Estimating Hail Damage Using Radar and Model Guidance

Friday Forum: August 06, 2025

1h 31m 32s

Keith Porter 00:00

All right, welcome to an unusual Wednesday edition of ICLR's Friday Forum. Today is August the 6th, 2025. This is the 232nd Friday Forum in the series. The series is hosted by ICLR, the Institute for Catastrophic Loss Reduction. We're Canada's leading source for disaster resilience knowledge. Our mission is to make Canada more resilient to natural disasters. Each month, we present recent research related to that mission. I'm your host, ICLR’s chief engineer, Doctor Keith Porter. I'm speaking to you from London Ontario. This place is on the traditional lands of the Anishinaabek, Haudenosaunee, Lūnaapéewak, and Chonnonton Nations. Last month you heard from ICLR staff members Dan Sandink and Tamara Mosqueda. They told us about ICLR’s resilient homes task force that's a collaboration with builders and insurers to find ways to build beyond the building code. It was a great webinar. I very much enjoyed it. If you missed it, check out the recording. You can find the recording of the speakers deck and a transcript at www.iclr.org/workshops you can find all our other Friday fora there too. Next month, CAL FIRE Deputy Director Frank Bigelow will talk about California's adoption of the wildland urban interface code and California's recently released fire hazard severity zone maps, if we fire hazard maps or building codes interest you join us next month. So why again Are we having a Friday forum on a late Wednesday afternoon? Because our speakers come from Melbourne and Sydney, Australia, where it is now 6am our usual time would have had them up at 3am on Saturday morning. It's still early, but it's not 3am Saturday early. Our speakers are Dr Josh Soderholm, Dr Luis Ackermann and Dr Rhys Whitley. Josh and Luis are atmospheric scientists with the Australia bureau of meteorology. They work in radar science, and they focus on hail. Rhys is an environmental scientist. He makes lost models at Suncorp, a large Australian general insurer. Their topic today is estimating hail damage using radar data. Australia has bigger hail problems than Canada, at least by a couple of measures. Canada has had two, $1 billion or greater hail storms. Australia has had 11. Our largest hail storm cost $3 billion the 1999 Eastern Sydney hail storm cost about $8 billion in Canadian dollars, and Australia's population is about two thirds that of Canada. I'm looking forward to hearing about how estimating hail losses is going to help Australians improve their resilience. I also want to see the alignment of insurer and government interests in hail loss estimation, and I'm going to pay attention to what comes next for this model. Now, before our speakers begin, here's our agenda. Our webinar is going to last 90 minutes, Our speakers will present for about half of that then I'm going to moderate Q&A for the rest of the time. Please feel free to chat your questions into the Q&A box. I'll try to pose your questions in the order they appear in the Q&A box. If we have a lot of questions, I may only pose your first question. Then I'll move on to others, then I'll circle back to your additional questions. Our webinar is recorded and ICLR will post our speakers slides and link to the video in the next few days. If you have colleagues who couldn't attend, let them know. You can find the video and the deck and the transcript and etc, at www.iclr.org/workshops probably around Monday. Now I will turn it over to our speakers, gentlemen, take it away.

Rhys Whitley 03:21
Well, thank you, Keith for that introduction, and it's great to be here. So I'm enjoying my name is Rhys, and I'm the Principal Scientist for the natural perils team that forms pricing analytics division Suncorp consumer insurance space. Yeah, I'm part of a team that's quite diverse. We're made up of Actuaries, climate sciences, engineers, computer scientists, and we're dedicated to determining the risk cost of all the natural hazards that affect Australian home motor owners across the country. I like to think we're quite cutting edge in our team. We take the best peril and use it to form accurate and fair premiums for our customers, using the latest statistics, implement machine learning techniques. We don't rely on one source of data. We try to seek out all sources of truth to get the best view possible. And when we don't see it exist, we go and fund the closure of those knowledge gaps, which leads us to today's talk, which Luis will give the bulk of and I'm just going to provide some context of why we've embarked on this partnership between a general insurer and a weather agency, and how our knowledge is Severe and thunderstorms is quite limited, despite the scale of damage and our exposure to them. So severe convective storms represent one of the most financially destructive natural perils that we come for in Australia, and that's across multiple lines of business, particularly residential property. Hail storm systematically destroyed a lot of the home structure, roofing materials, windows, skylights, solar panels, etc, and caused quite excessive water damage through compromise a compromised building envelope. So you can see from these photos all those tar pollens there on the on the left. That is from the 1999 Sydney house storm. And there in the top right and the top you can see that the penetration is quite significant. And when you get that water inside into the building, the damage, particularly in aggregate, can be quite, quite large. Also, there's the motor vehicle component attached to this peril, vehicles can be damaged in 10s of 1000s and not just a single afternoon, and you're looking at five to $10,000 on average in terms of claims costs, if not a total write off. There's also other damage we don't

really insure for but we're quite cognizant of it, particularly with airlines. I think that's from a Turkish airline, but I know for the Sydney 99 hail storm, a lot of aircraft were damaged. And I guess something with hail is that the lead time or the warnings for such events is very small, that it's very hard for customers and anyone to react to to get things out of harm's way. And of course, there's agriculture, which we don't cover, but there's also a significant hazard to that industry. So this is the we look at insurance impacts for severe thunderstorms, hail, it ranks as one of the costliest natural hazards that affect Australians. So these numbers are taken from the insurance Council of Australia's natural catastrophes database. And we've got historical losses here that are normalized to 2022 which considers all the economic inflation, cost of construction and population growth and expansion. What I wanted to highlight is, while incredibly rare, the hail storms are quite dominant events in the historical record. It can easily reach up to and exceed $1 billion in losses. In fact, that 99 hail storm is ranked as one of the most destructive events for Australia since records began, since 1967 and as Keith mentioned, it equates to about eight, close to 9, billion Australian dollars. Just to ensure losses alone, the economic losses would be higher. And it's just the scale of the damage from that event. There are over I think 25,000 homes affected, old buildings, up to 70,000 domestic vehicles, and all in one single afternoon. And while this was originally seen as an anomaly, there are indications that this wasn't that exceptional event. The hail sizes may have been around seven centimeters. I guess Josh can comment more on that. But what made it destructive was the part it took through Sydney, which is one of the wealthiest parts the eastern suburbs. And more than anything, it highlighted the exposure city, like Sydney, has to severe thunderstorms. So that in mind, it's not surprising to see severe thunderstorms and hail can be one of the biggest loss making perils for any insurer, and this is an example from Suncorp. It takes up quite a significant portion of our natural hazard allowance. If you were to group all the severe thunderstorm impacts into one peril here, we actually separate hail just the zone, as opposed to the wind, lightning and what rainwater Ingress, you would get a lot of that storm proportion together with the hail one, and it would overwhelmingly make up at least 50% across all lines of business. And the reason for these large portions is that while the average claim size may be smaller when you compare it to other perils like flood and bushfire, where you would get a total loss on home, severe thunderstorms across Australia do affect these large population centers, so it's a concentration risk, as opposed to this location risk that You see with other perils. Consequently, event loss tables in aggregate can be easily in the hundreds of million dollars for us. So additionally, there's also little our customers can do to prepare or mitigate against the damage these events that where we have significant health or highly localized, short lived so it's difficult to predict the point that we can't really offer any lead time for our customers to react. For us, at Suncorp, we've had a good but limited views severe thunderstorm and hail risk across Australia. We try and ensemble different perspectives of this risk from the market and our research partners. However, while these are highly informative, these views are limited to large scale geographic views of risk and refer more to the environment that produce severe thunderstorms, rather than the actual severity of actual storm itself. So we're limited to a very core scale view. This is an important point. So while it is useful to identify these stone prone environments, our inability to reliably predict specific frequency, intensity and the insurance impact of severe thunderstorms at a more granular level is somewhat detrimental to us for accurate insurance pricing, particularly when we understand more local effects are playing a role on thunderstorm risks at some regional scale. So while we understand how storms are notoriously difficult to observe a model because they are small scale, relatively rare phenomenon, as an insurer, we can't afford to price and severe thunderstorm risks based on incomplete science. So it's important imperative to our customers and shareholders that we get the fairest and most accurate view of the risk possible. Consequently, we see collaborative research as our path developing a better view for this severe thunderstorm risks across Australia, and our understanding of them. And his wife, Suncorp, reached out to Josh and Luis and others at the Australian Bureau of Meteorology and on that, I'm happy to pass on to Josh. If that works for you, Josh.

