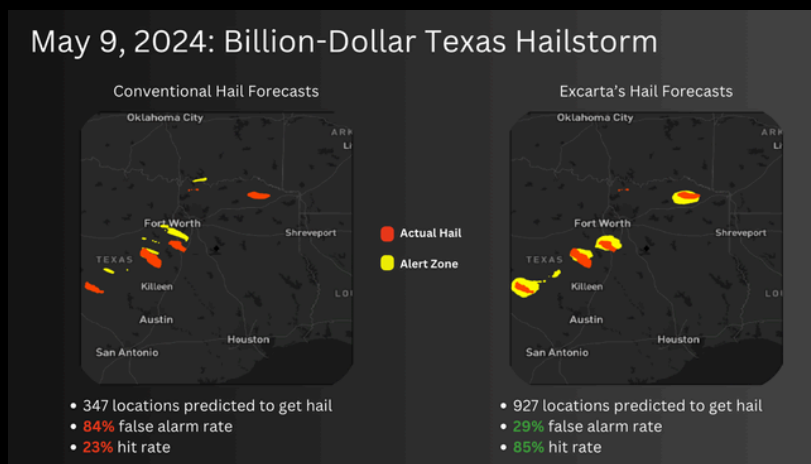
With this information in mind, Excarta tuned its model to optimize for reducing false alarms and aligning with these user-reported event certainty thresholds.



A "2:1" odds corresponds to a 66% chance of hail happening when the alert was issued, and "4:1" corresponds to an 80% chance of hail following the alert. HRRR model odds of 0.2:1 corresponds to a 16% chance of hail occurring.

Excarta's alerts use the predicted likelihood of hail at each location to determine whether or not to alert users at that location – and if they are to be alerted, what is the severity to convey to the users. These tiers of alert severity are further discussed in the Hail Alerting System section below, where each tier corresponds to a minimum likelihood of the alert being accurate.

There will undoubtedly be cases where the likelihood of severe hail is low, but severe hail still occurs. Excarta's alerts balance such missed events with false alarms, ensuring that users are not sent ineffective alerts that compromise trust in the system. When compared to the HRRR model for a specific severe hail event in May of 2024, the value of this balance is clear:



With the tuned model, Excarta ran simulations to evaluate its effectiveness across the entire 2024 hail season, and determined that **70% of predictions were accurate.**

Relevant Definitions

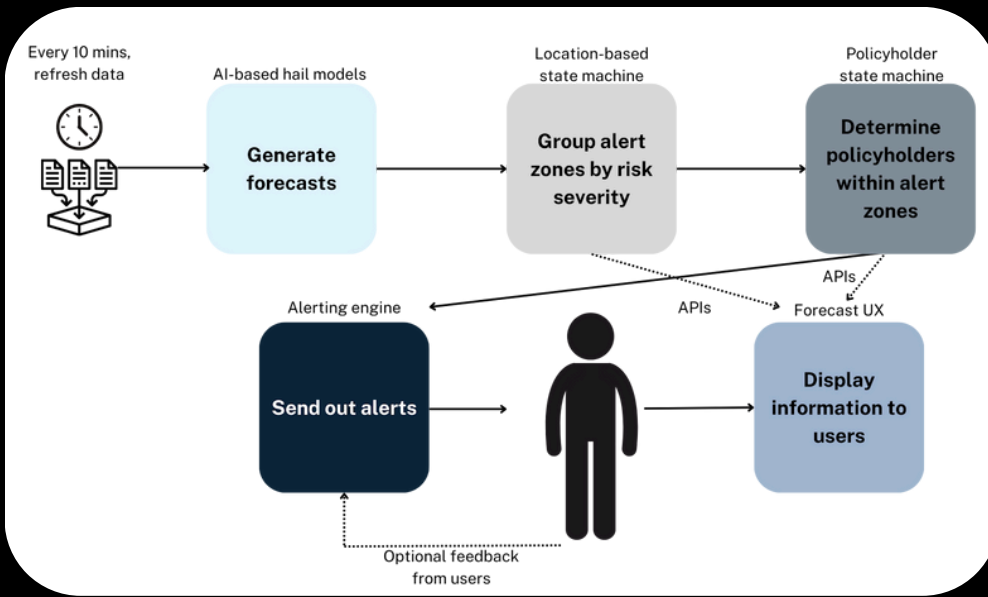
Alert quality: an alert is considered a quality alert when both of the following conditions are met: 1) the alert accurately predicts a severe hail storm within the defined alert radius of the monitored location and 2) the alert was delivered before the storm hits, therefore allowing the recipient to take preventative measures. If both of these conditions are not met, the alert is considered ineffective.

