Counting the cost

2019: a year of climate breakdown

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christian aid

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Christian Aid is a Christian organisation that insists the world can and must be swiftly changed to one where everyone can live a full life, free from poverty.

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Cover: Joyce Mwadzura, of Ngangu township in Chimanimani, at what was her home before the cyclone, 24 March 2019. The cyclone hit while she was away at her farm plot, where she was staying with her aunt. Her aunt and niece did not survive. After burying her aunt, she got news that her home had been destroyed. KB Mpofu / Christian Aid

Executive summary

Extreme weather, fuelled by climate change, struck every corner of the globe in 2019. From Southern Africa to North America and from Australia and Asia to Europe, floods, storms and fires brought chaos and destruction.

This report identifies 15 of the most destructive weather events of the year. All of the disasters caused damage of over US$1 billion, and four of them cost at least $10 billion. These figures are likely to be underestimates as they often show only insured losses and do not always take into account other financial costs, such as lost productivity and uninsured losses.

By no means do the financial figures show the whole picture – or even the most important parts of it. The report also provides estimates for the numbers of people killed in each event. The overwhelming majority of the deaths were caused by just two events, in India and southern Africa - a reflection of how the world's poorest people pay the heaviest price for the consequences of climate change. In contrast, the financial cost was greatest in richer countries: Japan and the US suffered three of the four most costly events.

Each of the disasters in the report has a link with climate change. In some cases, scientists have identified the physical mechanism by which climate change influenced the particular event or calculated the extent of its relationship with human-caused warming. In others, the events are consistent with what scientists have warned will happen as the planet warms.

The extremes in this report occurred on a planet that is hotter than anything humans have ever experienced, and it's going to get worse, due to committed warming from existing emissions. 2019 was around 1°C hotter than the pre-industrial average and is likely to have been the second-hottest year on record. But unless urgent action is taken to reduce emissions, global temperatures will rise at least another 0.5°C over the next 20 years, and another 2-3°C by the end of the century.

2019 was not the new normal. The world's weather will continue to become ever-more extreme and people around the world will continue to pay the price. The challenge ahead is to minimize the impacts through deep and rapid emissions cuts.

A year of climate breakdown

Date	Location	Impact	Estimated cost (US$ billion)	People killed
January	Argentina and Uruguay	Floods	2.5	5
January - February	Australia	Floods	1.9	3
March	Europe	Storm Eberhard	1-1.7	4
March	Southern Africa	Cyclone Idai	2.0	1300
March - June	Midwest and South US	Floods	12.5	3
March - April	Iran	Floods	8.3	78
May	India and Bangladesh	Cyclone Fani	8.1	89
June - August	China	Floods	12	300
June - October	North India	Floods	10.0	1900
August	China	Typhoon Lekima	10.0	101
September - October	Japan	Typhoon Faxai and Hagibis	Faxai 5-9 Hagibis 15	Faxai 3 Hagibis 98
September	North America	Hurricane Dorian	11.4	673
September	Spain	Floods	2.4	7
September	Texas, US	Tropical Storm Imelda	8.0	5
October - November	California, US	Fires	25	3

Argentina and Uruguay: Floods

The Pampas region of Argentina and Uruguay began the year with extremely heavy rain that led to widespread flooding. Rainfall levels set new records, with up to 33cm falling in a single day in parts of Uruguay.[1] By mid-January, the region had received about five times the typical amount of rain.[2] The floods came a year after the same region faced a devastating drought.[3]

The flooding killed five people, cost an estimated $2.5 billion[4] and was Argentina's second-most expensive flood on record.[5] Up to 2.4 million hectares of soybeans were flooded, according to Coninagro, an agricultural group[6] (Argentina is the third largest soybean producer in the world[7]) and more than 11,000 people were forced from their homes.[8]

Argentina's President, Mauricio Macri, described the floods as "the consequence of climate change"[9] and climate scientists have identified the role of human-caused warming in exacerbating extreme rainfall in the region. Extreme rainfall has increased since 1960[10] and heavy rain and flood risk will continue to grow unless carbon emissions fall rapidly.[11]

Queensland, Australia: Floods

Photo: Floodwaters in Albert Street, central Brisbane. Jono Haysom.

Queensland, Australia was hit by record-breaking rainfall and floods from January 26 to February 9, from an intense and slow-moving monsoon.[12] More than two metres of rain fell in parts of the state in 12 days[13], with some areas receiving their highest rainfall since records began in 1888.[14]

The heavy and prolonged rain killed three people[15] and around 600,000 cows.[16] It caused significant structural damage, with an estimated cost of $1.9 billion.[17] In the city of Townsville, which was particularly badly hit, 3,300 homes were damaged by the floods.[18] Properties in the area risk becoming uninsurable because of climate change, according to an industry expert.[19]

At the end of the year it was fires, rather than floods, that caused devastation to parts of Australia and sparked a debate about climate change in the country. However they didn't make this list because in terms of financial losses they are expected to reach $100m, a relatively small amount compared to other events.