Joshua Soderholm 11:23
Thanks, Rhys. Luis, can you share your slides now?

Luis Ackermann 11:37
Sorry. Can you see them? Yep, they come up perfect, and just let me know when you want me to switch. Thank you, Luis. Okay, next slide.

Joshua Soderholm 11:48
Next slide again. All right, so we just heard from race at Suncorp about the general insurance perspective and why they're interested in investing in a science project with the Bureau of Meteorology, and now I'll give an overview of why the Bureau of Meteorology was very interested in this collaboration with a large general insurer to better understand hail across Australia. So the Bureau of Meteorology itself, just like Environment Canada, it's responsible for Australia's weather forecasts, our severe weather warnings, climate monitoring and hydrological services, we're there to protect life and property, while also ensuring Australia's economic, environmental and social needs are met. Relating to weather and climate services.

We also provide specialized data, forecasts and climate information back out to industry to enable their productivity. So this is including agriculture, aviation, mining, tourism as some examples. And this weather information, we basically designed to allow them to make more informed operational decisions and manage weather related risk. And of course, insurance falls under this umbrella, as well, as part of this introduction, I also want to introduce the radar network in Australia. You can see the map of the current operational sites on the right as of 2025 so we have currently more than 70 radar sites across Australia. Bit like Canada, we have very large areas where there is no coverage. But for us, they're essentially the desert regions where there is very little population. So you can see a majority of our radars are situated along the coast, particularly on the East Coast, and this is very important for our project, going our discussion today, going forward as well. Next slide, please, Luis, so these radars are actually sitting along the east coast, and this is coincidentally where we also see a majority of our thunderstorm activity, which is co located with Australia's some of Australia's most densely populated cities. So the map on the left shows a radar derived severe hail climatology for Australia, where our hotter colors are indicating more frequent severe hail storms across Australia. You can see the peak activity is centered across the cities of Brisbane and down 1000 kilometers south to Sydney. So this area, these are two very large cities. Sydney has about 5.7 million people, and Brisbane is rapidly approaching 3 million people. So the significant urban centers in Australia, you can see the map of Australia's population is also very biased to this east coast as well, with the with the map, the population map on the right. So there is significant interest in improving we're in better responding to the exposure which were presented here regarding a hail hazard. Next slide, please. Luis, the next slide. So another problem for us in Australia is we currently have no ongoing public reporting of thunderstorm hazards, including hail. So for us, this is a big problem when we're trying to find some sort of ground truth to develop new retrievals, new environmental information and new environmental proxies relating to hail. We do, we do have some historical archives, but the quality is low, and also the like any report data set, they're affected by the poor spatial coverage, where our reports are biased towards capital cities. So this strongly motivate, motivates us to explore alternate data sets to better understand hail risk across Australia and better understand our understanding of hail estimates within the bureau. So an example of what the data sets we had before this project was on the right here. So on the left we have all of our hail reports from one of our internal archives plotted up, you can see they're very biased towards the capital cities of Belbin, Sydney and Brisbane. Of course, we do have a lot through that region where we do have hail impacts, but this is across quite a lengthy period as well. So we're talking more than 35 years. So the numbers are actually not that significant per event.

We might only have a couple reports per event, which is really quite insignificant in the scheme of things. And when we look at larger hail sizes as well, which create the more significant impacts which Rhys showed in his slides, the numbers drop off very quickly across Australia, despite these events occurring regularly across the warm season. So there is a strong desire by many of the Bureau's customers, not just insurers, but also by our forecasters, who service the generous general public, by energy and resources and also by agriculture, to better understand the first of all, the risk of hail across Australia and then have better information when hail storms are occurring to understand their impact. Next slide, please. Luis, so this brings us to the last few years, so there's been a renewed focus on hail at the Bureau of Meteorology, and this has included the development of national calibrated hail guidance, where we use our radar network that's been calibrated to map hail in real time and provide retrievals to our forecasters. And this information will also be going out to businesses as well who require it. But this is the baseline information where we're only estimating hail size, but it's a great place to start building upon. We also, as part of this project, developed our long term calibrated archives of hail estimates from weather radar across Australia. So we essentially reprocessed our radar archives, quality controlled them, and generated our hail retrievals back in the past as well, to complement what we're doing for the real time operations. So our collaboration with Suncorp, we're very excited to hear they're keen to work on similar problems that we are focused on internally at the Bureau, but also bring along their experience, their knowledge and, of course, their data sets as well, to help fill the many of the gaps which we're faced with. So this collaboration, which were that Luis will be, will be delivering the research from today, builds upon many of these capabilities we've developed across Suncorp and the Bureau, and enables us to have a new impact based assessment of property and motor damage that is very relevant, particularly for our insurance industry in Australia. And yeah, I'll hand it over to you, Luis,

