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Introduction

J.A.A.R. Indices, Incorporated are a group of meteorologists who specialize in key aspects of industries, and have learned your business inside and out. Our purpose is to help you save money and earn money with our fantastic weather indices. Lowe's is one of the largest home improvement and appliance stores in the United States, Mexico and Canada. Since its humble beginnings as a hardware store in North Carolina 72 years ago, your company has become the 8th largest retailer in the U.S. Lowe's rival home improvement store Home Depot is the fourth largest retailer in the U.S. Lowe's, however, is the second largest home improvement retailer in the world, operating 2,365 stores, 1,820 of which are in the U.S. and employing 290,000 full and part-time employees.

This company serves over 2 million customers in the U.S. every day. Net sales for the previous fiscal year were $65,017,000,000, but when taking into consideration the costs of sales, Lowe's gross margin is only $22,464,000,000. This is an 8% increase from 2015 and 13% increase from 2014. This means that Lowe's profit is only 34.55% of its total sales, a value that has decreased over the past two years. Home Depot reported net sales totaling $100,904,000,000. This is 1.55 times more than that of Lowe's. Home Depot's gross margin of 34,356,000,000 is also higher, but its profit is only 34% of total sales, which is 0.55% lower than Lowe's gross margin. Although Home Depot has less stores than Lowe's, 2,284 to be exact, the company has

found a way to better maximize its profits and be the leading home improvement company. One way that Home Depot does this is through lower operating expenses, which makes up 19.5% of net sales while the operating expenses for Lowe's are 25.56% of total sales.

As meteorologists, we know that we can help Lowe's maximize its gross margin. This will help the company grow and maximize profits to reach a gross margin higher than or close to that of Home Depot. We, the meteorologists, are responsible for effectively communicating accurate forecasts to the public. We must know what weather is happening, not just at Lowe's locations, but also around the country to identify how weather could affect the amount of customers that come into Lowe's and thus, business. For example, a boost in customers is likely when the conditions are warm and sunny, such as in the spring and summer. This is when more employees will be needed at stores. Also, customers are likely to buy certain products, like gardening tools, during this period. Home Depot has significantly benefited from this by having more stores than Lowe's in warm states, like California, Texas and Florida. On the other hand, fewer customers are likely when the temperatures are cold, such as in winter and late fall depending on geographic location. This is when the store will not be as busy, and fewer workers will be needed in the stores. Again, customers are likely to purchase certain products when the weather is colder. These may include heaters and other insulation products. Another important variable is precipitation, because it can significantly impact travel. Depending on the type of precipitation, it can be harder for customers to travel to Lowe's. Snow, for example, can make it difficult or even impossible to travel due to road blockages and traffic.

By successfully creating weather indices, we can save Lowe's time and money. An index will help store managers identify times when their stores will be busy and vice versa. This is

important, because it provides seasonal trends that could be used in the future to improve business. This index will help employers determine when a large staff is needed versus when the store will not be as busy. This could save money that Lowe's spends on paying its employees, and it could also help Lowe's determine the best dates for shipping, saving the company even more money, and products to sell, generating a larger revenue.

The model will be called the "Home Improver Index," since Lowe's is of course a home improvement store. This index will be based on different meteorological model data, which will be put into a clear and concise format that managers will be able to fully understand. The meteorological data will be updated every 12 hours. The index will be color-coded to indicate when business is predicted to be slow, normal and busy.

Meteorology

A meteorologist can be trusted for many reasons. While in school, meteorologists go through several years of training in mathematics and physics to gain a physical understanding of the atmosphere and how to forecast using numerical weather models. A good meteorologist not only applies what they learned in the classroom but also familiarizes themselves with each area's extremes and local variabilities. Aside from meteorologists themselves, there are several reasons why weather forecasting has improved greatly over the last several decades.

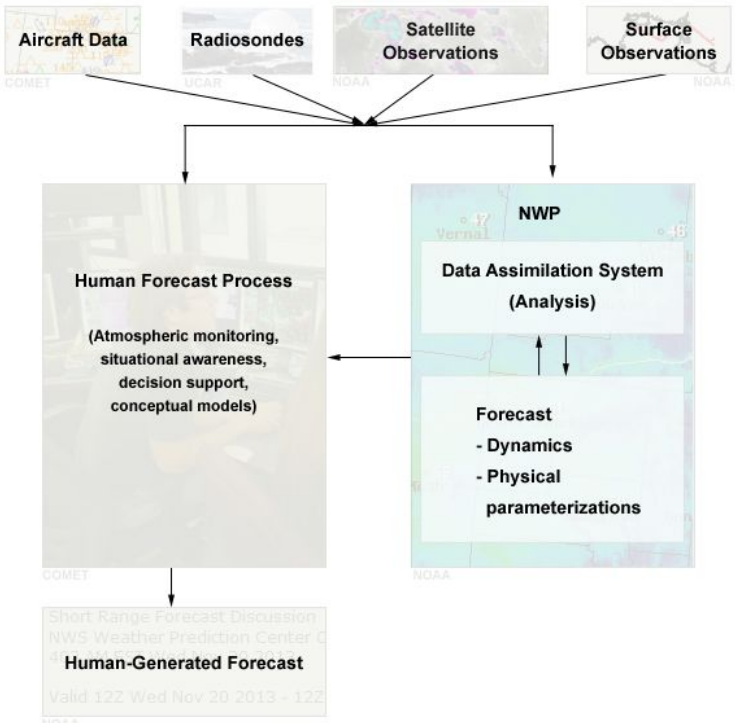
There was a time where tornadoes, hurricanes, floods and other weather disasters just happened without warning. It hit and communities were forced to deal with it and recover as quickly as possible. Fortunately, modern-day technology and investments in atmospheric research have allowed meteorologists to forecast further out in time with much more confidence, warning of extreme weather faster and with more detail. Weather forecasting is an imperfect

science but it is a field that has grown and will continue to grow as we develop better technology.

Forecasting is done within multiple time frames. The “short-term” forecast refers to the weather over the next 48 hours, while “medium-range” forecasting deals with the two to seven-day period of the forecast. Long-range forecasting deals with anything longer than a week. Short-range to long-range forecasting accuracy has improved greatly over the past few decades, thanks to improvements in satellites, volume of observations, and numerical modeling.

