

**RESILIENCE360**



# HURRICANE PEAK SEASON: WHAT TO EXPECT IN 2018

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## DHL RESILIENCE360 SPECIAL REPORT

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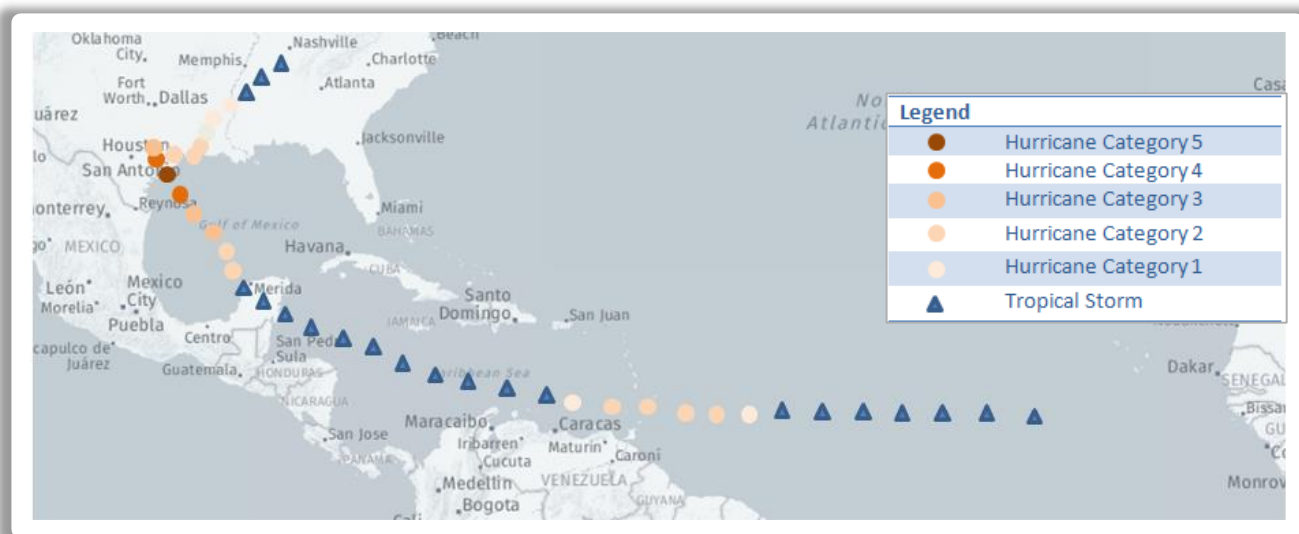
## BACKGROUND

When Tropical Storm Chris intensified into a Category 2 hurricane on July 10 off the coast of North Carolina in the United States, shipping lines, logistics operators and supply chain managers closely watched its trajectory as the storm produced large waves and severe winds along the U.S. East Coast. It was the second Atlantic hurricane of the season and the earliest since 2005, when Hurricane Katrina devastated New Orleans.

It has been a calm start to the 2018 hurricane season, which started on June 1 and typically runs until the end of November. Only 5 named tropical storms have developed in the Atlantic Ocean so far, compared to 8 around the same time last year. In its latest outlook, the U.S. National Hurricane Center predicted that there will likely be only 4-7 hurricanes in 2018, down from 10 in 2017. Last year's season was, in fact, the fifth most active hurricane season since 1861, with three powerful hurricanes, namely Hurricane Harvey, Irma and Maria, developing back-to-back in August and September.

## A LOOK BACK ON THE 2017 SEASON

Besides being the costliest hurricane on record, Hurricane Harvey caused major supply chain disruptions across southern Texas in late August 2017 and was one of the most impactful hurricanes in recent history due to several reasons. First, it was the first major hurricane with wind speeds of over 215 km per hour to make landfall in the US since Hurricane Katrina in 2005. Second, after dissipating in the western Caribbean it rapidly regained strength, developing within only 57 hours from a depression into a powerful Hurricane 4, giving individuals and businesses less than 3 days to take precautionary measures. And finally, its intensity and duration of the rainfall were unprecedented as Harvey lingered over the Texan Gulf Coast for 5 days, generating enough rain to cover the entire United States in one centimeter of water.