Australia has increasingly been experiencing heavy rainfall,[20] a trend that scientists link with climate change, and which is likely to worsen with further warming.[21] The state premier, Annastacia Palaszczuk,

warned that the “summer of disasters” hitting Queensland was evidence of climate change would hurt taxpayers.[22] A leading scientist, Ian Lowe, described the extreme weather that hit the state over the summer, including the floods, as “unmistakeable signs of climate change”.[23]

Europe: Storm Eberhard

In mid-March a powerful windstorm (or extratropical cyclone) moved across Europe, causing widespread damage. Storm Eberhard hit the UK, Belgium and the Netherlands from March 9, before moving east to affect Germany, Poland, the Czech Republic and Ukraine. Windspeeds exceeded 140km/h.[24]

The storm caused damage across Europe. At least four people were killed by falling trees and other debris,[25] and insured losses from the storm have been estimated at $1-1.7 billion.[26] Transport was heavily disrupted, with long delays on railways and roads. Nearly a million homes lost electricity across Europe.[27]

Climate scientists have found that severe extratropical cyclones will be increasingly likely to hit Europe as temperatures rise. According to two separate studies,[28] damaging wind storms will become more frequent as a result of human-caused warming, and the level of damage caused by each storm will increase. Analysis of the impact of these projections for the UK suggested insurance claims from windstorms could increase by 50% in parts of the country with continued warming.[29]

Southern Africa: Cyclone Idai

Photo: Survivors of flooding receive a food distribution of corn soya blend at Kalima Camp in Chikwawa district, Malawi. Richard Nyoni / Christian Aid

Cyclone Idai made landfall in Mozambique on March 14, hitting Mozambique, Madagascar, Malawi and Zimbabwe. It brought powerful winds, heavy rain and storm surges across the region, causing particular damage in Beira, Mozambique's second-largest city.

Cyclone Idai killed 1,300[30] people, making it one of the deadliest Southern Hemisphere cyclones on record,[31] and caused damages worth over $2 billion.[32] Followed by Cyclone Kenneth just a month later, the cyclones destroyed buildings, crops, roads and power infrastructure, with Mozambique worst affected. The two cyclones affected an estimated 2.2 million people[33] and Southern Africa's grain production fell 7% below its 2018 output.[34]

Scientists have drawn a direct connection between Idai and climate change, with human greenhouse gas emissions blamed for increasing the rainfall and coastal flooding that made the storm so dangerous. According to Friedericke Otto of the World Weather Attribution group, "because of climate change the rainfall intensities are higher… also because of sea-level rise, the resulting flooding is more intense than it would be without human-induced climate change".[35] Warming ocean temperatures also mean cyclones can now form closer to the poles.[36]

Christian Aid's partner organisations were some of the first to respond to the suffering cause by Idai. Head of Humanitarian programmes in Africa, Maurice Onyango, said: "I have seen first-hand the importance of empowering local partners in delivery of humanitarian assistance. In Zimbabwe, Christian Aid partners were among the first to access and deliver assistance to the communities that were cut off by the floods in Chipinge and Buhera, reaching almost 1,400 households within the first month."

Midwest and South US: Floods

Heavy rain in the US over an extended period, combined with high temperatures which rapidly melted the snowpack, led to extensive flooding across much of the country. The flooding began in March in the Midwest, but spread to the South as flood waters flowed down the Missouri, Mississippi and Arkansas rivers.[37] The 12 months prior to June 2019 were the wettest in US history.[38]

The widespread flooding caused significant damage across much of the country. By June, 11 states had requested disaster funds from the federal government.[39] Some of the worst-hit states were major corn-producing areas and the floods caused major disruption to the 2019 harvest.[40] At least three people were killed by the floods[41] and the cost of the damage has been estimated at $12.5 billion.[42]

The floods match projections of the consequences of warming and climate scientists have linked the floods with climate change. Annual precipitation (rain, snow, sleet and hail) levels have increased in the Midwest because of climate change, leading to more flooding,[43] and extreme rainfall is becoming more common worldwide because a warmer atmosphere can hold more water.[44] Donald Wuebbels, an atmospheric scientist, said "overall, it's climate change… we expect an increase in total precipitation in the Midwest, especially in winter and spring, with more coming as larger events."[45]

Iran: Floods

Photo: Aerial shot of flooded homes in Iran. Mohammad Moheimani[46]

Heavy rain across Iran from mid-March to April led to significant flooding and landslides. In one area of northeastern Iran, most of a year's worth of rain fell in just one day.[47]

The floods hit the large majority of the country, with 26 of its 31 provinces affected,[48] and caused widespread destruction. Across the country 78 people were killed, with two million people in need of humanitarian assistance, 314 bridges destroyed[49] and 179,000 houses damaged or destroyed[50]. One million hectares of farmland were also flooded.[51] The damage amounted to $8.3 billion, according to the government.[52]

The floods reflect both a trend that scientists have linked with climate change, and projections of future weather patterns in Iran if warming continues. A 2016 study found that "the hazard and risk of the extreme flood events over Iran are rapidly and exponentially increasing", along with the frequency of droughts.[53] A separate study, published in 2019, found that Iran is likely to experience more days with heavy rain and flooding over the coming decades, as a result of climate change.[54]

India and Bangladesh: Cyclone Fani

Photo: This family chose not go to relief shelter (because it was far away) they were hiding between the space on the wall of their destroyed house and their neighbours house. Christian Aid / Nirvair Singh.