Increased demand for accurate weather forecasts has resulted in further investments to research, datacenters, and supercomputers. We have a network of observations that simply did not exist before. According to the World Meteorological Organization, there are over 10,000 manned automated surface weather stations, ASOS’s, 1,000 upper-air stations, 7,000 ships, 100 moored and 1,000 drifting buoys, and hundreds of weather radars across the world. Upper-air stations are those that launch weather balloons, with a device attached that measures temperature, relative humidity, pressure, and wind. Rather than having observations on just a horizontal scale, upper-air stations give us vertical data as do radar and aircraft. This massive observation network not only gives us a better understanding of how our earth works, but it also helps improve accuracy of weather forecast models. The more high-quality initial conditions the model has to work with, the more accurately it will simulate the current state of the atmosphere. With better simulations, a computer model is more likely to predict the actual outcome of weather. Satellite technology has also improved, especially with the recent addition of GOES-16 imagery. GOES stands for Geostationary Orbiting Earth Satellite, a satellite that remains at a fixed point with Earth’s orbit, the first of which launched in 1975. Because satellites can measure

globe-wide meteorological variables from space, they also become critical for weather models to ingest. The later satellite versions each came with their own improvements, especially when the latest-generation GOES 16 launched in 2016. It is fitted with a primary instrument that collects three times more data and provides four times better resolution than the previous version, with multiple channels of visible, infrared, and water vapor imagery. GOES 16 also gets data faster, scanning earth's western hemisphere every five minutes and in some places, 30 seconds where severe weather is ongoing. Forecasting for shipping and aviation has been made easier with this upgrade now that meteorologists have an additional tool at their hands, and answers to questions they did not have before about the current state of the atmosphere. Not only does advanced satellite help with real-time forecasts, but numerical weather models now have that much more and that much faster information to ingest. In places where observations are still sparse, such as the oceans of the Northern and Southern Hemisphere, satellites are crucial in providing the initial data to the computer model. In weather models, initial data is compared to the latest 6-hour forecast of the previous model run and then the two are assimilated, or combined to best represent the current state of the atmosphere. If it were not for satellite imagery, initial conditions would be limited across much of the globe and model forecasts would not be possible in either hemisphere. Meteorologists examine forecast models, use conceptual models and their knowledge from previous events to fine-tune the forecast. A meteorologist knows of certain biases with each model, when it's appropriate to use each model, and are honest about communicating uncertainties.



Thankfully, with the help of radar, satellite, aircraft, and marine technology, meteorologists can use numerical weather models to forecast farther out in time and with more accuracy. When we compare today's standard of weather forecasting to last century, the difference is remarkable. In 1938, Long Island, New York, was hit by what was an estimated Category 3 hurricane. It killed over 600 people and damaged or destroyed more than 57,000 homes, making it the most powerful and deadliest hurricane on record in the northeast. Part of the reason it was catastrophic was because of little to no warning of the storm. The forecasting agency at the time, the Weather Bureau, had issued alerts within 12 hours of the storm, but it greatly underestimated the strength and incorrectly stated the storm was passing harmlessly to the south. Today, hurricane forecasts are revolutionized, with forecast tracks up to five days into the future. Amazingly, hurricane forecasts of 72 hours out now are just as accurate as 24 hour forecasts about 20 years ago. Forecasts of 120 hours out, or 5-days, were not even attempted

prior to 2000. Now, 120-hour forecast tracks are as accurate as 3-day tracks 15 years ago. This better modeling is due to improved satellite imagery, more powerful computing power, as well as better observations within hurricanes. In the 1990s, aircraft began releasing dropsondes, devices that can measure wind speed, temperature, dew point, and pressure from the point at which they are dropped all the way to the ocean's surface. According to NOAA, these measurements dropped by aircraft have improved 12 to 48 hour track forecasts by anywhere from 10 to 15 percent. As a whole, National Hurricane Center track forecasts are approximately 40% more accurate since 2005. As an example, National Hurricane Center's 3-day track forecasts issued in 2012 had an average error of 79 miles when compared to 140 miles in 2002 and 192 miles in 1992. Track errors are known as the distance between the center of the hurricane forecast track and the observed hurricane's track. Increased forecasting skill, greater lead times, and a greater emphasis on impact-based forecasting such as the issuance of Storm Surge Warnings in 2014 have undoubtedly saved thousands of lives. At the same time, less businesses are being placed under false alarms. Note the amount of communities that were unnecessarily on alert in the 2005 Hurricane Katrina cone. Unfortunately, forecast cones will always have a degree of uncertainty, but by limiting this uncertainty with improved forecasting techniques, meteorologists can save Lowe's thousands of dollars by keeping more stores open. At the same time, meteorologists can warn Lowe's faster of an impending storm, allowing stores to prepare sooner and move

resources as quickly and effectively as possible.