Alert radius: the radius (in kilometers) around a single point location for which any severe hail predicted in that area will still trigger an alert. For example, if severe hail is predicted 10 kilometers away from Jim's home address, but the alert radius is 9 kilometers, then Jim will not be alerted. However, if the alert radius were 15 kilometers, Jim would be alerted. The greater the alert radius, the more accurate yet less precise alerts become.

False alarm rate: the percentage of predictions made by the model that did not correspond to a real severe hail event (hail > 1") over the total number of predictions made by the model.

Hit rate: the percentage of predictions made by the model that did correctly correspond to a severe hail event (hail > 1") over the total number of predictions made by the model.

Hail Alerting System



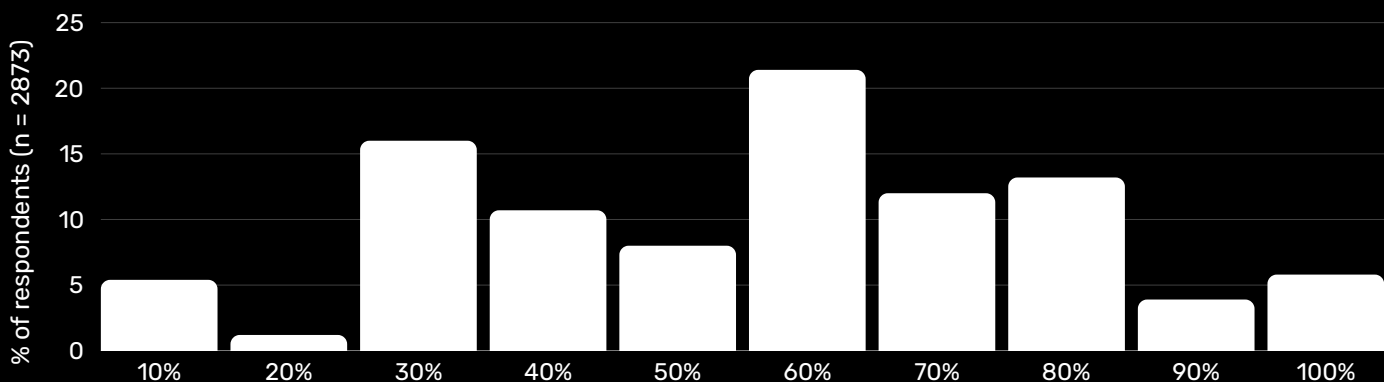
Alert engagement: an alert recipient is considered *engaged* if they actively interact with the alert. From the perspective of Excarta’s product, this means that the recipient performed one of the following actions: 1) they clicked on the within-alert link to follow the storm and learn more, 2) they responded to a survey asking about the helpfulness of the alert, and/or 3) they reported in an interview that they took direct action as a result of the alert. If none of these conditions are met, the alert recipient is considered *not engaged*.

High level flow of Excarta’s complete forecasting and alerting system. Every 10 mins, live data is gathered and run through Excarta’s AI model to generate a hail forecast. The location state machine assigns each 3km x 3km square of the country to an “alert zone”, which is then compared to a “policies-in-force (PIF)” map to determine customers in each zone. These customers are then alerted with a message that includes a link to a webpage with more information for following the storm.

With the model tuned appropriately and with certainty scores in hand for each prediction, the challenge now became implementing trustworthy alerts that people would act on. To do this, Excarta focused on three primary concepts → the development of alert zones, a text-message based alerting system, and a user interface to convey storm information to policyholders.

Conveying the right information with alert zones

In surveys and interviews, customers expressed a key tension: they want to be informed about severe hail risks without being overwhelmed by false alarms. Frequent, unnecessary alerts erode trust in the system. However, even when hail doesn’t materialize at their location, many still value being warned about the risk, as it prompts them to stay more attentive to the weather. When asked “at what level of hail likelihood would you want to be alerted?”, responses varied yet clustered between 50-80% certainty.

