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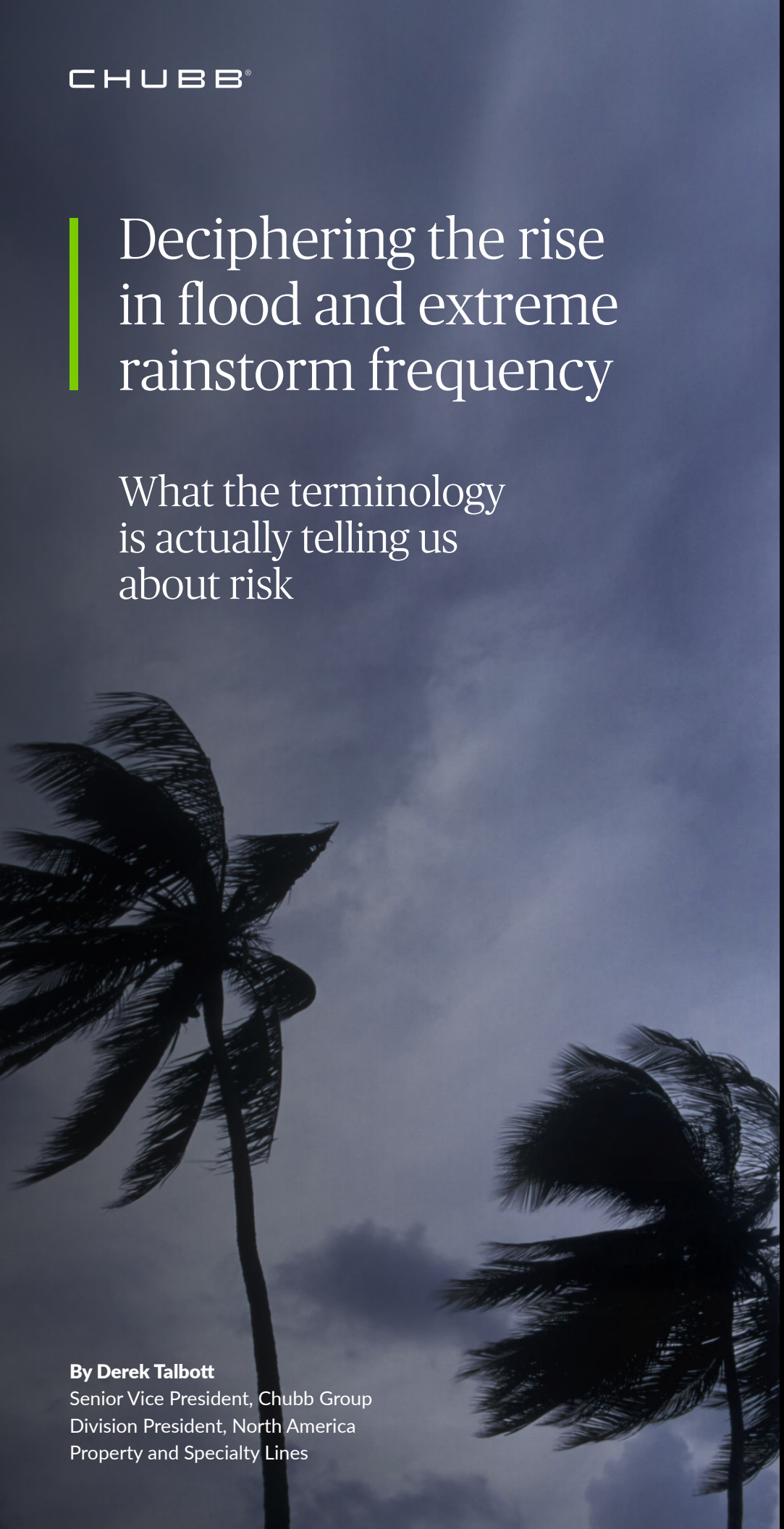
Deciphering the rise in flood and extreme rainstorm frequency

What the terminology is actually telling us about risk



By Derek Talbott
Senior Vice President, Chubb Group
Division President, North America
Property and Specialty Lines

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Number of top-ten years for extreme rainfall events that have taken place in the U.S. since 1995

42%

Global increase in flooding in upstream sections of rivers over the past 35 years

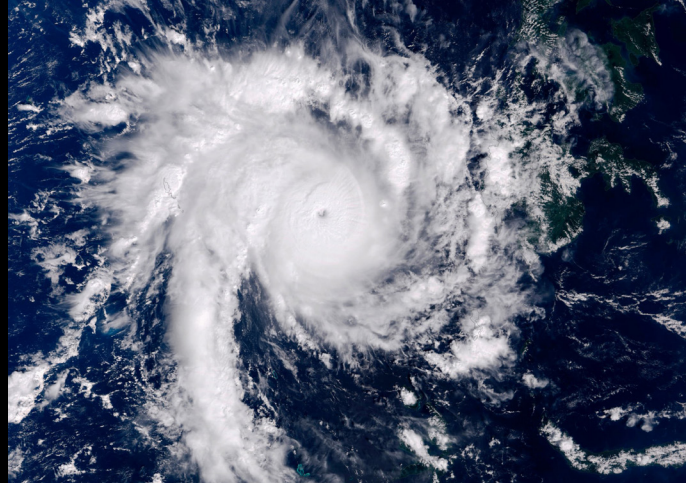
22%

Slowdown in Australian region tropical cyclones, increasing rainfall duration

0.20%

Chance of a 500-year flood occurring in a given year

The evidence is all around us: Floods and severe rainstorms are increasing in both frequency and intensity worldwide.