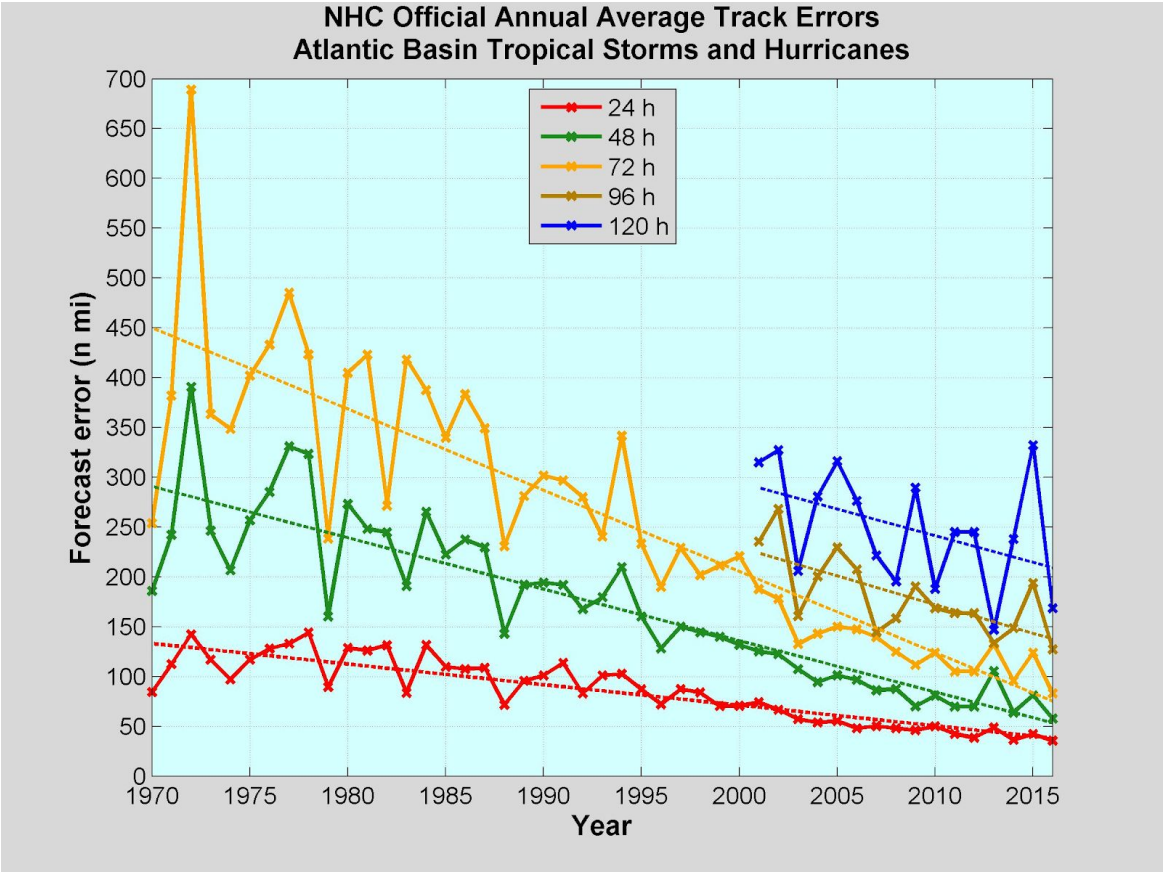


Figure 2: National Hurricane Center forecast track errors of 24, 48, 72, 96 and 120 hours from 1970 through 2015.

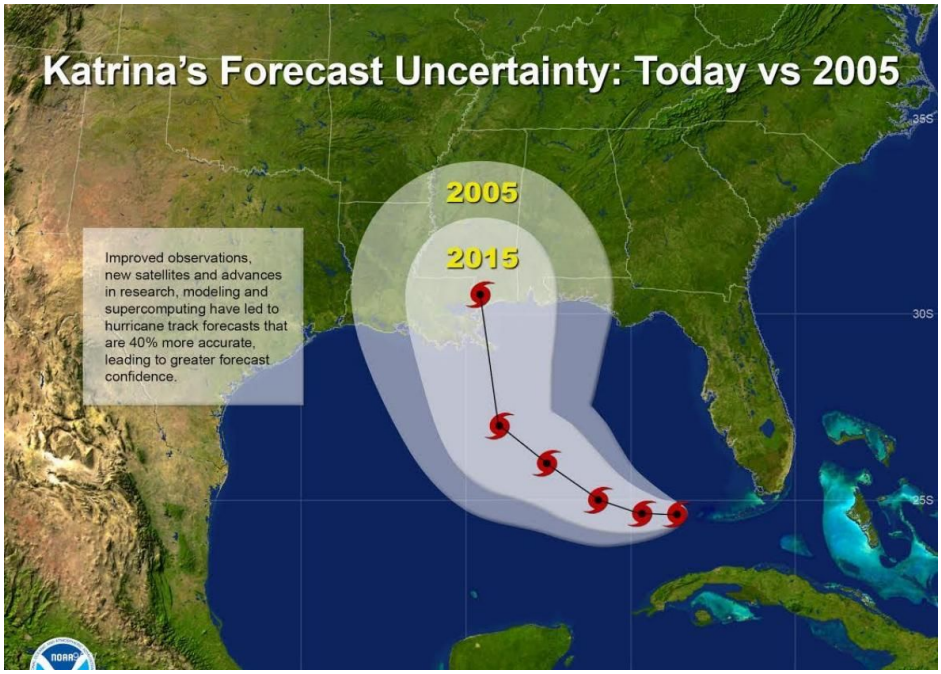


Figure 3: National Hurricane Center 5-day forecast track of Hurricane Katrina in 2005 compared to what a forecast track of the same storm would look like today. Reference: National Oceanic and Atmospheric Administration.

Numerical weather models normally forecast the middle layer of the atmosphere best. Near the ground, where moisture, terrain, and land/water interactions complicate matters, models struggle to handle temperature and precipitation, mainly because we haven't developed schemes to accurately portray localized weather features. But at the pressure level where planes fly, the atmosphere is largely in geostrophic balance, leading to less "noise" within the models and typically a better forecast of how weather systems move over time. The dynamic equations in weather models specialize in handling the movement of upper-level winds where the air is typically dry. This is why general storm tracks are easiest to predict while precipitation coverage, type, and amounts are most difficult. However, meteorologists have a tremendous amount of historical and current data to look over, and combined with experience and formal training, can pinpoint what kind of weather will occur with a certain pattern or storm system.

Figure 3: Forecast skill of height at which pressure reads 500mb from 1980 through 2015. Meteorologists use the unit millibar for pressure, which is proportional to the weight of the air over certain area. Sea-level pressure is a little over 1000mb, while 0mb is considered the beginning of outer space. 500mb can therefore be considered the mid-levels of the atmosphere. When tracking weather systems, this is the most critical level to use.

Much like hurricane forecasting, global weather models are doing a much better job today than decades prior in all aspects. In the 1970s and 1980s, models were much more coarse, or lower in resolution. Resolution is significant in weather because it is usually the small features that are important and "make or break" weather systems. In the 70s and 80s, the smallest waves, or disturbances models could see in the atmosphere was 500 miles across. Today, with the development of high-resolution short-range models, they can "see" waves that are as small as 10 miles across! In addition, meteorologists also use ensembles to grow confidence in their forecast. Rather than just running one model forecast, meteorologists run a set or "ensemble" of forecasts, which involves running the same model several times with slightly different starting conditions. This allows for further probability assessment, and depending on how close the forecasts are, is

an indicator of how much uncertainty exists. Use of ensemble forecasting, increase in model resolution, and better algorithms have allowed for more accurate prediction of precipitation, including thunderstorms. Thunderstorms on a global-scale are very small and decades ago it was nearly impossible to pinpoint where they would form. The finer resolution has allowed models to resolve intense precipitation, part of the reason why precipitation forecasts are much more accurate now. Meteorologists still use the term "scattered" during summer-time because it remains quite difficult to predict where and at exactly what time pop-up thunderstorms will fire. However, as weather communicators, we can pinpoint which counties are most at risk by using probabilities and model methods aforementioned.