Luis Ackermann 18:50
All right, and you can hear me. Well, I cannot see you, so I'm gonna hope, okay, that's a yes, we hear you. Awesome. So I'm bringing this, this figure back, just to give you a little bit of reference. Bit of reference. Um, during the talk, I'm going to show you some of the the products that we're generating, and I'm going to reference these two events that are the the one on the left is the 2014 Brisbane one, and that is a little bit more on the expensive side, and the Halloween event on the right. And just to show basically what it looks like the products that we're generating on events that are somewhat on the high end, but not on the very outlier end. And of course, this is why, and I just wanted to show you a physical example of what we

actually see on the ground that are generating those huge damages. So our motivation a little bit of context before we go forward, just on on how we derive one of the measurements that we're going to use a lot and we're going to reference here, which is that severe hail index, Shi that is basically created by doing an integration of reflectivity above the melting layer. Basically the radar looks at a thunderstorm, and it will take the anything, any measurements above the melting layer where we expect hail to grow, and we integrate that in a weighted manner, and that give us this severe hail index, that is that has some information about how much Hail there might be on that volume. Now that's not necessarily the Size of the hail to do that basically that severe cell hail index is fitted to some observe hail sizes on the ground, and we'll show you that later on. So the objective of our project was basically to create an improved radar derived hail product, using our radar archive and leveraging the about 10 years of claims data from hail damage provided by Suncorp as the ground truth, which is extremely valuable for us so but there are some challenges. The first one is hail size uncertainty, as I said before that Shi that measurement from the radar can be then fitted to some hail sizes on the ground. And that's the relationship that we observe. The one we actually using to do that correction is that blue one. It was on the 75th percentile. But as you can see, all of those fits are somewhat uncertain. There's a lot of variability. And what we can see in effect is that for the same radar measurement, you can have multiple health sizes that match to those, and that's due to the fact that for the radar, a volume with a few large hail stones will have the same amount of reflectivity that a volume with a large amount of smaller hail stones. So there's an intrinsic uncertainty on the Hill size distribution that the radar cannot decipher, cannot tell. Nevertheless, that's the fitting that we have, and that's basically a radar derived hail product, but it's widely used mesh. The other challenge that there is with using radar to detect hail is that, well, if you use something like mesh, which is derived from Shi that is derived from observations aloft above the melting layer, which can be up to two kilometers high, but that is within a storm that has some movement because of the winds, the storm winds, plus the large scale winds, and that will create addiction, basically a movement of the storm of the stones, from where they were grown and created and detected to where they actually land and create some damage. And here on the right, we can see stories from from Brooke at all on 2021 that basically because on that domain, they had a multi Doppler radar, they can have three the winds, and then they can actually try to do trajectories for each hail stones and do basically a correction for that storm. And you can see the dots are what this the radar detects as potential hail. The blue is the damage on the ground. And you can see that before correction is is offset to the right. Well after correcting it for wind addiction, it's much better represents the the damage swath. So that is an actual problem, and in most of our domains, we don't necessarily have a way of creating 3d wins because we don't have multi Doppler radar coverage. So the first part that we're going to show you on the results is going to be on the residential hail damage estimates for which we use the data set that Suncorp provided for hail damage on houses. And then once we started looking at the data, we quickly realized that there was a source of variability that we needed to correct for, and that was the vulnerability differences between different property types. And here's a good point to remind everybody that we actually got a policy level data from Suncorp, meaning that we had the not only claims, we also had nulls, which was extremely important to basically know where there were no claims also. But we also had characteristics for each one of the policies. So roof type, wall type, tree coverage, the year of built, etc. And what we find is that if we combine these characteristics into basically archetypes, we saw that basically houses with tiles and concrete walls were fairly common, and we can group them tiles, houses with metal roofs and wood walls were fairly common. So we were able to create some archetypes that represented most of the data. 11 archetypes represented more than 85% of the data, and we created a last archetype, number 12 there that basically grabbed everything else, houses that were very uncommon. And what you can see there is the distribution of the relative damage. And by relative damage I mean, the incurred loss divided by the insured sum. So I'm going to be using damage referencing to that in general, and we can see that there's a lot of variability or different vulnerability for each one of those archetypical property types. And we before we go forward, we need to basically correct for that, because otherwise we're trying to to the vulnerability due to the intrinsic house properties has nothing to do with the hail itself. So we needed to correct for that to to create a normalized damage. So what we did is basically we tried to, we took the medium for each one of those archetypes and we corrected it so each archetype has a medium hail relative damage equal to the overall data set, which is the column on the right. So that allows us to basically group them, compare apples to apples. The other issue that we needed to fix first is that, well, we needed to have a good data set that where we were sure there were significant hail damage that we can then compare to the radar. You can see the original data set on the left that basically there's a characteristic health swath the damages on red. But there were areas where there were uncertain whether or not the damage was significant. So what we tried to do is we kept policies or grid points that where we had a majority of damage, and then Paul grid points where we had basically no damage, and anywhere in between where where the damage would have been uncertain or difficult to to pinpoint. We maxed them out, and then we graded the data. And since we already had corrected for vulnerability differences, we can actually grid data and have an average damage per grid point. And we did this for all the events. We had a little bit less than 30 events, 30 intense hail events, where we were working from from many cities, but overwhelmingly from the East Coast. So what do we did with the advection problem? Since we cannot rely on having 3d wins for everywhere, we needed to look for another solution. And what we came from this assumption of, well, let's say the radar observations are not perfect. We saw that that fit is not great, but there is information there. Let's assume for a second that the radar do have some information about how much Hail there is. Maybe it's not correct, but potentially, for each event, it has a relative scale, meaning that if you have some detection of hail above that is very intense, and you have some place on the bottom where you have a hotspot, most likely the hotspot is due to the hotspot on the radar observation. And that's what we did. We basically took all the grid points for each event. We sort them by from descending order, from starting from the highest point of damage, and we look on a four kilometer radius of influence, the highest radar signature close to it, and we match them. We're saying, well, the highest damage should be due to the highest radar signature close to it. And then we then to the next grid point and find the next radar point and match them together. And you can see on the on the left hand side are before any correction, any advection correction. The right hand side is, if we match all of them, basically that star represents the average of all of the corrections. You can see them all where, basically to the left. And if we apply that bolt correction into the the radar data set, we can see that, then the swath actually matches quite well. So this is if we have claims on the bottom. This is basically a way of correcting for that advection, which is what we did for all events. And we basically corrected that, and now that created a data set of ground damages that was matched to radar observations aloft and with with that, we can see a little bit of the progression. So this is the start of the project, the relationship between mesh so radar and observed damage without correcting for advection, as you can see, quite bad. And I will explain why the blue and red means, if we correct for advection, it improves, but still not great. And you can see that fit on that grid line. That grid line is a sigmoid. You can see that, well, the fit is not terrible, but it's not great, for sure. But one of the things that we saw is that the blue and the red there are two specific events, two days, those days that we have been talking about, and the black is all of the other ones. And you can see and this, we saw it over and over, event wise, there is a somewhat of a relationship. You can see that we can potentially move that green fitted line to match that single event. But of course, it wouldn't match the other ones, then that red one could potentially be fitted individually. So this gave us some hope that, well, the radar is indeed picking up something correctly within the event. The problem is that there's there are changes from one event to another one that the radar is not picking up that are driving a lot of that variability, potentially. And what we tried as well say, well, maybe there's something in the metrology that we can use to to fix that. And we try multiple equations and formulas and corrections, but it ended up being not that straightforward. But we found out that if we use a neural network, and we basically use a lot of metrological variables from Arrow five for the location, for the time of the event, we can actually correct for that, and that's what we did. And this is that new hail damage estimate model, which is basically a radar plus metrology product that corrects a lot of the variability that we were seeing, creating a very nice correlation, if we see what it ended up driving the model. And the way we did it is we created this model. We put as much from the metrological science as we can think of, using era that potentially could be an effect, and then use chap analysis, which basically tells you how much each input variable has an impact on the output and started removing input variables that had basically no impact, and rerunning the model and removing variables that were not really impactful until we ended up with only the really impactful ones. Basically, when we started removing variables and the performance starts to decrease, we stopped. We can see that the variables that survive were on top of everything, the radar, the severe health index, driving about a third of the variability, and then the rest was this, other metrological variables, humidity, winds and Cape convection, variable and convection inhibition variables, which physically makes sense. Now, creating this model with a relatively good performance, I will say, kind of allows the possibility of, since this model is created, is calculated aloft, where the Shi is being measured, and mesh is also aloft. This kind of bypasses the problem with the abduction. So we can say, well, if we have this HDE, this potential truth for damages, we can then compare it to mesh, since they're both a lot and see if there's actually some relationship that we can get between mesh, the more traditional radar product, and this new damage. That is a lot we saw that the fit is actually not bad. There is a lot of variability, as we saw. So in here, we can see that vertical variability that is due to the uncertainty of the hill size distribution, which the radar cannot tell, but at least we have some of a correct of a fit. That red line there, that fit is that green line. And then, using that fit, we can then, from damages back, calculate hail size, which is what we did on panel D here, just so we can have because damage percentage is a little bit weird for for us scientists, we we are much more used to hail sizes in our in our mind to As a references for damages.