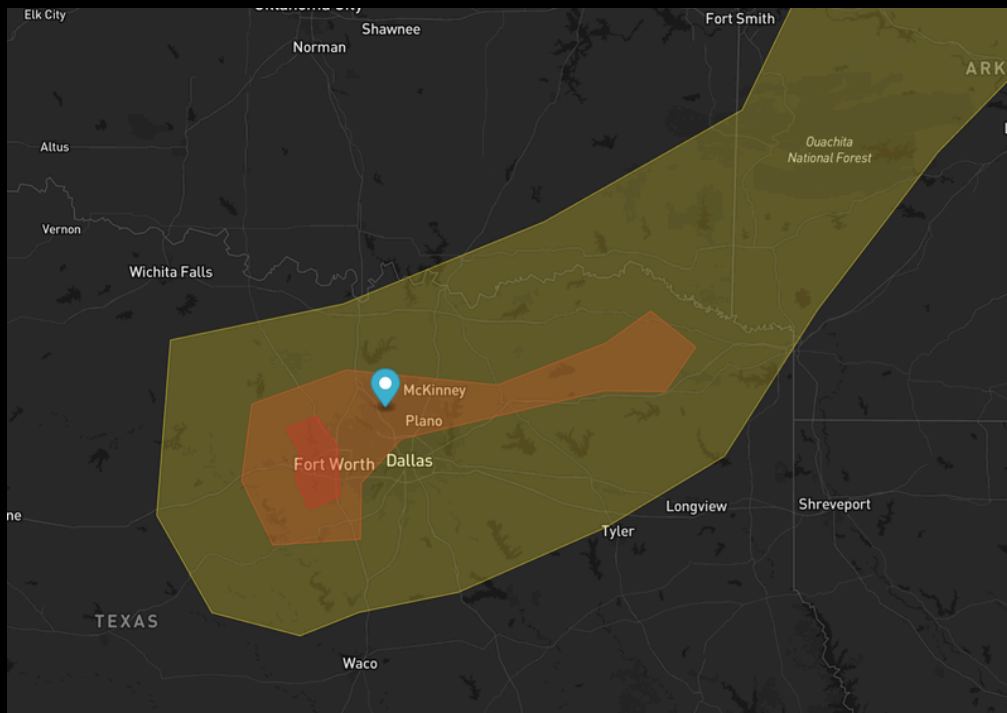


The majority (75%) of people want to be alerted only when there is at least a 50% chance of severe hail affecting them. However, responses varied across the spectrum.¹⁰

Qualitatively, customers described wanting to get a “heads up warning” but also being reminded later if hail was actually likely to hit them. This information led Excarta to adopt a tiered alerting framework that takes inspiration from the National Weather Service’s Tornado and Severe Thunderstorm alerting system with which most Americans are already familiar. The tiers are as follows:

Tier	Certainty	Timing	Suggested Action
Watch	50%	Up to 3 hours in advance	Follow the forecast
Warning	80%	Up to 1 hour in advance	Take preventative measures
Imminent	95%	Up to 30 mins in advance	Take cover immediately

This tiering system allows for the creation of “alert zones”, or geographic polygons where the severe hail risk exceeds the certainty threshold. Every time the Excarta forecast runs, each 3km x 3km square of the US is assigned an alert zone state→ None, Watch, Warning, or Imminent. This, when paired with PIF maps or monitored location lists, allows Excarta to assign each customer to an “alert state” and send them alerts through the alerting engine.



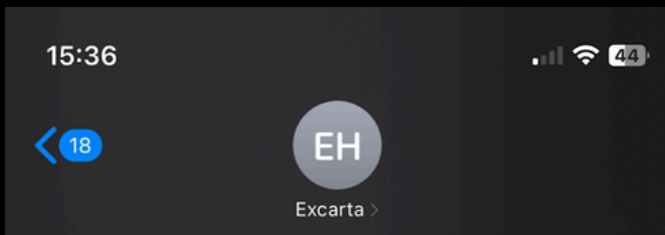
An example of alert zones in practice. A larger area is informed of a general risk to pay attention to, yet a smaller, more confident area is informed to take action.¹⁵

Alerting when it counts

After alert zones have been established and the system knows who needs to be alerted, the alerting engine sends text messages conveying the necessary information. For each alert, there are five key pieces of information to communicate:

1. The severity level to provoke an appropriate response.
2. The general hail size to tangibly communicate the threat. Severe hail is defined as > 1".
3. The alert radius in respect to the monitored location.
4. The time that the threat is expected to start.
5. An action to take.