Winter precipitation forecasting relies heavily on the vertical profile of the atmosphere, which, a few decades ago, meteorologists had very limited data on. With an improvement in observations and network of observations, predicting precipitation-type and winter storm impacts has become much more doable now when compared to 20 years ago. According to the AMS, the Weather Prediction Center's national two-day forecast of 24-hour accumulated precipitation issued in 2012 were on average as accurate as one-day forecasts in 2006, further asserting that precipitation forecasting has improved.

Medium range forecasting is the 2 to 7 day timeframe of the forecast. Since weather models are almost purely mathematical equations, any slightest error in initial conditions means increased error in the model the longer out in range it forecasts. Unfortunately, we will never reach an observing network that gives us perfect initial sampling of the atmosphere. In today's modern-age, models typically begin to perform poorly after five days. However, according to the American Meteorological Society, the skill range of forecasts has been extended approximately

one day per decade. More specifically, average five and six-day surface temperature forecasts issued by the National Weather Service had the same accuracy in 2012 as did three and four day surface temperature forecasts in 1992. This is further proof there is generally increasing skill of forecasting temperature trends several days out.

Long-range forecasting is more difficult because models perform noticeably poorly in this range. Beyond 5 days out, climatology typically wins out over computer models. Models will overdo the excitement of waves and produce rather unusual forecasts. Despite this, the goal of forecasting beyond 7 days is to look for trends, rather than specific numbers. This has also been improving over the past several decades. Highlighting certain places in the country that may appear wetter, drier, or warmer than normal is very doable with today's weather technology and knowledge of climatology. Climate of course is what we expect at a given time of year when it comes to temperature and precipitation while weather is what actually occurs. In addition to the 7 day forecasts, NOAA Climate Prediction Center releases 8-14 day temperature forecasts. According to the AMS, temperature forecast skill in 2013 at 8-14 days was equally as accurate as those from the 6-10 day outlook in the late 1990s. Despite still being the least accurate, forecasts at long-ranges have also demonstrated a great improvement in skill, something that will continue as we obtain more observations and historical data. NOAA's Climate Prediction Center now goes as far as to issue monthly and even seasonal temperature and precipitation outlooks in the United States.

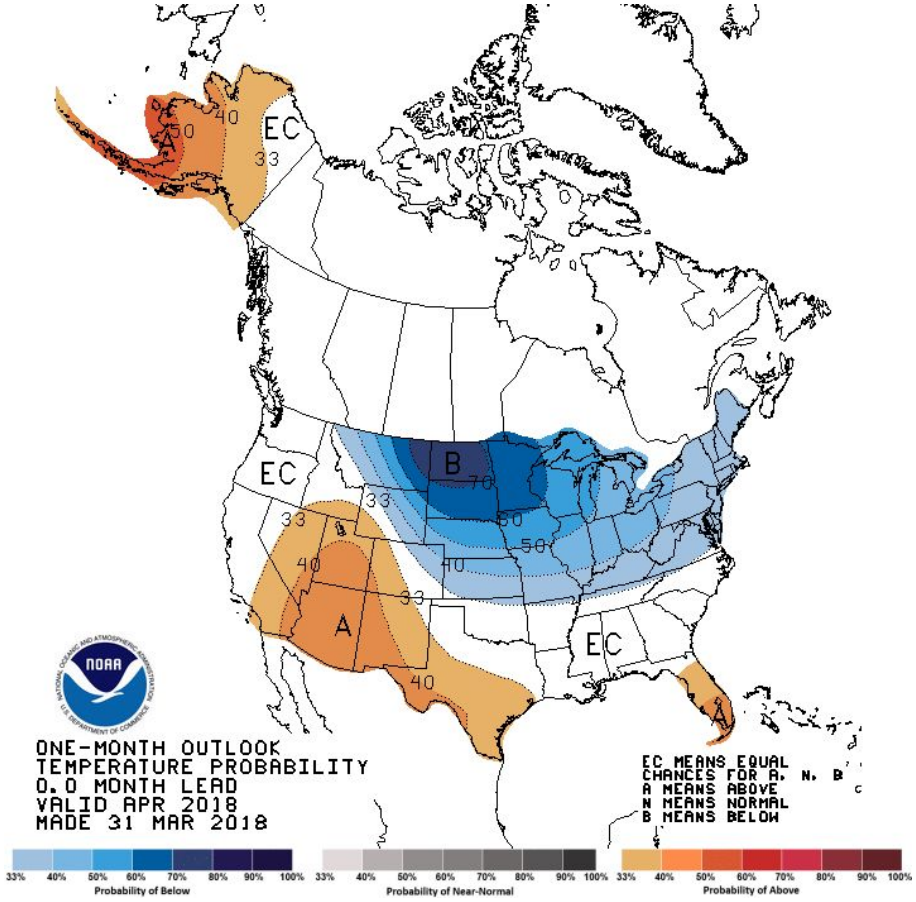


Figure 4: An example of a long-range forecast made by the Climate Prediction Center. Cooler colors represent a stronger probability of below-average temperatures, while warmer colors represent likelihood of above-average temperatures. Reference: Climate Prediction Center.

Long-range forecasting typically takes a different approach, known as analog forecasting, which is when meteorologists look for years in the past where there were similar trends in ocean temperatures and atmospheric pressure to current conditions. Based on that, forecasters can determine if and how similar weather will set-up. Longer-range models rely more heavily on climate but can still give a general indication of what regions will be wet, warm, dry, or cold based on large-scale global weather patterns and the El-Nino Southern Oscillation (ENSO). The ENSO is a natural cycle in the eastern Pacific Ocean where a narrow strip of water becomes warmer than average, which is the El Nino phase, and colder than average, the La Nina phase.