Keith Porter 35:21
Alright. So, yeah, for just a second we are seeing a message bar at the bottom of your screen that says teams are sharing your screens. Yes, thank you so much. Yeah, well, now, now we're seeing your presenter view.

Luis Ackermann 35:38
Yeah, let me see if I can get back to it.

Keith Porter 35:40
The thing is that that message is hiding some of your access labels.

Luis Ackermann 35:47
Can you see the presentation now?

Joshua Soderholm 35:49
No, no, it's all right. No worries,

Luis Ackermann 35:53
We'll get it there. Yeah, I was seeing that, but sometimes it's not shown in the actual teams.

Luis Ackermann 36:04
So, I can hide it, and then I can go back there.

Keith Porter 36:06
That looks Yeah, thank you so much.

Luis Ackermann 36:10
All right, we'll get in there real quick. Sorry to interrupt. No, no, no, that was perfect, because sometimes those pop ups don't actually pass through, but you never know. Thanks for that. So, yes, so perfect. So by calculating it, we can actually see better the effect of the correction that the metrology is doing to the radar, and now we can see how those basically that blue event that was over estimated by the radar, basically saying that the hail was of higher damage that we could have expected with respect to the mean. The mean of the distribution was corrected on the right direction, while the red was corrected also in the right direction. So that was quite promising. Now let's see each one of those, the red and the blue, more in a special sense, what actually happened on the ground. On the left here we have the original mesh from the radar, nothing special, already advection corrected, and you can see that on the bottom here we have the damage swath on red with the gray, where no damage happens, on the middle, we have that back calculated mesh basically derived from that fit from the model, and we can see that it is a much more tight contours for the damage. One of the things that quickly show up is that anything that didn't produce any damage, that is we can see here basically got suppressed by the model. Here I'm showing the difference between the two, where basically blue colors show