The engine composes a simple text message containing only this necessary information and includes a link to the user interface for additional information. It also ensures not to alert customers who have already been alerted for their current state.



HAIL WATCH: Severe hail (>1" in diameter) is possible within 10 miles of your location starting around 6:00pm CDT today (8/22). Pay attention to the forecast.

Follow the storm here: <https://hailwatch.ai/xi39f2>

Reply STOP to opt out

An example alert sent to a customer.

De-escalation Message	Good news! The threat of severe hail in your area has passed. Thank you for staying alert and prepared. We'll continue to monitor and keep you informed of any changes.
Watch	HAIL WATCH: Severe hail (>1" in diameter) is possible within 10 miles of your location starting around 6:00pm CDT today (8/22). Pay attention to the forecast. Follow the storm here: <link to visual UI>
Warning	HAIL WARNING: Severe hail (>1" in diameter) is within 10 miles of your location starting around 6:00pm CDT today (8/22). To prevent damage, cover your car and avoid driving. Follow the storm here: <link to visual UI>
Imminent	HAIL IMMINENT: Severe hail (>1" in diameter) is very likely to hit within 10 miles of your location at 6:00pm CDT today (8/22). Take cover immediately. Follow the storm here: <link to visual UI>

Finally, as an important note on timing, even though Excarta defines actionability as alerting at least 30 minutes before an event and has optimized its forecast to do that, customers indicated that they still want to be informed no matter what.

“Even if it's 2 minutes away I want to know” – Heather, Colorado.

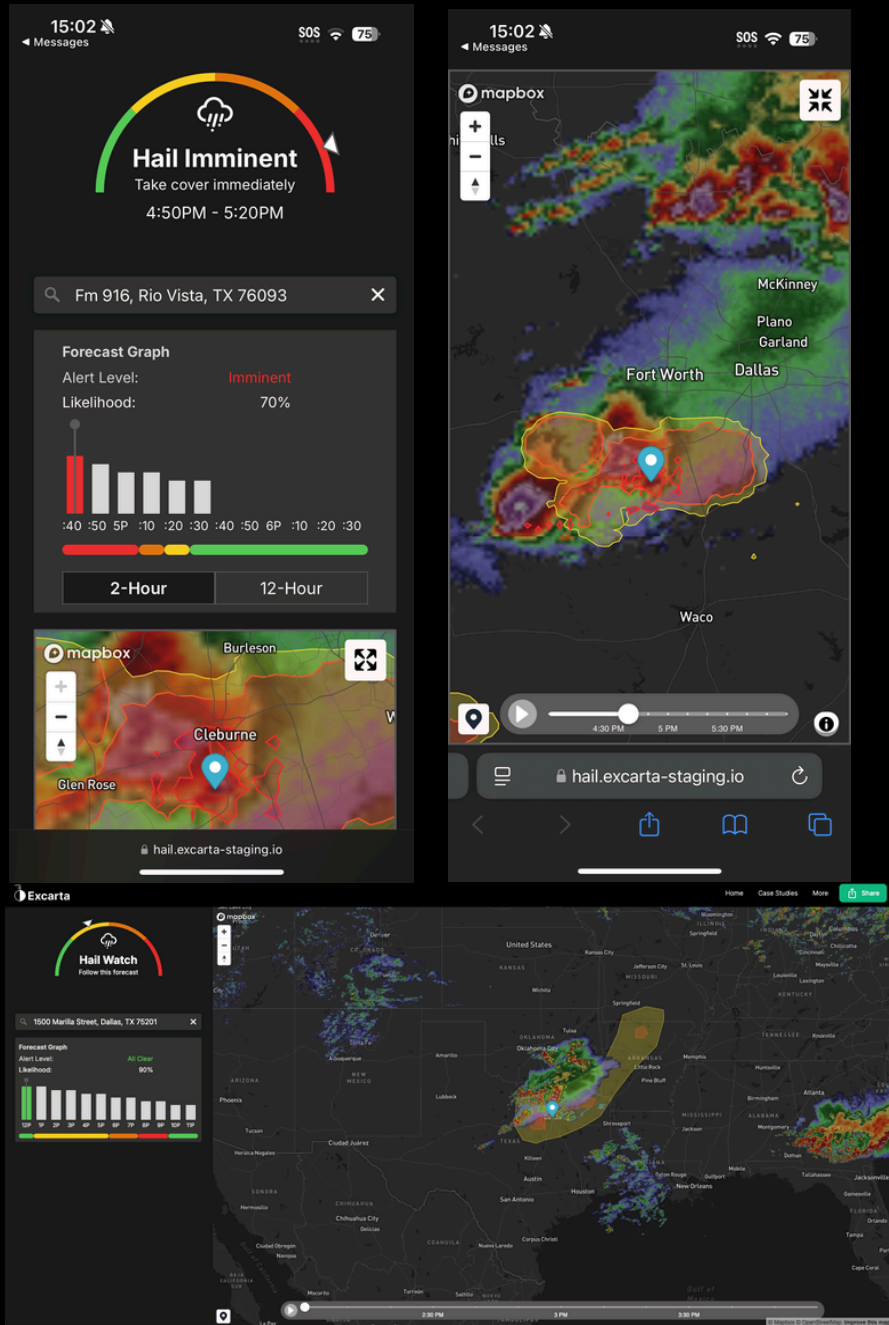
The alerting engine will continue to send customers alerts if any state changes, even if it's just 10 minutes in advance.