*Hurricane Harvey's path from August 17 to September 2; Source: National Hurricane Center*

Scientific research published in the *Journal of Climate* found that since 1949, hurricanes have become both wetter, carrying more rain, and slower, spending more time over a particular area. Both of these aspects exacerbated the disruption in southern Texas, affecting industries from petrochemical to manufacturing and logistics as refineries and plants were flooded for weeks. Petrochemical companies such as Total, Dow Chemical or LyondellBassell had to shut down production sites, affecting downstream customers in the automotive and health care sector due to shortages of key chemical building blocks. A plant belonging to the chemical company Arkema that produces intermediate products for the chemical, pharmaceutical and plastics markets even exploded due to damages from floodwater, rendering the site inoperable and causing severe environmental pollution.

## A LOOK BACK ON THE 2017 SEASON

Airport and seaport terminals as well as highways and major roads in the Greater Houston area were closed for several days, causing weeks of delays for critical shipments out of or into the area, regardless of the mode of transportation. Supply chains relying on sea transport were particularly affected as they were unable to get raw materials out of the area with both rail transportation being affected and the Houston Ship Channel not operating for days. Many businesses were faced with either higher costs for transportation or longer shipping times due to the disruption.

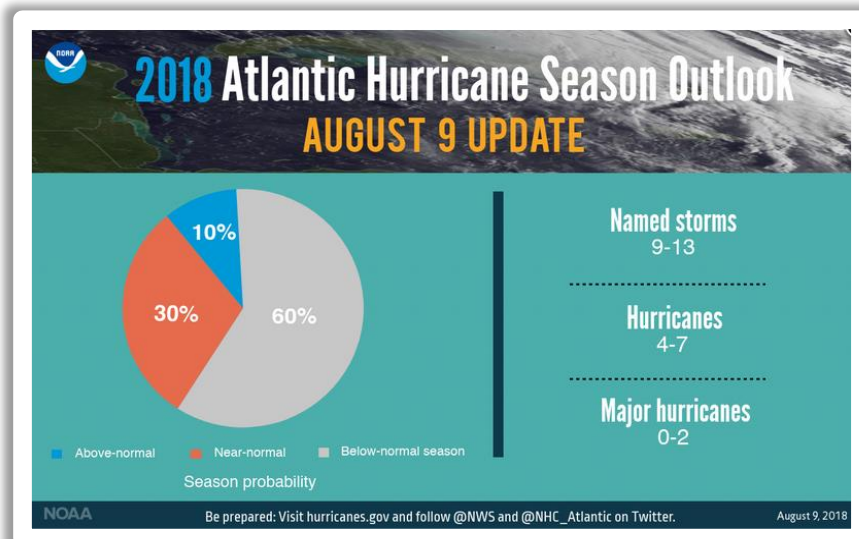
Due to the material shortages, some companies had to secure supplies from alternative suppliers from overseas at higher prices, with increased transportation costs and with longer shipping times. At the same time, companies relying on container movements in the area faced weeks of delays, as shipping lines unloaded Houston-bound vessels at ports in New Orleans or Miami and brought them to Houston through their network of regional and national carriers, or connected them with alternative services at a later stage.

Similar supply chain impacts occurred in September 2017 when Hurricane Irma and Maria affected the Caribbean islands and Florida within a short time span. First, Hurricane Irma made landfall as a category 4 storm in the Florida Keys, disrupting operations at airports, ports and oil terminals from Puerto Rico to South Carolina for multiple days. Widespread fuel shortages, highway & interstate closures, flooding and power outages prevented logistics movements from resuming quickly, causing an estimated USD 20-40 billion in damages to the private sector.

Shortly thereafter, Puerto Rico, a key production site for the global pharmaceutical industry, suffered major damages from another Category 4 hurricane. In addition to extreme wind speeds and flooding, Hurricane Maria brought about the collapse of the national power grid, leaving residents and businesses on the island without electricity for months. Companies including Baxter International and Eli Lilly were thus unable to cool their products, forcing them to partially halt production at their Puerto Rican plants and shift some production to other plants abroad. As a result, more than 85 drugs were still in shortage in the US some 6 months after the hurricane hit, according to the US Federal Drug Administration (FDA).

## LOOKING AHEAD

While recent scientific research found that Hurricane Harvey was strengthened by climate change, this does not necessarily hold true for every hurricane season from now on. The development of 10 hurricanes in 2017 was exceptional, and latest forecasts predict the 2018 season to be quieter, with 4-7 hurricanes expected to develop until November 2018. An average season experiences 6.5 hurricanes per year.