that the new mesh, the corrected mesh, is lower. So you can see that overall, the model is suppressing the signal, not as much in the in the course, a lot in the outsides. And you can see that that basically result of correcting it. Now for the other event that it actually corrected on the other way, we can see the same effect on the places where no damage occurred, but actually on the actual swath it was actually enhancing it, which is what we needed to happen. So we can see that it's not just doing it across the board for each event, it's dependent on the actual location potentially being driven by the radar observation. Another nice thing to note here is that you might have noticed that, well, this damage reports were actually corrected to zero. What's up with that? And those reports are actually from this location that I actually went ahead and look why are they being corrected to zero, and look around from satellite images and actual radar observations, and there were basically no clouds ever reaching that area. So those are pretty much explorious or mistakes on the data set, or maybe other damage those were mislabeled. So the model actually was able to identify mislabel or no damages and correct it for those, which was interesting. So now let's jump to the vehicular hail damage estimate. And the idea here was, well, we did this with residents. Can we do the same with vehicles and have an estimate of damage from radar potentially corrected with metrology. For vehicles, the first challenge that we saw is that, well, we needed to do the vulnerability correction, as we did for the archetypes on the houses. But for vehicles, there is a lot more archetypes. You have much more different makes. We had all the information, and basically we we didn't, we didn't find that the size of the engine really matter on hail damage, as you might have expected. But there were still a lot of things that matter. The make was very important, the type of use of the vehicle, if it was a private, a commercial or something like ride share that had an effect the body type, the decade of manufacture, those things have a had an effect on the vulnerability. And then when you combine all the possible combinations of those, we find that we had something like 10,000 different archetypes or different combinations. So which how do we deal with that? Well, one of the things that I'm showing here is basically policies per archetype. So you can see that there's some very common cars, maybe something like a Corolla, while then you have things that are more rare, like your luxury cars. The other part is, well, in red, you have policies. Each one of those dots is a different archetype of vehicles. You have archetypes that produce a lot of policies, mostly driven by the popularity. So there's a relationship, but we realized that, well, if we had an archetype that has less than 30 policies, we cannot really say anything statistically significant about the distribution of their damage, right? So we basically filtered any archetype and policy and types of cars that had less than totally 30 policy 30 claims in the data set. We just grouped them into one bucket, like we did on the with the houses on that 12th. And we're calling it the other archetype, and that's about 18% of the data. 81% of the data is represented by specific archetypes, which turn out to be about only 400 archetypes, which is much more manageable than 10,000 if we see the variability of the damage ratio of each one of those archetypes. And I'm here, I'm just showing the the median. I'm sorry, the mean and 25 and 75 percentile, with this one being the other bucket, that 18% we can see that there's a lot of our ability. So we needed to correct for that vulnerability differences. And we did the same thing that we did on with the houses, basically where we made made it such that the mean damage ratio for each archetype was equal to the overall mean damage ratio. That way we can have apples and apples. Now the second big challenge with the vehicles is that we don't know where they are when they got damaged. We from the policy data, we only had the address of the residents associated with that policy, the postal code, postal residency, not the data set didn't contain the location where the hail damage occurred, which is understandable, but it it brings a big issue, kind of like the advection problem. We don't know what to match to what the advection side, since we're using the same event data set, we actually cheated, and we use the correction that we already calculated from the advection, the bulk abduction for the houses. Since we know they're the same events, we know that they move this much, so at least the abduction part we can we can cheat and use the house correction. But how do we know where the car was? Well, we started with the following assumption. Well, let's say if you have a small neighborhood, like one kilometer square neighborhood, and you have a bunch of policies associated with that neighborhood, the likelihood that those policies happen, because the cars all move around, commuted, whatever, and they were all at the same, same spot where the storm happened is low that they all happen to be there by coincidence, it is more likely that they were damaged close by to that policy, and therefore that's why you have a hot spot in that area. So that's what I'm showing here. All those panels show basically, and I'm going to start basically on the left, if I were to filter policies by the amount of policies that they have close by. So basically, if I had just one hit within one kilometer, or two hits, or three hits, I can potentially filter out a cars that were not close to the to the storm that just happened to be hit by it. So let's say and in blue, here we have the SWAT of the damage for this event. We can see that there were some cars here that are not associated with any of the of the SWAT of the event, so are likely just commuted and got hit by it. But there's definitely a hot spot in that is associated with the swath. If we increase that number of policies that reported claims that are needed per for that small neighborhood, one kilometer square, we can see that if we go all the way to 10, then that that signature in red very closely matches or Swat. We lose a lot of the data right from 8000 to 6000 but we basically know that the ones that are being left are at least we can associate it or match it to their respective radar signature. Now that's for that event, but we saw Well, other events are a little bit different. If we use such a high threshold for hits, then we lose a lot of the data. We go from 1600 to a little bit less than 500 so we basically find that, well, somewhere in the middle of that, about five hits, provides a good in between that works for most events where you keep as much as the data you can I'm going just back, but you don't have you at least remove the clear outliers that were just there, were nowhere close to any storm. And then once we had that, what we did is, well, now we have cars that are unlikely being damaged right on their house where they were parked, but at least in the vicinity. And then we can do the same kind of assumption to match it to radar observations that we did for the house is basically where we we look for the highest damage and we match it to the highest radar damage. But here we're not greeting the how the vehicles, the cars, because we cannot really grid them, because we don't know that they were actually in the same grid point, or grid points from the radar are one kilometer by one kilometer. So what we did is, is policy wise. We matched to radar by policy. But that brings the problem of, well, how many policies do I match to a single radar point? So we needed to know basically how much space each grid point could have potentially hold in cars. We went to Google Maps and basically got information about the road sizes and types for for the whole domain, gridded that to the same radar grid to create an estimate of how many cars can each radar grid hold potentially. And that allows us to basically say, okay, so this radar grid that has this amount of hail potentially, can potentially hold this many cars around it, and then we match policies that were already filtered for definitely cars that were too far from their location to a radar grids based on this maximum amount of vehicles that could be held by it, and that created a match data set of damage to radar observations. And we apply the same methodology where we use metrological variables to correct and we were able to basically create this new HDE for vehicles with a similar not as good as a performance as the houses, likely due to the uncertainties on on the movement of the vehicles, and it was especially hard to predict the really high damages, mostly because it's not as represented on the data set. So it's hard for the model to actually predict it, although we did try some some weighings on the training but nevertheless, a relatively good performance with I'm just showing you there. We needed one more metrological variable, but the metrological variables for vehicles were not the same as for houses, and this is likely due to your being on a different size of the sensitivity. Basically, we needed to be able to discern smaller hail stones, because smaller hail stones that will not damage houses will still damage cars, which is part of the importance of this research is allow us to bridge that gap into less severe hail, but still damaging. Now, if we use this data set of vehicles now that we have and we run it for the whole archive for one of the domains we can create, we can see, well, every time it exceeds a certain threshold where we know damage is going to then be recorded on the ground. We can then create climatologist, and this is the climatology for Brisbane, for example, for hail damage, basically how many times it is likely or expected to have some damage for vehicles. And we can see that, then some spatial biases start to show up. So there are some definitely hot spots that are present, if we want to see, well, how is this changing over time? One of the things that we really want to know is, well, not only are damages more common or not? Something that comes up often in the literature is that, well, it might be that maybe the overall frequency of hail storms is decreasing or increasing depending on climate change, but maybe the intensity is changing, so maybe they're less frequent but more intense, or more frequent but less intense, depending on the place. So we did is we defined this as thresholds for for exceedances, and we tried to see if there's any statistically significant trends on any of those thresholds. So we can see well, are the frequency decreasing overall, or whether or not some intensities frequencies are increasing. So we can see, for example, for Brisbane, none of those different thresholds are showing any statistically significant trends. While, if we go for something for another domain, like Melbourne, where we see overall less hail frequency, but we see a changes on some of those intensities. So we can see that the low intensity damages pretty much show no statistical significant change or trends, but on the higher on the lower ends of the of the the intensity, there is an increase, statistically significant increasing trend on another location Perth, we see a different situation happening, where we see pretty much all intensities showing a decreasing trend for that data set, statistically significant decreasing trends. Now, if we compare, now that we have both products, if we try to use them to have some comparisons, first, as a sanity check, does it make sense what we're seeing? So in a sense, we shouldn't see that we have a place from a storm, from us, the same storm where we have vehicular damage and no in but the other way around, where we have damage on houses, so very intense hail that is not damaging cars, right? It makes no sense. We should see the other way around. We should see places where you have hail damage for houses and cars, and then some places where only cars got damaged because the hail was less intense, and we see it here. Now surprisingly, I would have expected a priori, that there will be a bigger footprint around that. So it will be a little more of a smooth transition between no stones and big stones able to damage houses. But what we saw is that solar storms just have cores that are showing very sharp edges with no smooth decreasing on Hill sizes. On the other hand, some storms do show some. So this one, you can see some damages on places where there were no residential damages, while others basically have almost full association where there's damages for both of them and basically no damage for only one of them. If we do a more statistical analysis, we can see the likelihood of annual risk for hail, for vehicles and residential and we can see, well what we expected. Vehicles are much more likely to be damaged than houses, although they share somewhat the same hotspots. If we go for another domain where hail is not only less frequent, but in general, less intense, we can see that there's stock differences between the residential risk and the vehicular risk, which shows the value of having repeated that that methodology for the vehicles and summary, basically and that we can potentially leave there for people to observe during the questions.

Keith Porter 55:00
Wonderful. Thank you so much. Give people a second to absorb the summary that's on the screen as I look over my questions. We don't have any questions yet from attendees, so let me offer. Let me ask some of mine. Gentlemen, Joshua posted a link to 2024 paper, is that report is that clear enough that you know and that and that people could imitate it in Canada. And I'm thinking, you know? Are the data that also begs the question of whether the meteorological data and the policy data that you have available to you in Australia, is that kind of information generally available in Canada as well as in other words, is this something that we could imitate in Canada?

Luis Ackermann 55:56
Well, the on the meteorological side, yes, definitely. We use arrow five, which is a widely available data set. It's an hourly data set, and we use it basically. We find the closest grid point from error five that were co located to the radar and the closest hour to each one of the radar observations on the policy side, I will say most likely, and that's not my field, but I will guess that the insurance will keep track of which policies were associated with hail or other perils, so they can segregate them from that and keeping track of the properties on the policies is probably something that you do regardless to know their potential vulnerability. So I will say definitely something that you should be able to do. But I don't know what you guys think,

Joshua Soderholm 56:57
and I'll just highlight that then the northern hail project had been working on implementing the radar retrievals that we use as well. So we use a US approach called mess mesh, and it's also being implemented by Environment Canada through the with collaboration with the northern hail project. So I believe the underlying, lots of the underlying data is there might need a little bit more work to get to the point, but there's definitely a huge potential to repeat a similar type of analysis.

Keith Porter 57:28
Mark I'm gonna mark Baker, I'm gonna ask you to chat your question into the Q&A box. We don't do we don't unmute you just because this format. Thank you very much. So the those six parameters that the AI picked out the six impactful variables. Those are ones. Those are standard meteorological parameters that Environment and Climate Change Canada would normally be collecting and disseminating.