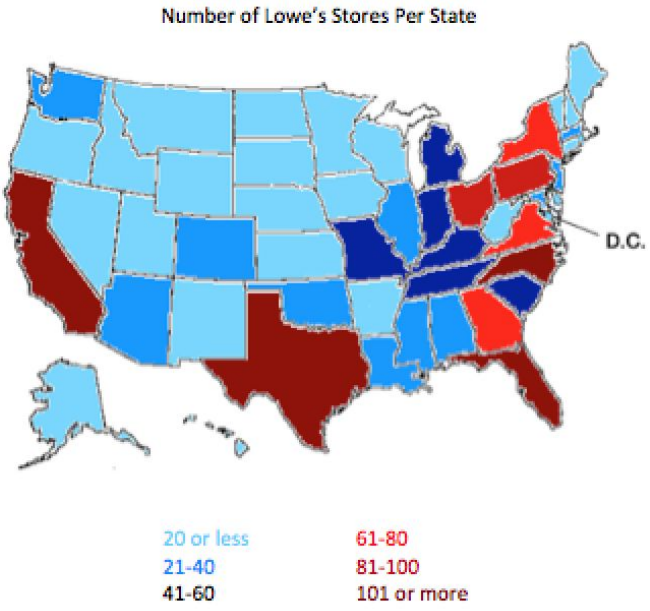
The warming and cooling of ocean waters can have dramatic effects on weather downstream. As an example, warm ocean waters also heat the air above it, which leads to increased thunderstorm activity during El-Nino years over the eastern Pacific. As the thunderstorms grow and become more intense, the difference in temperature in the horizontal grows, which induces a stronger jet stream over the subtropics. This intensification of the subtropical jet usually means increased risk for heavy rainfall in the western and southern United States, where moisture becomes transported most efficiently. The strengthening jet also results in a higher amount of wind shear over the western Atlantic. Wind shear is the changing of wind with height, and is detrimental to hurricane development. This is why during El-Nino years, confidence in a weaker hurricane season increases. Forecasters can use analog forecasting to determine at what strength El Nino or La Nina years produced certain conditions in a given location. This along with the use of long-range climate and weather models which take into account ENSO allows forecasters to issue not only monthly but seasonal outlooks quite well, despite not being able to nail specifics.

The power of long-range forecasting can benefit Lowe's by outlining which areas in the United States are most likely to experience above-average temperatures and below-average precipitation. Customers are more likely to get out of their way and shop when the weather is dry and the temperature is above 65 degrees. On cloudy, cold, and perhaps snowy days, customers are less likely to work on outdoor home improvement, and more likely to focus on indoor insulation. The next section will feature more information about Lowe's business.

Lowe's Business

Lowe's business model is to sell gardening and hardware supplies for Do It Yourself (DIY) projects and home improvement. Their main competitor, Home Depot, is much larger than

Lowe's with over 2,200 stores in the U.S., Canada, Mexico and other countries, such as China. Having stores in other countries gives the company an advantage to extra income that Lowe's will not see, unless they expand. Home Depot has almost double the amount of employees but makes almost $30 billion more than Lowe's, making it quite the powerhouse. Its gross profit margin is lower than that of Lowe's by less than 1%; this is good for Lowe's but it could be better. By using our money earning and money saving indices, the gap can increase from much higher than 1%, giving you a fantastic lead.



With 2,129 stores across the U.S., Canada, and Mexico, Lowe's has made a name for itself. With each store receiving around $92,500 in sales, it came in second place in the DIY and home improvement market, but it did lose a lot of money in distribution and warehouse management. Therefore, Lowe's gross profit margin is $22,464,000,000, which is only 34.55% but still a touch higher than that of its main competitor. This includes a rise in sales by 10% over

the last few years. Our products will help raise the gross profit margin substantially by saving and earning money when it comes to warehouse maintenance, inventory, and saving money due to shipping concerns.

One of the most important things about owning a business is the building in which it is housed. In the case of Lowe's, the average store size is 112,000 square feet of indoor space and 32,000 square feet of outdoor space, a size larger than that of their competitor, Home Depot. Warehouse and building maintenance gets exponentially more expensive during certain times of the year when it comes to heating and cooling as well as electricity. The larger the building, the more money it costs to power it, and with Lowe's warehouse sized buildings, that is a large price. Our first product will provide information about which stores in the U.S. would do better from staying open longer. Certain stores do not need to be in operation as much as others during certain times of the year. When not in operation electrical systems do not need to be in use. Without these systems, massive amounts of money will be saved on cooling and heating, as well as the huge warehouse lights. This will drastically decrease the amount of expenses and raise their gross profit margin. Most of Lowe's profits are seen during the second quarter, during May, June and July. The lowest amount of profits are seen in the fourth quarter, during August, September and October. If Lowe's closes earlier during the slower seasons, where more energy is needed, your bottom line will rise. Our Climate forecaster and money saver (CFAMS) index will provide a clear picture of where some stores could flip their switch. Lowe's employs 290,000 people, and 100,000 of these are part-time workers. Payroll expenses can be lowered during the months when business is low, the fourth quarter. Part time workers do not need to

come in as often, or at all, since less customers will come into stores. Over time, this will save the company more income that it could put into inventory costs.

Next to the building, the costliest thing for a business is the inventory. Knowing when to have certain stock is key for getting the most customers into the store at a time. Our products will help determine which areas in the country experience the most disastrous weather phenomena, such as floods, tornadoes, and hurricanes, which would result in the necessity of hardware supplies to make repairs. In areas that experience frequent heat waves, such as the southern and midwestern portion of the country, more air conditioners and fan units in stock are essential. For places that have increased chances of flooding, large stocks of carpet cleaners, pumps, rugs, and wallpaper are important, as they would help these stores get the most business. For these examples and others, advertising is key. Selling these items for a lower price would bring more customers, who might not have come otherwise, through the door. Our product will show which areas would most often experience situations like these and give an idea of how much stock should be in the stores. Knowing how much stock per store will also keep shipping consistent.

A major cost for a business that deals in sales is shipping. Having shipped inventory arrive late or damaged can lose a lot of money and a lot of customers. Our second product will show which major roads will be hazardous due to weather events and possible alternate routes to take. Avoiding troubled routes will avoid destruction from fallen debris, crashed cars and other accidents. Avoiding these routes will also keep the time for shipping lower by driving around heavy traffic that would delay the shipments. Transporting fragile supplies and equipment over long distances can be hazardous to the products, since there is an increased chance of damage to

products the longer they are in transit. Our second product will assist in finding the fastest routes away from weather related hazards.

The Indices

The Long Haul Overall Index will include more real-time information that is crucial to the safe and efficient transport of Lowe's goods. This index is as follows:

Long Haul Overall Index **=** *Risk of Moderate/Heavy Snow, Ice, and/or Heavy Rainfall * (0.25) + Amount of Salt Available * (0.1) + Amount of Plows Available * (0.1) + Odds of Surface Temperature Below 32 * (0.1) + Chance that Wind Speed Exceeds 40 mph * (0.2) + Risk for Limited Visibility Below a Half Mile * (0.25)*

Figure 6. Scale of shipping index. As the index approaches 50, risk of impactful weather to shipping processes goes up.