*Atlantic Hurricane Season Outlook; Source: National Hurricane Center*

This year, only 5 named tropical storms have developed until August 29 in the Atlantic, which can mainly be attributed to three reasons:

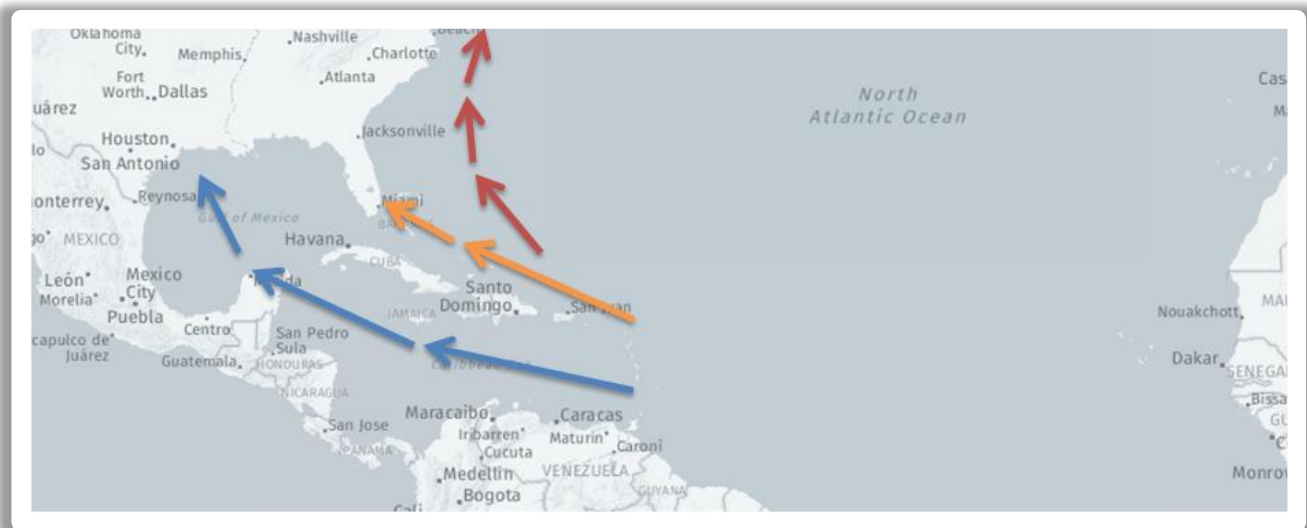
1. Since June 2018, thicker than usual dry and dusty air from the Sahara Desert has kept tropical waves off western Africa from developing into tropical storms and hurricanes so far.
2. The colder than normal water temperatures in the Atlantic Ocean have prevented storms from forming, as these need warm ocean water to strengthen.
3. Forecasters predict that the El Niño weather phenomenon, which in part determines hurricane activity, will likely form over the coming months. This natural phenomenon causes the Pacific Ocean to warm up and prompts strong winds to blow into the Caribbean, suppressing the development of tropical storms in the Atlantic, Caribbean and Gulf of Mexico, in particular during the months of October and November.

This, however, does not mean that the upcoming hurricane season will have less impact on supply chains as it only takes one devastating storm for risks to materialize. It is worth remembering that no forecaster predicted three powerful hurricanes to develop rapidly one after another in 2017. Moreover, there are no reliable forecasts on the number of hurricane landfalls per season, which usually cause most damage

## TYPICAL TRAJECTORIES DURING PEAK SEASON

During peak hurricane season in August and September, tropical storms often form in the central or eastern Atlantic Ocean from disturbances and tropical waves off the northwestern coast of Africa. These tend to move much more quickly. All of the most powerful hurricanes in 2017, namely Harvey, Maria and Irma, originated on the western coast of Africa before consolidating on their way to the Caribbean. From there, hurricanes typically take one of three paths displayed on the map below.

**Path A** resembles the path that Hurricane Harvey took in 2017, crossing the western Caribbean and Yucatán Peninsula before making its way through the Gulf of Mexico. Hurricanes following **path B** usually track further northwards across the Caribbean islands before reaching southern Florida, similar to Hurricane Irma in 2017. And finally, a recent example for hurricanes taking **path C** was Hurricane Jose in 2017, which bypassed the Florida peninsula, tracking further northwards along the US East Coast without making landfall. Hurricane Chris took a similar path in July 2018, though, forming south of Bermuda.