Joshua Soderholm 57:57
Yep. So that EA five product is a global product. It provides coverage everywhere. Cool. Let's see

Keith Porter 58:11
your slide 16 with the box and whiskers. That was, I didn't quite pick up on that when you said that, you sort of normalize the vulnerability of the archetypes to the overall average. You're saying that you sort of have a single vulnerability function that you then just sort of scale up or down uniformly, depending on which archetype a building falls into. Yeah, basically

Luis Ackermann 58:39
given the using the medium of the distribution for each archetype, I basically corrected such that the medium, the new medium of that archetype, will be equal to the overall medium hail damage. I could have put it anywhere. It's just that keeping it at that point allows it to be a little more sensible. Anyway, once you calculate the HD, when Suncorp wants to use that value to calculate the actual incurred costs that they will experience, they have a vulnerability curve associated with that correction. So HD will then go through that vulnerability curve for that archetype, for that policy, that then will translate that HDE into percentage damage for that property, that then they can multiply by the insured sum to get the estimated cost for that policy for that event. So yeah, but so we had basically 12 vulnerability curve that each one associated with one archetype I see, and for the same for the vehicles, we just had 400 of

Keith Porter 59:50
them I see, and that the the residential property, one the the one that Joshua linked to paper to that has The 12 vulnerability functions in it, or does it has the 412, no.

Luis Ackermann 1:00:05
So that paper is for the residential properties that one docent the vulnerability curve were not shared publicly for, for commercial reasons. Oh, because that that, yeah.

Rhys Whitley 1:00:23
I mean, they probably won't be very useful overseas. Either they're all going to be relevant for eastern Australia or where, wherever we hold policies. But the idea of the paper was to you could repeat the experiment to derive your own vulnerability curves. If you're another insuring interested in this work.

Keith Porter 1:00:43
Gotcha, okay, so that, so the the architect specific vulnerability curves are proprietary, right?

Rhys Whitley 1:00:51
Yes, because they will be linked, they're calibrated to our insurance claims.

Keith Porter 1:00:57
Gotcha, okay, um, thanks. Um, Rhys, can you tell me, how are you using that model in practice? How is the use of this model helping you do business? Is it saving you money? Here? Are you doing it on on claims. How do you, how do you, how does this inject into your sort of daily business practice?

Rhys Whitley 1:01:19
Yes, a good question. So we use it for pricing. It helps us get to a more granular view of the risks. We like to price at the address level in Australia or all perils. And that works really well when you have something like river Ryan flood or bushfire or wildfire, I guess for you guys with hail, it's not going to be that granular, but we can get drill down further, as opposed to, I don't know, I think used to be like 50 or 75 square kilometer. That was the limit of our view, but we can now get to more convective permitting resolution, maybe five kilometers, which can make a massive difference for fairer pricing. So there's no there's less cross subsidization for our customer base, at least regionally. So I mean that that's the short answer. Is just we get fair and more accurate pricing to the extent that the data allows to do this. But there's, there is, I guess Josh can probably speak to this. We do see other uses for this product. We have, we're going to continue the relationship with the Bureau we are looking at doing in our casting exercise

where this this product would be used once again. I don't know if you wanted to comment on that. Josh,

Joshua Soderholm 1:02:54
yeah, sure. So this is essentially a radar retrieval which we're talking about here. We can run it historically, which is what Luis has presented, or we can run it in real time and produce real time maps of estimated loss. That's sort of a one kilometer resolution. And we can also produce short term predictions, say, out to 30 minutes, out to 60 Minutes, of what the losses might be if the thunderstorm continues on our predicted path. So there to our other applications, which we're currently starting our projects to implement, and this will essentially allow for better, earlier response by insurers as they plan for these events, as they're occurring, and respond to them to the benefit of customers, of course, as I'm sure Rhys can comment more on,

Rhys Whitley 1:03:43
yeah, we do try and issue warnings to the customers when we get guidance from the Bureau for one and I think, some other partners, but the best We can do is probably 30 minutes, if we're lucky. It is hard. The thunderstorms will hit at the worst time of the day, usually the peak hour, typically when or everyone's cars out there either running, they're coming home from work or it they're picking up the kids from school, and it's when you've probably got the highest density of cars on the road. And so these warnings, they're going to have a limit to what what you can do to mitigate possible damage. However, you had longer lead times with and understood the severity of facing because you don't want to cause panic either. Of course, people could probably prepare what they're going to do for the next hour, and maybe I won't take my car out for whatever. I'll delay my trip. It kind of changed, trying to help the change the behavior so that the person's not exposed to the storm. I mean, you don't really lose your life, but you could if there's a flash flood event, I suppose. But the idea is that we're better informed, and then we can get these warnings out much earlier and maybe update them at a higher frequency to the public. Then we can do our best to mitigate the impacts of these events. And

Keith Porter 1:05:24
is it possible to sort of spatially target the warnings? Do you to broadcast a warning that says, look out for hail in these particular locations? You narrow the warnings to just those locations? Or how do you how do you optimize that warning? How do you apply the warning message so

that you know the people who need to see it see it, and people who don't you know don't get bothered by it?

Rhys Whitley 1:05:48
Yeah, it's a good question. So at the moment, it's very broad. The warning, I guess, Josh, you want to mention the AI guidance is probably the answer to this.

Joshua Soderholm 1:06:00
Yeah, yeah. There's a couple questions there, like around warning communication, but also the resolution of the warning itself. So it's our warning system is quite similar to Canada. At the moment, we use fairly large polygons to represent the expected impact area, but we are moving towards providing more refined Spatial Mapping of where the storms have been and where they expected to go, and also breaking these down into individual hazards. So we'll be able to show this storm is having a certain percentage chance of producing severe hail and different percentage of wind, a different percentage of hail, of rain, heavy rain, as well. So breaking the hazards down will allow people to respond more effectively.

Keith Porter 1:06:53
We just went, you just muted yourself. Joshua, oh, sorry, yeah.

Joshua Soderholm 1:06:56
So communication is also a huge problem as well. We don't actively disseminate warnings over the cell phone networks in Australia, like you guys do in Canada and US instead, we rely on more traditional means, so people accessing the website, the app, through radio, through TV. So that's certainly something that should be looked at, but I can't quite comment on. The other aspect I wanted to comment on is also having better warnings also improves the responsiveness of say, the insurer, who needs to prepare some some resources on their end to respond to the event, but also for energy as well as they need to get their staffing out to respond to damage across the electricity networks, various other industries as well, which respond to these events. So better warnings do allow for better preparation and faster response across a number of different groups.

Keith Porter 1:07:57
Sorry. Go ahead.

Luis Ackermann 1:08:00
On the application side, there's one thing that I wanted to mention, something that has been coming up for dealerships is a potential, very valuable product that can potentially be done in in partnership with the insurance company of the dealership, because one of the things that we, we have been communicating on is that the dealerships usually have a subset of vehicles that will drive the losses of of the lot, and then, if they have a warning of 30 minutes, and because The swath are relatively not tremendously huge in area, the dealership can potentially move the highest cost vehicles that the ones that are the biggest loss out of the way or into the warehouse, and at least mitigate the cost of a potential hail storm that is coming. So, so that's a I just remember, that's one of the talks that we have had internally.