Precipitation is a major concern when it comes to shipping. As probability of moderate snow or ice increases, the risk for major travel concerns also increases. Roads can quickly become slick, and visibilities can be reduced to a half mile or less in heavier-intensity snow. Snow and ice are more likely to accumulate when the surface temperature is at or below freezing. Therefore, it is important to include both the intensity of precipitation and the temperature when considering road conditions. Impacts of wintry weather are most severe in the locations that are climatologically not used to significant accumulating snow. Inefficient road treatment and lack of resources make shipment much more difficult, so 3 inches of snow in North Dakota will cause significantly less impact than 3 inches in Atlanta, Georgia. This is true

both on the roads and at the airport. The average number of 2 inches or higher snowfall events per year and 0.1-inch ice events will determine the severity of snowfall for the particular location. Places in the southeast see very few, if any, sizeable snowfall events per year, so the lower the number, the higher the index will be. If there is no threat of moderate snow, the average 2-inch snowfall portion of the index goes to zero. As the threat for moderate snow approaches 100%, the snow term pushes to 30, and if the temperature is below freezing, the previous two terms reach 40. If visibility is reduced to under a half mile, the index value will be pushed above 50. If the area of concern has enough salt and plows to treat areal roadways, the index will be held down some, but if vulnerable locations like those in the southeast have little to no resources, this term will only increase the index. 50 will be considered the beginning of the "danger" zone for shipment travel. It is at this point when trucks are urged to choose different routes in order to avoid serious delays. To make sure our index covers everywhere in the United States, our Long Overhaul Index will be displayed on a United States national map, with the ability to zoom in to each region. As an example, if moderate snow is in the forecast for Richmond, Virginia, with little plows or salt still available, but just light rain is in the forecast with some reduction in visibility in Raleigh, North Carolina, one would see an abrupt transition from red to green between southern Virginia and central North Carolina.

Precipitation does not have to be frozen to cause problems on roadways. Heavy rainfall not only slickens roads but also can significantly reduce visibility, slowing the speed of all vehicles and increasing the risk of accidents. Shipping trucks are not as likely to slide or hydroplane, but smaller vehicles, especially those that ride closer to trucks, experience more splashing onto their windshield. Any accident, whether it is due to rain or snow or another factor,

will delay travel and negatively impact Lowe's shipment timing. This index is therefore designed to not only point out the greatest weather concerns but also to point out traffic backups and/or speed reductions. Heavy rain and snow also impact airplanes, mainly because visibilities become reduced and runways can become covered. Precipitation, of course, is not required for a reduction in visibility. Our index also includes the risk for any kind of limited visibility, including fog, because it can cause problems, especially in mountainous regions. Trucks must slow down and airplanes may not be able to take off if visibilities are reduced to less than a half mile.

The last portion of the index includes the impact of wind which is important to high-profile vehicles such as trucks. When winds begin to blow over 40 mph, roll-over risk increases, meaning thay trucks then must reduce their speed. This results in shipment becoming delayed, which is why wind is included in this index. Planes are also impacted by winds, especially when ground-level winds exceed a certain threshold. Takeoff and landing becomes more difficult when winds exceed 40 mph, and a delayed takeoff or landing will result in delayed shipment to stores and customers nationwide.

Routes that feature blizzard-like conditions, temperatures that are below 32 degrees, winds exceeding 45 mph, and fog will produce the highest index values. At places where the is no precipitation, above-freezing temperatures, maximum visibility and calm winds, the index will produce the lowest values. Featured in the index is a color scale that ranges from white, indicating no impacts, to dark red, indicating the most severe shipping concerns. A yellow color will indicate moderate values where, perhaps, moderate snow is falling but winds are calm and temperatures are above freezing. We plan on using a blend of high-resolution model data

combined with current conditions and forecasting experience to support the index. The index will be used nationwide, and it will be updated at least four times per day. Our index will cover the entire country over the coming 48 hours and be updated at 6am, noon, 6pm, and midnight. The frequent updates will ensure the most up-to-date forecasts to allow shipping trucks to make last minute changes if needed. In rapidly-changing weather situations, there will be ensured time to change routes.

Shipping is an everyday concern when it comes to the weather, but the weather also influences how many people shop at Lowe's in a given one-week period. Weather also determines what products are sold the most. The factors that will ultimately determine these are the amount of sunshine, how warm it is compared to the average temperature and the risk of precipitation. The "Lowe's" risk shopping index will be as follows:

*LRS = (Number of Mostly Sunny Days * 0.2) + (QPF Forecast * 0.2) + (How Many Days Does it Rain or Snow? * 0.2) + (Temperature Departure From Average Forecast * 0.4)*