Warmer atmospheric temperatures are leading to heavier precipitation; at the same time, climate change is also intensifying the destructive power of hurricanes.

In the U.S., many coastal communities and areas near rivers have experienced dramatic increases in flooding events every decade since the 1950s.

As a result, people are more likely to hear meteorologists and other scientists using epochal language to describe extreme flooding or rainfall events: These experts might refer to a "500-year flood" or a "hundred-year rainstorm," for instance. The terms have distinct meanings but can be somewhat confusing since they don't quite signify what they sound like they signify. With a better understanding of what these labels actually mean, however, we can more accurately gauge the probability of these extreme weather events and more effectively prepare for them – lowering the risk of catastrophic damage to homes, businesses, communities and public health.

So what is a 500-year flood, exactly?
We might begin answering this question by stipulating what it's not: A 500-year flood isn't a flood that is projected to take place only once every 500 years. In fact, over a single 15-year period spanning the 1990s and early 2000s, the U.S. Midwest experienced two of them.

That's because the term "500-year flood" is a marker of statistical probability – not time. It refers to the 1-in-500 chance that a flood of a given magnitude will occur in any given year. Similarly, a 100-year flood refers to there being a 1-in-100 chance, a 50-year flood refers to a 1-in 50 chance, and so on. These probabilities can also be expressed as percentages, of course: Another way to think about a 100-year flood is to think of there being a one percent chance that it will strike over the course of a year. (Hydrologists mark time in "water years," which in the U.S. begin on Oct. 1st and end on Sept. 30th.) The same terminology is used to describe the probability of severe precipitation events; if you hear a meteorologist describe a massive and prolonged downpour as a 50-year storm, for example, they mean a rainstorm that has a 1-in-50, or a two percent, chance of occurring in any given year.

Why is this distinction important? Because thinking about floods and severe rainstorms in terms of their annual probability shines a spotlight on a sobering fact: Events that were once considered relatively rare are now, indisputably, becoming more common.

Behind the rise in extreme rainfall events
We know that extreme rainstorm events and the floods they so often cause are becoming more frequent and more severe. But why are they doing so?

One big reason: Warmer air can hold – and ultimately release – more moisture. For each degree Celsius of warming, the air's capacity for storing this moisture goes up by nearly seven percent. As atmospheric temperatures continue to rise, then, the likelihood of intense precipitation events rises with it. According to the Center for Climate and Energy Solutions, an environmental policy think tank, annual precipitation in the contiguous United States has increased at the rate of .2 inches per decade since the beginning of the 20th century, "with extreme precipitation events outpacing this trend."

Another reason has to do with the changing behavior of tropical storms and hurricanes as they move over water and land. The slower one of these tropical cyclones moves, the more time it has to dump its rain in a given location. Scientists tell us that this is exactly what's happening: Tropical cyclones affecting land areas in the North Atlantic and western North Pacific have slowed down by 16% and 21% respectively, whereas storms affecting land areas in the Australian region have slowed down by 22%. These scientists theorize that global warming has "cause[d] a general weakening of summertime tropical circulation," which is just another way of saying (as the Environmental Defense Fund puts it) that "[t]he winds that steer hurricanes move more slowly in a warmer climate." There's also evidence to suggest that these storms are moving further inland upon making landfall than they have previously, since the warmer temperatures of the ocean's surface can act like a "fuel" for tropical cyclones and extend their journey.

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Flash flooding and rivers

Data collected by the National Oceanic and Atmospheric Administration (NOAA) tells a troubling story.

The percentage of precipitation that comes in the form of intense, one-day events has been increasing.

In fact, the data indicates that of the top ten years for extreme single-day precipitation events in the U.S., nine of them have occurred since 1995. The Mid-Atlantic and Northeast have been hit the hardest; according to the U.S. Dept. of Agriculture (USDA), in these two regions the amount of rainfall occurring in the top one percent of daily events has increased by 55% over the past century.

These highly intense precipitation events can have an impact on both the size and frequency of river flooding. A joint study by the University of Cincinnati and the University of Massachusetts Amherst found that flooding is becoming much more common in the upstream sections of rivers, having increased globally by 42% over the past 35 years. This flooding, the researchers note, can have serious effects on navigability, pollution, the infrastructure associated with hydroelectric power and the geochemistry that keeps aquatic life in balance.

Protecting against rising waters

A clear understanding of how flood risk has changed – and how it continues to change – is the most important line of defense for individuals and entire communities seeking to reduce this risk. We know we can expect heavier rainfall events, and with them more floods, in the years to come, as well as a rise in costs both expected and unexpected. Chubb's extensive package of flood insurance products and risk management services is designed both to inform and empower clients by providing them with the most up-to-date and relevant data on flooding in their area and then acting on that data by presenting them with the insurance, technological and advisory tools they need to protect themselves and their property. Working together, we can keep the water from winning.

55%

Increase in the amount of rainfall occurring in the top one percent of daily rainfall events in the U.S. Mid-Atlantic and Northeast over the past century

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Number of 500-year floods the U.S. Midwest experienced in just one recent 15-year period

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