Keith Porter 1:09:08
We have a question from Evan yason or yatone. We have an insurer funded hail suppression program in Alberta that performs cloud seeding to reduce the intensity of hail, and he's interested to know if Australia is doing hail seating as well.

Joshua Soderholm 1:09:30
So we have no systematic program at a federal state level. There is, has been a couple intermittent programs at the local government level, but nothing sustained. And I think that really does reflect the science around it. There is still a lot of uncertainty about the cost versus benefit, particularly when you look not just at individual events, but across so many years, many seasons, where is it? Is the effect really one to reduce the severity of the hail, or is it sort of lost in the noise, something we're still struggling with?

Keith Porter 1:10:11
ICR did some research in the last few years on that question, and we think we did. We do see a signal in the in the noise, moving the distribution of hail stone sizes to smaller diet, more small stones. And we think the signal is strong enough to be kind of definitive about it. Let's talk a little bit more about those hotspot maps. Do you think that they and I you showed some on slides 34 and 44 in particular. Do you think that those show places that, just because of topography, or something about the, you know, the, I don't know, something that's static on the ground or in nature, causes those places to be more frequently hit by hail, by big hail. Or might those hotspots reflect just sort of randomness that might average out if you were to have more decades of data. Or what are those? What are those hotspots actually mean to you, physically and sort of in terms of physical processes?

Joshua Soderholm 1:11:42

Do to want me to take that one? Luis, sure. Yeah. So there is, across some of the map, there's sort of two kinds of hot spots. There's a sort of a sort of more gentle modulation between low peaks and high peaks, which really does reflect the sample size. So particularly for cities which have a low frequency of hail storms, we see that for cities with a higher frequency of hail storms, particularly across the East Coast, and we have very long radar records there as well, we see much less of that behavior. So there we can start to see the true hot spots. And there have been a number of studies, including my own PhD, where I focused on understanding the drivers of those hot spots, and they're really linked to local processes. So we have sea breeze influences across the East Coast, and we have a lot of terrain as well. So we have a mountain range that sits between about 50 and 200 ks inland running down the east coast that moderates the initiation of thunderstorms. It also moderates interactions with the sea breeze as well. So that's why you often see on one side of a mountain range a very different thunderstorm climatology compared to the other side of the mountain range. Across the East Coast, there's a lot of variability across the region.

Luis Ackermann 1:12:57

So those hot spots, yeah, it was, I wasn't paying close attention to the scale of those figures, but they are, those figures are so or each one of those radar domains, they are the radars 150 kilometers.

Joshua Soderholm 1:13:13

Got sorry I forgot to mention that. Thanks.

Luis Ackermann 1:13:17

And regards to the effect from topography. We from what I remember, we see it also in Canada, I think what you have a very clear hotspot that is due to topographical feature, right? Joshua, this is from a couple of years ago. I remember you had a campaign there, yeah.

Joshua Soderholm 1:13:35

So the Rockies, of course, they hit dry. Have a lot of what happens across Alberta. Without the Rockies, you would have a completely different thunderstorm climatology across the Canada and, of course, across the US as well. Without the Rockies, you wouldn't have any of the tornado nowhere near the magnitude of tornado activity you have across the Central Plains in the US. So mountains play a huge role no matter where they are.

Keith Porter 1:14:06
I really love on some other time to see the those hot spots compared with topography or shown with mountain ranges over lane.

Luis Ackermann 1:14:18
Yeah, it's hard to show it in a quantitative way, because they are displaced. So it's not that it happens right on top of it. They they affect the initiation and that then downwind affects it there. There's another paper that is coming up later this year, that talks a lot about the looking at HDE driving it by HD it follows each one of those storms and tracks that object and sees the behavior of that object and the relationship of where is it generated and how where the actual damage occurs. So So, yeah, that that basically explains a little bit of why that's that displacement and and also shows biases on on direction of initialization, so which way they usually heading. So, but we didn't include that in this talk.

Rhys Whitley 1:15:19
I'm really sorry, but I am going to have to drop off to make this workshop we're all attending. Okay this morning. So thank you so much for having me. And if you have any questions on the insurance side, please send them through or relay them to Josh and Luis, and I can get back to anyone.

Keith Porter 1:15:35
Thank you so much. Rhys.

Rhys Whitley 1:15:37
Cheers, thank you very much. Hope you all have a great day. Cheers. Bye, gentlemen.

Keith Porter 1:15:41
Do you are you? Do you have to run off to the workshop as well?

Luis Ackermann 1:15:45
We are, but we're very close by, so commute is much shorter.

Keith Porter 1:15:50
Okay, great. Let's see, are you? I mean, it's super interesting that an insurer wanted to fund this or participate in this research to such a great extent. Are you working with other insurers to are they consuming these, these products in in ways that you know about?

Joshua Soderholm 1:16:19
So at the currently, no they definitely consuming the paper that we produced, that we shared here. So that's inspired, I think it's inspired a lot of them to look along similar avenues in Australia, of obviously this project, we have to share a lot of commercially sensitive data. So and also, there is embargo on some of the products that we produce from this data set as well. So there's at the currently, there's limited, there's no direct sharing, of course, between competitors of Suncorp. So, but once this embargo lapses, the derived products which we produce is definitely something we could potentially share on sort of a national level, for to the benefit of all the entire industry. So, yeah, obviously, when you're working in this space, you just have to be aware there's a lot of commercial sensitivities and competition. Sure, absolutely.

Keith Porter 1:17:16
Well, let's go back to this, the issue of warnings. I know you guys are not, you know, your meteorologists, and you probably have sort of limited connection to the, you know, the research and whatnot about about warnings. But I'm super interested in in the effectiveness of warnings, and maybe how to how to target them in Alberta, right? You know, we have a sense of when the hail is coming. And, you know, we see a big, big gap between the information that meteorologists have and the message that that goes out. Oh, I can, you know, environment, climate change, Canada issues severe thunderstorm warnings that cover entire counties. And, you know, they say there's a big storm coming, and it could have this effect, and it could have that effect, and it's sort of less actionable than if they were able to say, Hey, I understand you've got a car at 123, Main Street, and there's going to be a hail storm, and it's going to drop, you know, two inch hail stone. So maybe you want to garage that car. You know, of course, you can't issue, probably can't issue warnings that are that specific, but you can see that there's, you know, a big there's a big gap between a big storm is coming and it could have all these different effects anywhere in this county. And move your car because it's going to get whacked. Are you trying to move from this side to that side?