Bringing the information to life

The final, yet vital, component of the system is the user interface that policyholders are linked to in their alert texts. This interface aims to provide the additional information that users reported would help them develop greater trust and engage in the information. This additional information includes:

- An easily digestible header bar with key information, including visual cues for alert severity, the timeframe it is valid for, and the action to take
- A timeline view of the likelihood of severe hail
- An expandable map with visual representations of:
 - The alert zones
 - The live radar
 - Recently reported severe hail events

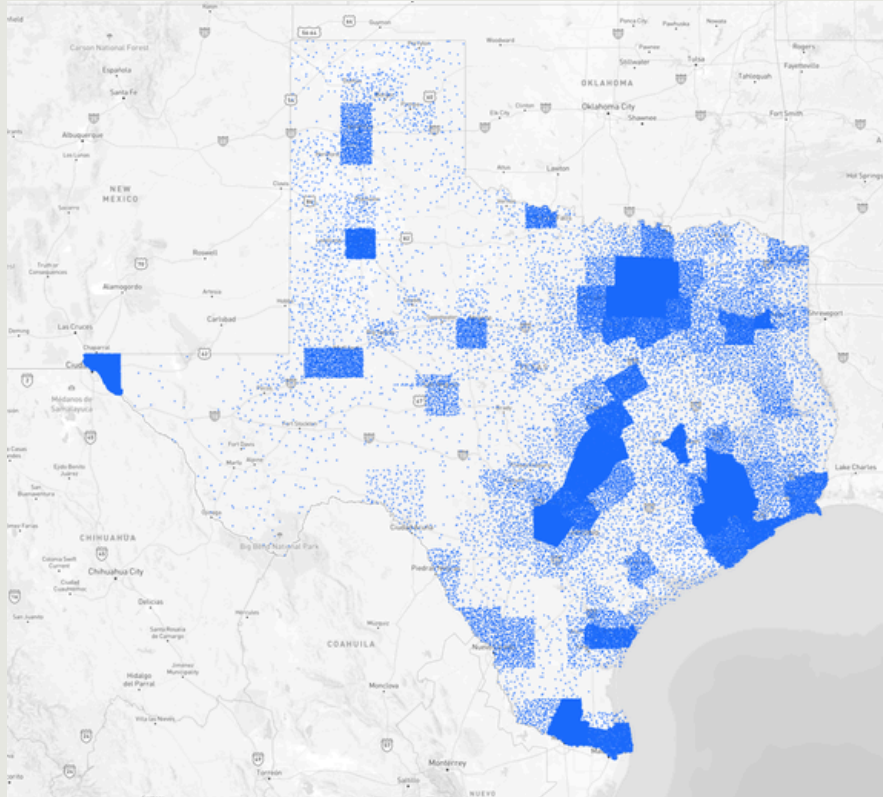
In an ideal situation, a user would receive an alert about a Hail Warning for their location, click on the link, and immediately see their location encompassed by the alert zone with a radar system moving steadily towards the area, and a few markers indicating where severe hail has already fallen at the lagging edge of the radar system. This information combined tells an immediate story that there is a storm system containing severe hail moving towards them, thus justifying the alert. With all this information combined, users feel empowered to make their own decisions about taking preventative measures, even if it's after monitoring the storm for some time.