*Typical trajectory of hurricanes during peak season; Source: National Hurricane Center*

Mid-September is usually the most dangerous time of the Atlantic hurricane season, specifically from September 10 onwards. Nearly 44 per cent of hurricanes making landfall in the U.S. between 1995 and 2017 occurred in September. Hurricanes Harvey, Irma and Maria all occurred between mid-August and mid-September, with Hurricane Irma making landfall in Florida exactly on September 10.

## AREAS AND INDUSTRIES PARTICULARLY VULNERABLE TO HURRICANES

Hurricanes Harvey, Irma and Maria have exposed the vulnerability of certain geographical areas spanning from Puerto Rico to Texas as well as some industrial supply chains ranging from petrochemicals to pharmaceuticals. These are, however, not the only areas or industries which are prone to supply chain disruptions caused by hurricanes.

### *Geographical areas at risk*

Seen in the wider historical context, neither Texas nor Puerto Rico necessarily faces the highest risk when it comes to tropical storms. Prior to Hurricane Harvey, no major hurricane made landfall in Texas since 2005. Other regions and areas in the Atlantic Ocean, Caribbean and Gulf of Mexico are more exposed to the threat of hurricane landfalls each year. Based on data from the US Federal Emergency Management Agency (FEMA) and NHC, the US states of Florida, North Carolina and Texas have experienced the most storms and hurricanes tracked directly over their territory since 1851, with Florida having nearly double the amount than that of North Carolina. This is mainly because Florida has the longest coastline, sticks out geographically and can get hit by storms moving both northeastward from the Gulf of Mexico and westward from the Atlantic Ocean.

However, it is not the sheer quantity of hurricanes and storms, but their strength and intensity which is the most important factor, as one single hurricane per season is enough to have a devastating impact. Most often, it is also not the wind itself which causes the main impact, but the associated rainfall and flooding it produces, which can lead to power outages, road closures, infrastructure damage and even plant explosions.

## AREAS AND INDUSTRIES PARTICULARLY VULNERABLE TO HURRICANES

As shown on the map below, between 1995 and 2017, 34 major hurricanes have made landfall across Mexico, the United States, Nicaragua, Belize, Cuba, the Bahamas, Puerto Rico and Haiti. Most of these have hit Cuba (8), the US state of Florida (5), the Bahamas (4) and Mexico's Guadalajara (2) and Quintana Roo (2) regions. In addition to that, US states along the Gulf Coast including Texas, Louisiana, Mississippi and Alabama have regularly experienced landfalls of major hurricanes.



### *Manufacturing supply chains at risk*

Within these high-risk zones, major industrial centers such as pharmaceutical and medical equipment factories in Puerto Rico as well as petrochemical plants in southern Texas have experienced the impacts of hurricanes in 2017. However, there are other key manufacturing hubs at risk of potential hurricane impacts: in Florida, aerospace manufacturing and energy terminals are oftentimes located in coastal areas, making them vulnerable to passing hurricanes and subsequent storm surges and flooding.



## AREAS AND INDUSTRIES PARTICULARLY VULNERABLE TO HURRICANES

When Hurricane Irma made landfall in Florida, Rockwell Collins, a large aerospace supplier, preemptively shut down its operations in the cities of Melbourne, Medley and Wellington due to the approaching storm. Nearby Alabama also has a burgeoning aircraft industry, with Airbus recently opening a plant in Mobile, in addition to already being an integral part of the US automotive supply chains. Many OEM manufacturers and suppliers, including Daimler, Honda and Hyundai, have sites in Alabama. Key suppliers of auto parts, such as steel processor AM/NS Calvert, metal inserts producer ACP and rubber manufacturer HS Automotive, are all located in the coastal hinterland of southern Alabama. Although the biggest impact can be expected on coastal areas, hurricanes usually cause heavy rainfall and strong winds in the coastal hinterland during the dissipation process. Furthermore, inland locations near flood zones with low elevation, high average rainfall and nearby rivers or lakes are prone to flooding impacts from passing hurricanes, and should be factored into risk assessments of specific locations/areas.