Joshua Soderholm 1:18:45
Yeah, I think our role at the Bureau is to enable, say, local governments who have a lot of

information on the properties within their jurisdiction, jurisdictions, so which one might be more vulnerable and less vulnerable, enable electricity networks and provide distributors and also insurers. If we provide them with a richer data set, then they can use their own customer data sets to augment that data and provide more value when it reaches their targeted customers. Of course, this approach you if you're going down to the an industry such as insurance, you will, there'll be very there'll be a large portion of people who aren't covered by one insurer. So you also have to be very careful relying on this approach, of course. So it's a little bit difficult for hail, because it sort of doesn't really sit in Australia as a responsibility for local governments. Any messages that do go directly to customers really do come from insurers here as well. So they will take, currently, they actually do take the Bureau's information in real time, do some geospatial analysis on their own exposure their portfolio, and then send that subset of them information, the same information that the Bureau provides, but directly to those customers, and provide additional via sites, put your car in the shelter or make safe your property so but yeah, there is a big, big gap there, and it's definitely an active area of research, particularly for social science. Yeah, not just in Australia, but everywhere across the world. At the moment, trying to close that gap between what the weather agency provides and what the public actually needs and understands to act appropriately.

Luis Ackermann 1:20:36
There's another aspect of it, especially with the vehicular side of story, I will say a large proportion of Australians do have the Bureau's weather app on their phone, and that could allow us the possibility of, once we start having the nowcasting capabilities for HDE, for saying, Well, the next 30 minutes, we expect there to be damaging hail in this area. There's nothing technically stopping us from potentially, since we also use the users location to tell them weather information, there's nothing stopping it technically, from having that user location. If the user location is within that swath or that damage inspection expected damage, of having a notification on the on the app saying there might be hail damage on your area if you move outside of that area, the likelihood is less I see that as a quite viable, technically available, low hanging fruit, basically. And it's not necessarily doing a spam message to everybody, it will be to people that have the app, they can potentially enable that feature.

Keith Porter 1:22:04
So the app knows latitude and longitude down to probably meters, because it's you can.

Luis Ackermann 1:22:10
You can give it your location to tell you your your weather, which is what we usually, all of us do. You can also set it up to just tell you the weather of a specific city, but,

Keith Porter 1:22:24
but one of the options is just the app is aware of your geolocation correct, like Google Maps is,

Luis Ackermann 1:22:32
yeah, that's, that's the current app that we have. You can just set it to to tell me the weather of my location.

Keith Porter 1:22:40
So, in principle, in principle, in principle, you could tell the app we're expecting a hail swath in this polygon, and the app says, oh, no, I'm in that polygon. I'd better warn my owner to move

Luis Ackermann 1:22:54
his car. Yeah, potentially, yeah. I it's not something that is in the works, but I, I think that will be of high value.

Joshua Soderholm 1:23:04
Such a service does exist for the Swiss and the German weather services, so they're able to push warnings directly to customers based on direct to the public based on their application.

Keith Porter 1:23:16
And are they seeing success with that? I mean, are garaging their vehicles.

Joshua Soderholm 1:23:21
I guess it's reflected in the uptake of the app as well. So there's a huge uptake in the app in those two countries and the public. There's lots of other more interactive features in their apps as well. They engage more closely of collecting reports of what weather is going on and they cease. Yeah, they see significant benefit of having these sort of two way interactions with the public through their app.

Keith Porter 1:23:45
You said Swiss and German? Yes, people have these. Can you give us a proper noun, like, is there a name for these apps?

Joshua Soderholm 1:23:56
Yeah, so it's the medio Swiss app, which is the weather agency in Switzerland, and it's the DWD app, their official app, which is the Weather Service in Germany. German is not quite good enough to pronounce the full name of the German Weather Service. Gotcha.

Keith Porter 1:24:18
Okay. Oh, you know, I want to still not getting any questions, but I have lots and lots the hotspots could they I mean, presumably there are protection attributes that might show up in like In the vehicle vulnerability that, I mean, I know that we had a big hail storm in couple big hail storms in Calgary, one last year that cost 3 billion Canadian and one just a few weeks ago, that it's probably in the 30, $40 million range. And the lots of reasons for the differences, but one of the reasons for the differences is that the neighborhood that got whacked last year had people have fewer garage spaces. There's less protection for vehicles, and the one that happened a few weeks ago happened in an older neighborhood where there are more garages per vehicle? Might that sort of thing be showing up in some of your data?

Luis Ackermann 1:25:33
Yeah, definitely. And it also might be not only garages, but the density of parking, like commercial parking, and the density of roads, right? So they will, they will drive that certainly.

Keith Porter 1:25:51
But the hotspots are normally cars.

Luis Ackermann 1:25:55
But we need to remember that this is from the from the observation side, from the radar side. It just telling you where there will be hail that would be damaging if there was an exposure to that, right?

Keith Porter 1:26:13
So, right. Got it. I was super interested in the sharp edges to the damage boundaries around

slide 41 I mean, that's, that's a really neat distinction to be able to say it's not, you know, you don't see move a smooth drop off in.

Luis Ackermann 1:26:31
It's not a smooth transition. It's, it's damaging here, and it's not damaging less here. It's just, that's the although we did so storms that had more of that transition, but many of the more intense ones were very sharp delimitated, yes, and they also have relatively sharp temporal delimitations. It's not like it slowly starts to damage and then it peaks. It's more like it peaks quickly, very naturally, towards the center of the storm,

Keith Porter 1:27:06
right, a tap turns on, then it turns off.

Luis Ackermann 1:27:10
Yes, it's more more binary in that sense, not completely, but it's much more than what I expected.

Keith Porter 1:27:17
Interesting. Interesting, super interesting. Well, we are running out of time. Do you have any last thoughts for us before I conclude the webinar?

Luis Ackermann 1:27:27
From my side, the value of having policy level data was was just a nothing would have been possible if we didn't have that. Also, because it allows us to have nulls without many of the things that we have on the reports, people will report there's hail here, but nobody reports there's no hail here because it's, it's the problem is the survival bias, right? Yeah. So having the whole data set for policies allows us to also tell the model there's no hail here, so Don't give us false alarms. That's extremely

Joshua Soderholm 1:28:11
valuable. There's one important point from my side as well. A lot of the cap models are developed from both insurance claims and also hail size reports where they're available. And I just wanted to emphasize that there needs to be some caution around hail size reporting. It is often inferred that is the maximum hail size that is collected during the storm, but truly it is an unknown percentile in the entire distribution of hail storm stones. The other factor is, there's a

huge piece of missing information when we rely on maximum hail size, and that is, we don't know the concentration of hail stones. So you can have an event passing over with 15 centimeter watermelon size hail stones, but you might only get one every 100 square meters, but then you have another event with golf balls, and it's producing, say, 50 per square meter, and you have a much more significant loss event from that property or motor. So there really just needs to be some caution about relying on hail size reports to infer it to estimate damages and loss from hail storms, absolutely.

Keith Porter 1:29:27
Yeah. Thank you so much, gentlemen. Thank you so much. Super interesting talk, super interesting science. I want to remind our attendees, thank our attendees for coming today and remind everybody that next month, on September the 12th, CAL FIRE's Deputy Director Frank Bigelow, is going to talk about California's adoption of the International wildland urban interface interface code, and it's recently released fire hazard severity maps. So that will be September 12, once again, remember that our speakers slides will be available by Monday or Tuesday or so at www.iclr.org/workshops the slides along with the video transcripts and so on. So thanks everybody, and I look forward to seeing you next month,

Luis Ackermann 1:30:21
Bye, bye. Thank you. You