Excarta's mobile default view (top left), along with the expanded interactive map layers (top right). The desktop view is shown below.¹⁵

Case Study

To pull all of this work together, Excarta ran a simulation for 100,000 drivers dispersed across Texas proportionally to population density. This simulation evaluated the effectiveness of Excarta's alerts to these simulated drivers throughout the entire 2024 hail season (March - September).



Map showing the locations of Excarta's 100,000 simulated drivers receiving "alerts" for the 2024 hail season.

Simulation Results

56%

of drivers impacted by severe hail were successfully alerted beforehand (49k/88k).

3.4x

the number of times on average a driver was alerted the entire hail season.

70%

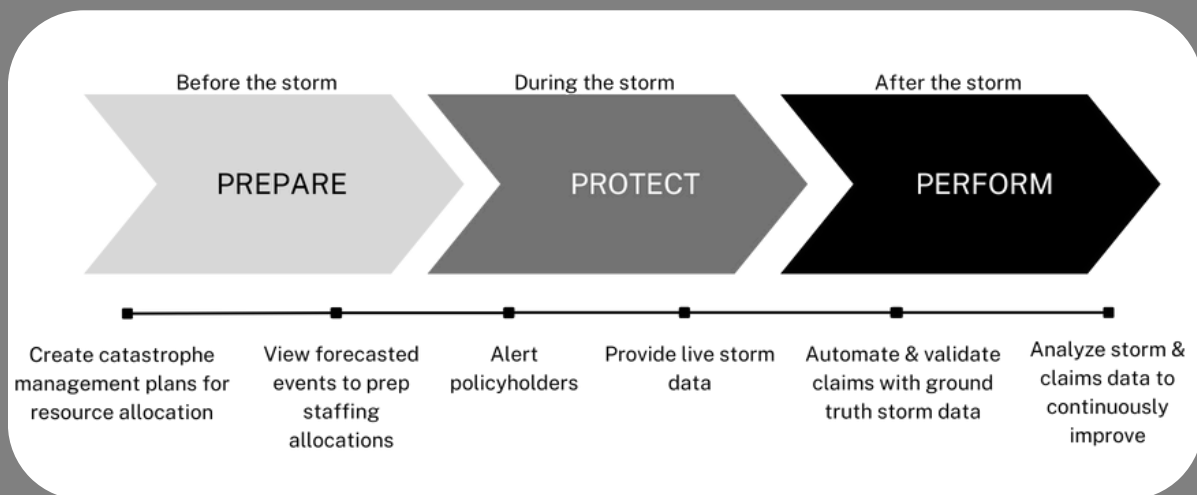
of "Warning" alerts sent 1 hour ahead of a forecasted severe hail storm correctly resulted in severe hail falling within 15km of the user's location.

To quantify the financial impact, the average hail damage auto claim is approximately \$5,000 and rising.¹⁶ If just 1% of the 88,000 impacted drivers experience severe hail damage and file claims, the total losses amount to \$4.4 million within this 100,000-driver population. Moreover, Excarta's behavioral research, detailed in the *Research & Methodology* section, conservatively estimates that 30% of drivers will take action to protect their cars when provided with improved alerts. As a result, **these alerts could have already prevented at least \$1.3 million in damages during a single hail season per 100k drivers in Texas.**

Looking Forward

Where is the Insurance industry heading?

While this work demonstrates the exciting efficacy of AI-driven hail forecasting to protect policyholders and avert hail losses, it represents only the tip of the iceberg in a new frontier of financial and operational improvements that can be made to address the challenges of catastrophic weather. Excarta, building upon the foundations of this work, has outlined a product vision that serves as the catastrophic weather nerve center for insurers, handling all the data, automated processes, and analysis from the formation of catastrophe management plans all the way to end of year cat claims reporting. In this way, by combining the recent advances in AI-based weather forecasting with company claims data, insurers can more effectively *prepare* for catastrophic events, *protect* their policyholders, and *perform* appropriate claim resolutions.