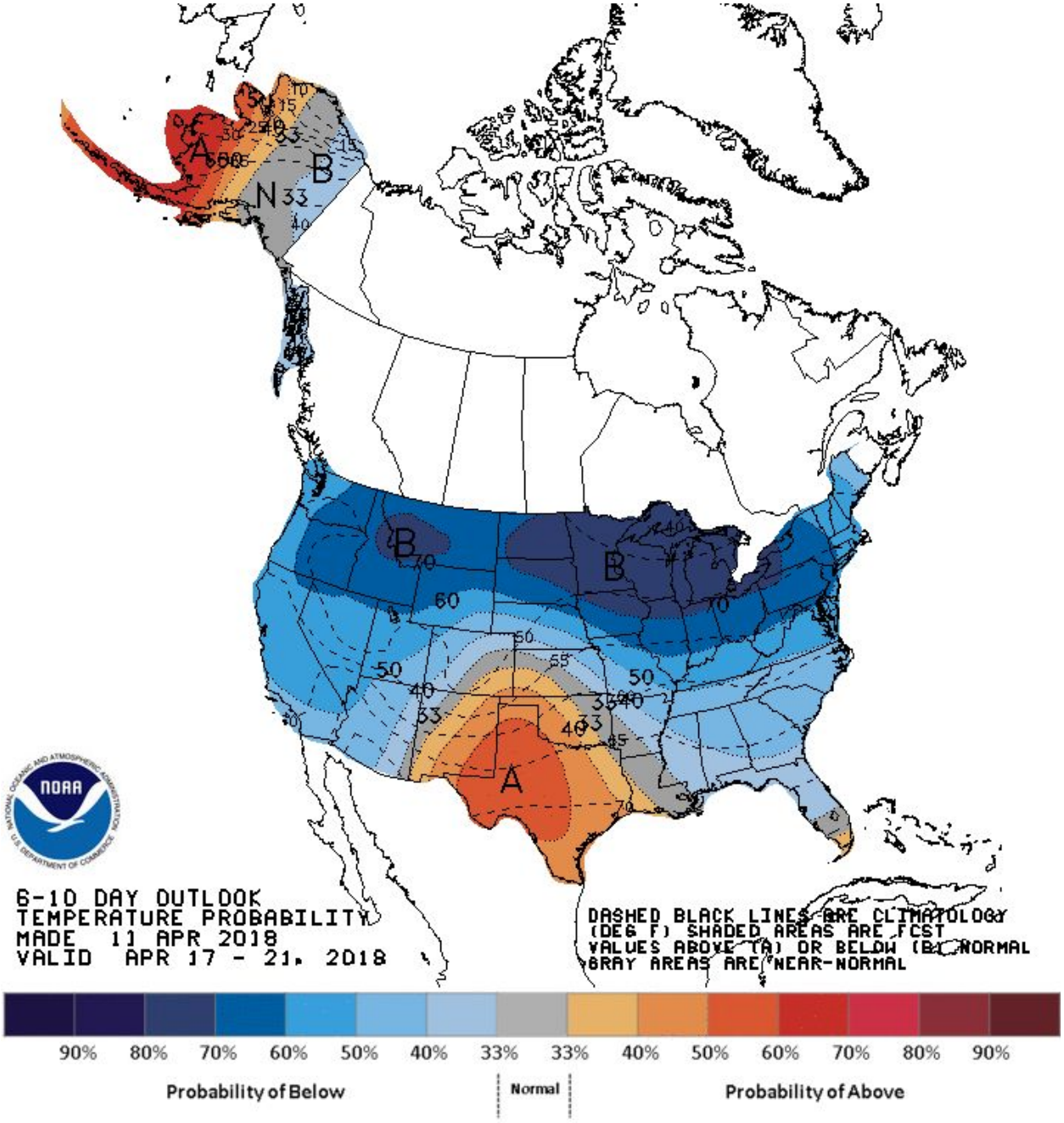
Low	0-40
Moderate	41-70
High	71-100

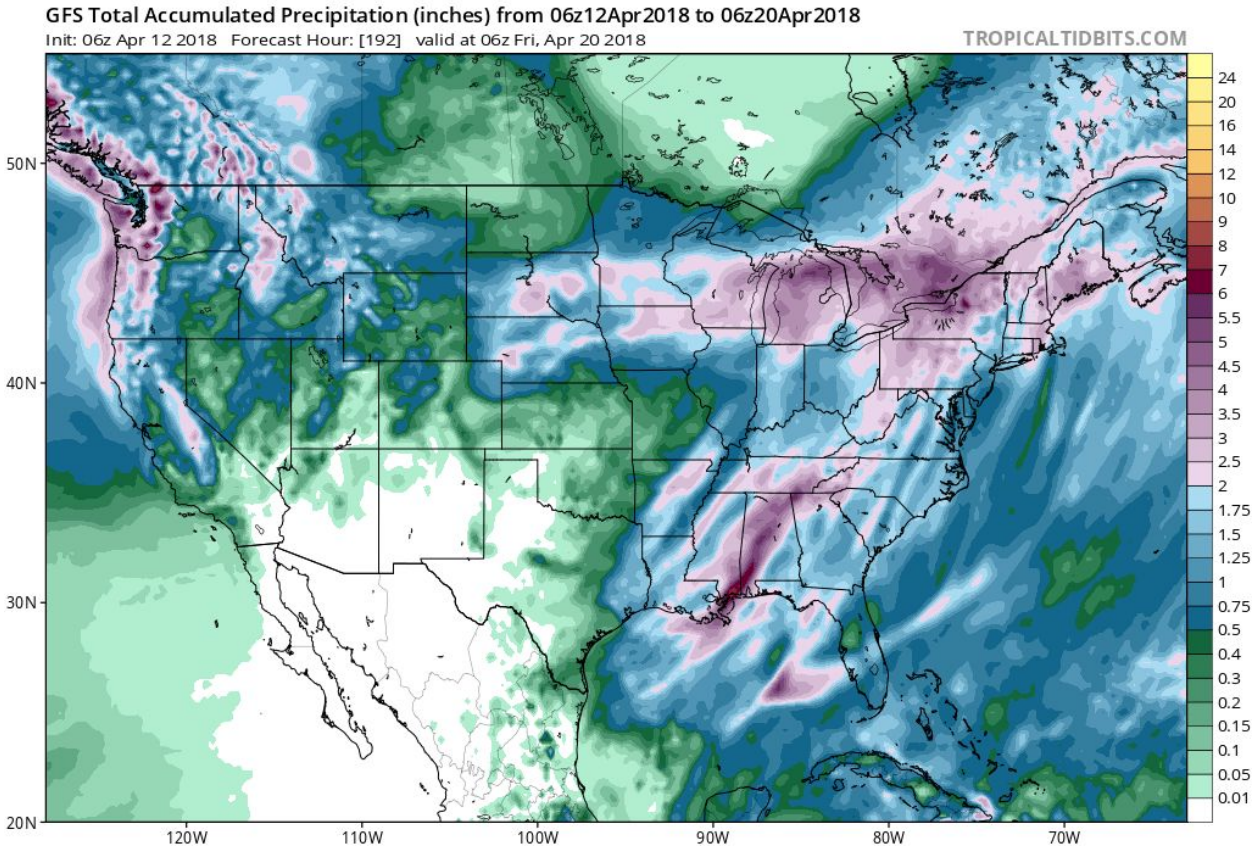
Figure 7. As the index surpasses 70, a higher influx of customers is expected for the fiscal quarter.

Seasonal influx of customers will depend on how likely temperature will deviate from average, and how much precipitation will fall. In seasons where precipitation is lower than average and temperature is above average, normally May-July, customers are more likely to shop at Lowe's. Besides temperature and precipitation, weather conditions are also a significant

variable. Customers are more likely to shop at Lowe's during sunny weather compared to when it is cloudy. A sunny portion of the year in a particular location will ensure higher influx of customers into local Lowe's stores. People are more motivated to do home improvement and gardening projects during sunny times of the year, as many projects may take several days or even weeks to complete.