*When Hurricane Irma made landfall in southern Florida Rockwell Collins preemptively shut down its operations across the state due to the approaching storm.*

Besides production and supplier locations, industrial supply chains may also experience disruptions in their logistics network as a result of tropical storms. Many major airports and ports are located in the identified high-risk zones, potentially bringing flight or vessel services to a temporary standstill.

While the Texan petrochemical industry relies on terminals in the Port of Houston and its ship channel, manufacturing industries of high-value goods in Florida depend on Miami International Airport, southeastern Florida's major air gateway, to connect their products to final customers. Both transportation hubs were shut down for days during last year's hurricane season, causing supply chain managers to search for ad-hoc capacity on alternative routes.

Likewise, container and bulk terminals along the US Gulf Coast and the US East Coast as far as Charleston, South Carolina, had been temporarily disrupted due to strong winds and storm surges caused by nearby hurricanes in the past. The coastal stretch between Charleston and Jacksonville, Florida, is particularly vulnerable to flooding as its sea levels have increased by 10 centimeters since 2010, amplifying the severity of coastal flooding. On the Pacific coast of Mexico, hurricanes have led to the disruption of major shipping gateways in the past. In 2015, Hurricane Patricia forced the Port of Manzanillo, the ocean gateway to and from Mexico City, to temporarily halt its operations.

In addition to import and export hubs, transshipment ports and airports may also experience the impact of a passing hurricane; cargo may be routed through major transshipment hubs and terminals where carriers connect long-distance shipments to more local services. For example, the Bahamas Freeport, the transshipment hub for containerized cargo of the Americas, has been forced to halt its vessel and port operations due to tropical storms in the past. This has then led to severe congestion issues for weeks at the port, causing extended period of shipment delays as well as missed connections.

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## HOW CUSTOMERS CAN PREPARE

As the 2018 hurricane season approaches its peak on September 10, Resilience360 customers should keep abreast of the latest developments by continuously monitoring weather forecasts and consider implementing the following risk mitigation measures:

### *Short term measures:*

- **Pre-positioning essential material and stocks:** Hurricanes can now be forecast in advance with much greater accuracy, giving companies more time to plan mitigation efforts. By monitoring storm forecasts in real-time, companies can save valuable time that can be used to assess potential locations and routes at risk and initiate efforts to minimize disruption. Mitigation efforts may include: increasing inventory to bridge short-term supply shortages; storing fuel reserves and back-up generators for power generation during power outages; and setting up alternative communication systems such as Emergency Alert Systems (EAS), CB Radio or social networks for employees and customers.
- **Drawing up business continuity plans for at risk locations:** In case of a disruption, it is essential to have a business continuity plan in place to increase the speed of disaster response. In such a plan, customers should consider addressing critical aspects like potential alternative suppliers, alternative routes to and from crucial locations, key points of contact, additional short-term transportation costs and priority shipment identification.

### *Long term measures:*

- **Use mapping tools for supply chain risk assessments:** Companies may consider mapping tools to create greater transparency and understand interdependencies in their supply chains. By overlaying risk exposure scores and identifying locations prone to hurricanes or flooding, companies can prioritize mitigation efforts for risky locations down to sub-tier supplier levels more effectively.
- **Diversify manufacturing and distribution locations:** Organizations can consider mitigating operational risks by diversifying supplier, manufacturing and distribution locations, which will reduce the probability of complete production and/or distribution failure. If alternative suppliers, production and warehouse facilities lie outside of high-risk areas, customers may still be able to continue production and fulfill orders in case of a disruption. Alternative transportation routes from unaffected suppliers or warehouses should be established in advance.
- **Establish long-term partnerships with logistics suppliers:** Securing logistics capacity during a disaster can be made possible through trusted relationships with logistics providers, who can book capacity on charter flights to move a customer's shipment to its final destination and from disaster areas when everybody is vying for space.

## ABOUT DHL RESILIENCE360

DHL Resilience360 is an innovative, cloud-based platform that helps companies to visualize, track and protect their business operations. The solution facilitates intuitive supply chain visualization, tracks shipments and ETAs across different transport modes and enables near real-time monitoring of incidents capable of disrupting supply chains. DHL Resilience360 easily integrates with business systems and helps companies keep track of risk in combination with their business performance indicators. It enables companies to better ensure business continuity, building risk profiles based on over 30 risk databases, and identifying critical hotspots using heat-maps to mitigate risks and to turn potential disruptions into a competitive advantage.