Forecasting Beyond Hail

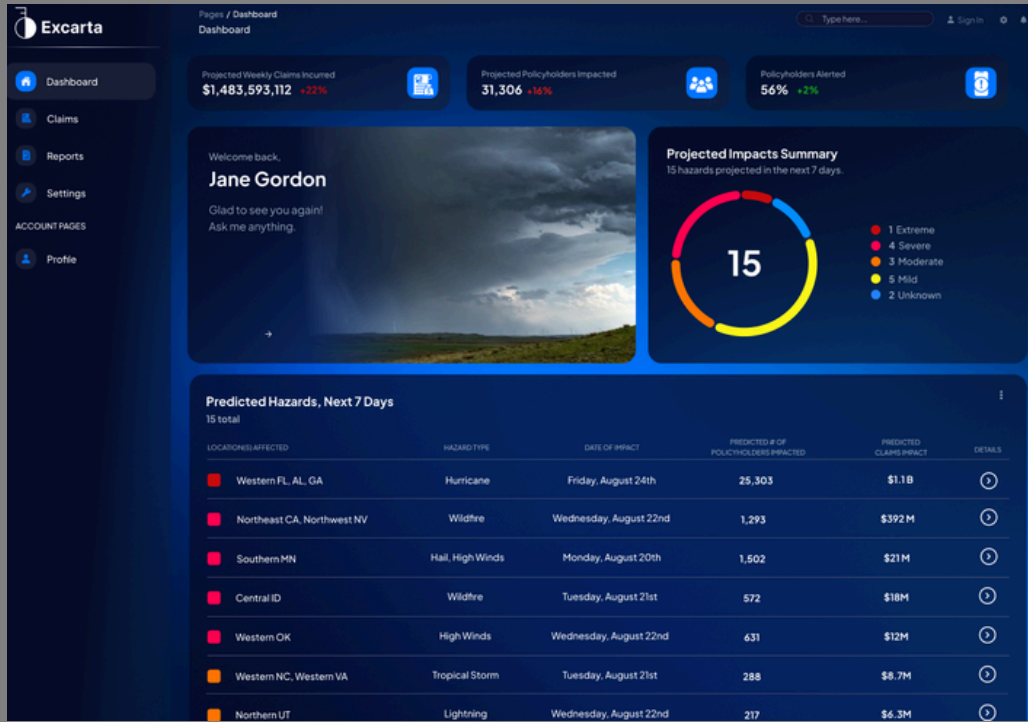
Beyond forecasting severe convective storms (hail, tornadoes, high winds, and heavy precipitation), AI models have also been shown to more accurately forecast the path and severity of tropical storms, the movements of wildfires, and the development of significant temperature swings such as heat waves and freezes. Excarta is already evaluating its AI-based forecasts for these events- its 5-day geopotential forecasts outperforms the world-leading ECMWF model by over 10%, and Excarta's 5-day temperature forecast outperforms ECMWF by over 5%.¹¹ Also, while not yet fully in production, Excarta's tropical storm model accurately predicted the path of 2024's Hurricane Ian 3 days prior to landfall while the NWS's forecast remained off by over 300 miles.



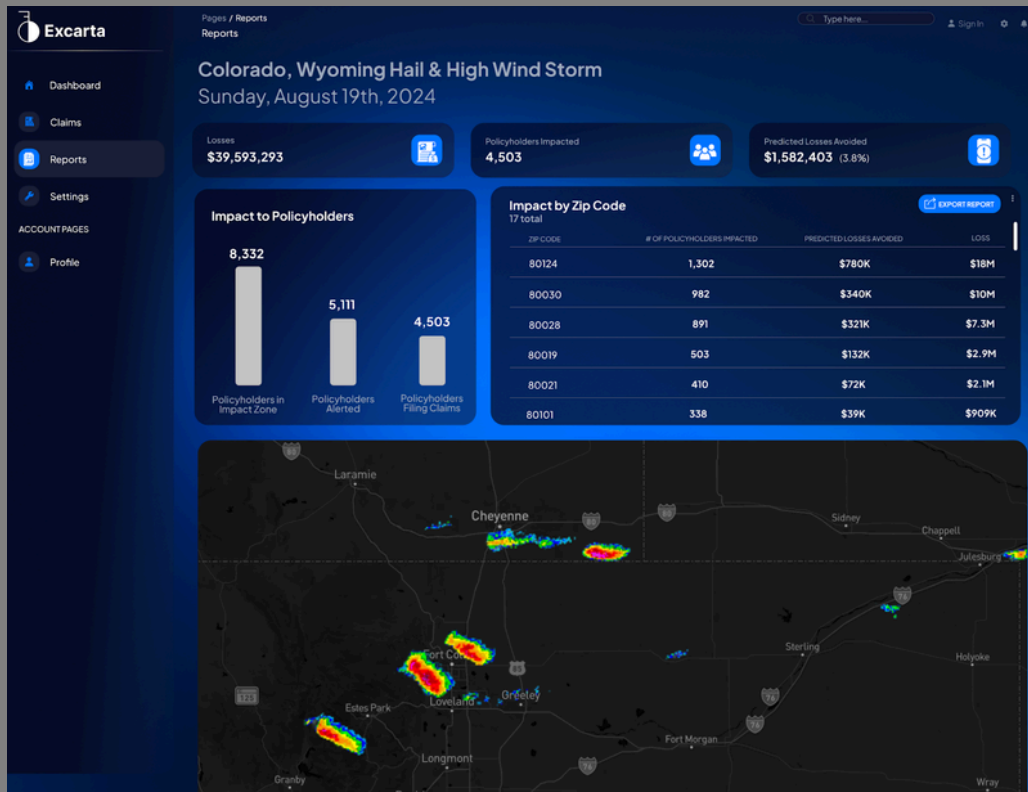
Excarta's forecast of Hurricane Ian's path (green), 3 days before landfall, compared to NOAA's forecast (orange) and the actual path (red).¹⁷