The one-week temperature forecast will come from the 6-10 day Climate Prediction Center's national outlooks. The higher above average temperatures expected, the closer the temperature portion of the index will be to 40. With precipitation, we will be using a model's QPF output, which according to NOAA, represents the expected amount of melted precipitation accumulates over a specific time period. As precipitation increases, the amount and timing of it must be considered. If a heavy amount of precipitation is expected to fall in a short period of time, this part of the index will be noticeable but not reach extreme thresholds. When there is strong confidence in low precipitation, that we will define as under 0.1" in a day, with most days staying dry, but with above-average temperatures, the temperature and precipitation terms combined will approach 80. If the amount of model-generated cloud cover is low, the entire index itself will approach 100, meaning a greater influx of customers over the next week is likely. This will be updated four times a day with each model run, that arrives at approximately 2am, 8am, 2pm, and 8pm, giving plenty of updates for Lowe's management teams. Once again this will be a color-coded map that is available to the entire United States.


6-10 DAY OUTLOOK
TEMPERATURE PROBABILITY
MADE 11 APR 2018
VALID APR 17 - 21, 2018
DASHED BLACK LINES ARE CLIMATOLOGY
(DEG F) SHADED AREAS ARE FCST
VALUES ABOVE (A) OR BELOW (B) NORMAL
GRAY AREAS ARE NEAR-NORMAL
90% 80% 70% 60% 50% 40% 33% 33% 40% 50% 60% 70% 80% 90%
Probability of Below
Normal
Probability of Above



Reference: Tropical Tidbits.

The color bar represents probability of above and below-average temperatures. Above-average temperatures will go into the index as the probability displayed above. If temperatures are below-average, however, the probabilities will be inverted, so 100% chance of below-average represents 0 on the temperature portion of our index. The precipitation amount can be found by examining the accumulated precipitation, or QPF, on the lower map. When precipitation is expected to be low, that term in the index will be quite high, because an increase in customer influx would be expected. If precipitation exceeds 1.0”, the amount term will decrease to around 0 after multiplying by the weight. If the number of days that it rains is also high, the timing term will also go to 20, increasing the overall index. For sunshine, the scale will

range from 0-20, with zero days of sunshine during the week equating to 0 in the index and 7 days of sunshine representing a value of 20, again at least in the cloud cover portion of the index. Sample calculation for southern Texas for May-June-July 2018:

- 40% chance of below-average precipitation equates to 60% for the index.
- Less than 0.1" of precipitation over the 7-day period equates to a value of 19 for the precipitation term.
- Rain will occur only in 1 of the 7 days, which means an index value of approximately 86 multiplied by 0.2 which yields 17.2
- Number of days with sunshine, based on model-generated cloud cover = 6, equating to a value of 85.

  (60 * 0.4) + (90 * 0.2) + (86 * 0.2) + (85 * 0.2) = **76 → High.**

In this case, stores in southern Texas should expect a high influx of customers during the summer portion of the fiscal year. This makes since we have high amounts of sunshine expected, low precipitation, low number of days that it rains, and a reasonable chance of above-average temperatures.

The final index is the Weekly Weather Watcher Index, and as its name suggests, this index is updated weekly to provide a short-term outlook of the weather. The index will help store managers identify times when their business is predicted to be slow, moderate or busy. Something important that this index does is take into account the days of the week. In addition to this, the Weekly Weather Watcher Index, or Triple W, accounts for cloud cover, temperature and precipitation. Each variable is assigned a number and associated weight, as indicated in Table 1.

Table 1: The Weekly Weather Watcher Index is based on four variables, which have weights to indicate their importance in the index. Precipitation, temperature, day of the week and cloud cover are the variable with weights of 40%, 30%, 20% and 10%, respectively.

Precipitation	Value	Temperature (°F)	Value	Day	Value	Cloud Cover	Value
None	100	20 or less	0	Sunday	100	Sunny	100
Light	66	21-40	25	Monday	50	Mostly Sunny	66
Moderate	33	41-60	50	Tuesday	0	Mostly Cloudy	33
Heavy	0	61-80	100	Wednesday	0	Cloudy	0
		81 or higher	50	Thursday	50		
				Friday	100		
				Saturday	100		

Low	0-40
Moderate	41-70
High	71-100

Figure 8. This figure shows the busyness that the store is predicted to have based on the variables in Table 1.

*WWW = (Precipitation * 0.4) + (Temperature * 0.3) + (Day * 0.2) + (Cloud Cover * 0.1)*

Below is a sample equation:

The location has light precipitation, 50°F-temperatures and cloudy skies on a Wednesday.

*WWW = (66 * 0.4) + (50 * 0.3) + (0 * 0.2) + (0 * 0.1)=41.4*

Busyness in this example would be moderate.

J.A.A.R. Indices, Incorporated

An agreement between Lowe's Companies, Inc. and J.A.A.R. Indices, Inc.

This agreement is hereby entered into April 12, 2018 between Lowe's Companies, Inc. hereafter called the "**Client**", and J.A.A.R. Indices, Inc. hereafter called the "Provider"

This agreement serves for the provision of specialized weather indexes for, and only for the Client. The beginning of this arrangement begins on the first of the month.

Our Responsibility

1. Provide access to the "Home Improver indexes" the Long Haul Overall Index, hereafter called "**LHO**", Lowe's Risk Shopping index, hereafter called "**LRS**", and the Weekly Weather Watcher index, hereafter called "**WWW**".
2. Keep the indexes up-to-date based on the agreed payment choice of the Client.
3. Maintain the prices the Client chose throughout the agreement's lifetime.
4. LHO and LRS payment options are as follows, and are for each index:
    a. Daily updates: $8,000 per month
    b. Weekly updates: $6,000 per month
        i. Includes WWW for an extra $1,000 a month.
    c. Monthly updates: $4,000 per month

d. Yearly updates: $2,000 per month

Your Responsibility

1. Make payment deadlines of the first of every month, or risk the termination of the agreement, the withdrawal of the indices, and a lawsuit.
2. To provide new information about your business practices as needed, or as requested.

Both Parties have a right to terminate this agreement with cause by providing written notice, and evidence against the party in question, for one of the broken responsibilities. This will be handled by a representative of both parties.

This is a two year long agreement, another agreement must be made if business is to occur, one year after signing this document. During this time, prices are subject to change, as is the agreed upon price.

The agreed upon indices and prices are

_____

_____ Client Initial

By signing below, both the Client and the Provider indicate that they have read, understand, and agree to all the terms and conditions outlined in this agreement.

Client: _____ Date: 4/12/2018

Provider: ____ Date: 4/12/2018