Thus, in addition to hail forecasting and alerting, AI models are primed to monitor and alert on all catastrophic hazards, ensuring that severe weather never surprises policyholders and claims teams and ready to respond. Additionally, when integrated with claims data into a comprehensive user interface, insurers are able to

understand the complete story of a catastrophic event– the initial exposure of policies-in-force, the effectiveness of proactive alerts to policyholders, each aspect of cycle time response, and the overall financial impact of the event. Excarta posits that, while these capabilities seem aspirational today, they will become an absolute necessity for insurers to both manage the rising challenges of a changing climate and effectively compete in the industry.



This kind of catastrophic weather management hub– where claims managers can view forecasted threats, analyze automatic alerts to policyholders, and analyze storm data, can now be achieved through the pairing of AI weather models with company PIF maps and claims data. Above, a catastrophe manager views a dashboard of forecasted events for the week, sorted by their projected severity & impact. Below, the same manager reviews a recent hailstorm with highest impacted areas, high resolution storm data, and information on the number of policyholders affected, alerted, and filing claims.¹⁸



How do we get here?

With any adoption of new capabilities, components of the solution must be integrated gradually. For any insurer poised to take advantage of Excarta's advancements in severe weather forecasting, alerting, and analysis, the following series of checkpoints outline the path forward:

1. Implement hail alerts to policyholders

- This is the lowest hanging fruit that leads to proven loss mitigation and improved customer experience.

2. Adopt an AI-based severe weather forecast dashboard for catastrophe claims management teams

- Forecast dashboards require no additional data integration yet provide teams with a single source of information on the severe weather systems that are likely to impact policyholders, helping them to monitor storms and prepare resources accordingly.

3. Implement automated alerts for additional hazards beyond hail

- Expand alerting to policyholders when they are likely to experience a tropical cyclone, tornado, high winds, flooding, and/or wildfire risk.

4. Integrate PIF maps to automatically forecast the impact of predicted hazards

- Combining Excarta's forecasts with PIF maps creates a deeper understanding of the impending financial and operational impact of a storm.

5. Integrate claims data to close the loop on forecast and company performance

- With claims data pulled into the solution, insurers can harness a wealth of performance data— alert effectiveness, predicted losses vs realized losses, response times, etc.— in addition to automatically validating claims based on ground truth storm data.

A world where severe weather is never a surprise

The data is clear— severe weather is worsening in its frequency and intensity. Insurers are being forced to adapt. Yet, technology is improving alongside our changing world, and AI has ushered in a new era of weather forecasting ability. As these models are paired with behavioral research and claims data, insurers stand poised to unlock a wave of financial and operational savings in the face of catastrophic weather. Ultimately, Excarta is working towards building a world where severe weather is never a surprise.

Through hail alerting, Excarta is already helping insurers and their policyholders to avert hail losses and improve claim cycle times. Excarta understands the operational intricacies of insurers and works flexibly to integrate its modular solution into your workflows as needed. These solutions are designed to be expanded upon for your highest priority severe weather use cases. Excarta looks forward to helping your organization reduce losses, improve customer satisfaction, and become more resilient to severe weather.

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Endnotes

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