Cyclone Fani was the strongest storm to make landfall in India in over 20 years, hitting India and Bangladesh from May 2-4.[55] It had wind speeds up to 200 km/h and led to storm surges of 1.5 metre.[56]

The storm brought heavy rainfall and flooding, causing widespread damage that killed at least 89 people, mostly in Odisha.[57] More than 3.4 million people were displaced,[58] more than 10 million trees were uprooted[59] and, in Odisha alone, 140,000 hectares of crop land were damaged.[60] The damage has been estimated at $8.1 billion.[61] In November, both countries were also hit by Cyclone Matmo (also known as Bulbul), which killed at least 39 people and did damage worth at least $3.4 billion in India alone.[62]

Cyclone Fani reflected the consequences of climate change in several ways. Warmer ocean waters increased the energy available to it, allowing it to build strength; warmer air temperatures allowed it to hold and then drop more water; and sea-level rise increased the storm surge. According to Prof Michael Mann, a climate scientist, “Fani is just the latest reminder of the heightened threat that millions of people around the world face from the combination of rising seas and more intense hurricanes and typhoons. That threat will only rise

if we continue to warm the planet by burning fossil fuels and emitting carbon into the atmosphere."[63]

China: Floods

Photo: Local Chinese residents evacuate by life boat from flooded areas caused by heavy rain in Jiujiang city. Photo: humphery / Shutterstock.

From June to August, southern and eastern China saw heavy rain that led to widespread flooding. Parts of the country experienced their highest rainfall in nearly 60 years, 51% higher than usual.[64] In Fujian province, 15cm of rain fell in just three hours.[65]

The floods caused major damage across China, killing at least 300 people.[66] Estimates of the impacts include at least 4.5 million people affected,[67] 3.7 million hectares of farmland damaged,[68] 200,000 homes and other structures flooded[69] and a total economic cost of at least $12 billion.[70]

The extreme rainfall matches projections of how the climate in China could change as a result of continued warming. As temperatures rise, a greater proportion of China's rain is expected to fall in concentrated downpours, suggesting floods could become a growing risk.[71] This reflects trends seen and projected elsewhere, linked with human-caused climate change.[72]

North India: Floods

Extreme monsoon rain caused widespread flooding in parts of Northern India, as well as Bangladesh and Nepal, from June to October. The rainfall was the highest for 25 years[73] and came after a late start to the monsoon season.[74]

The long-running heavy rain brought widespread flooding and destruction across parts of India. Government figures suggested nearly 1,900 people were killed in India alone,[75] with flooding in 13 states and more than three million people forced from their homes.[76] The damages in India have been estimated at over $10 billion.[77] The floods also hit Rohingya refugees from Myanmar, in Cox's Bazar in Bangladesh.

The floods reflect trends that are being driven by climate change. In general, climate change makes extreme rainfall more common. One reason for this is that an atmosphere that is warmer can hold more water vapour. The world has so far heated about 1°C since pre-industrial times[78] and, around the world, heavy rainfall has increased.[79] In North India, rainstorms have become 50% more common and 80% longer.[80] The trend of more unpredictable and extreme rainfall in India reflects what climate scientists predict will happen due to climate change, particularly if emissions do not fall.[81] Another study found that monsoon rainfall will become more unpredictable, with variability increasing up to 50% this century if emissions continue to rise.[82]

China: Typhoon Lekima

Typhoon Lekima (named Hanna in the Philippines) hit China in August, making landfall in Zhejiang with winds of 185 km/h.[83] It was the fifth-most intense storm to hit China since 1949.[84] Rainfall reached 40cm in some areas, leading to widespread flooding,[85] while daily rainfall records fell in 19 locations.[86]

The storm caused major damage in China. It triggered floods and landslides, with transport systems shut down, two million people evacuated, 13,000 homes destroyed[87] and an estimated 2.7 million homes left without power.[88] It killed 101 people and is estimated to have cost at least $10 billion,[89] making it the second-most costly typhoon in Chinese history.[90]

Typhoons that make landfall in Asia have become more destructive in recent decades, with an increase in intensity and more category 4

or 5 storms.[91] These trends are the result of warming oceans that allows storm systems to pick up more energy. Lekima intensified extremely quickly,[92] a phenomenon also associated with increased global temperatures. Climate scientists project that the power of the strongest typhoons will grow even further as global temperatures increase.[93]

Japan: Typhoon Faxai and Typhoon Hagibis

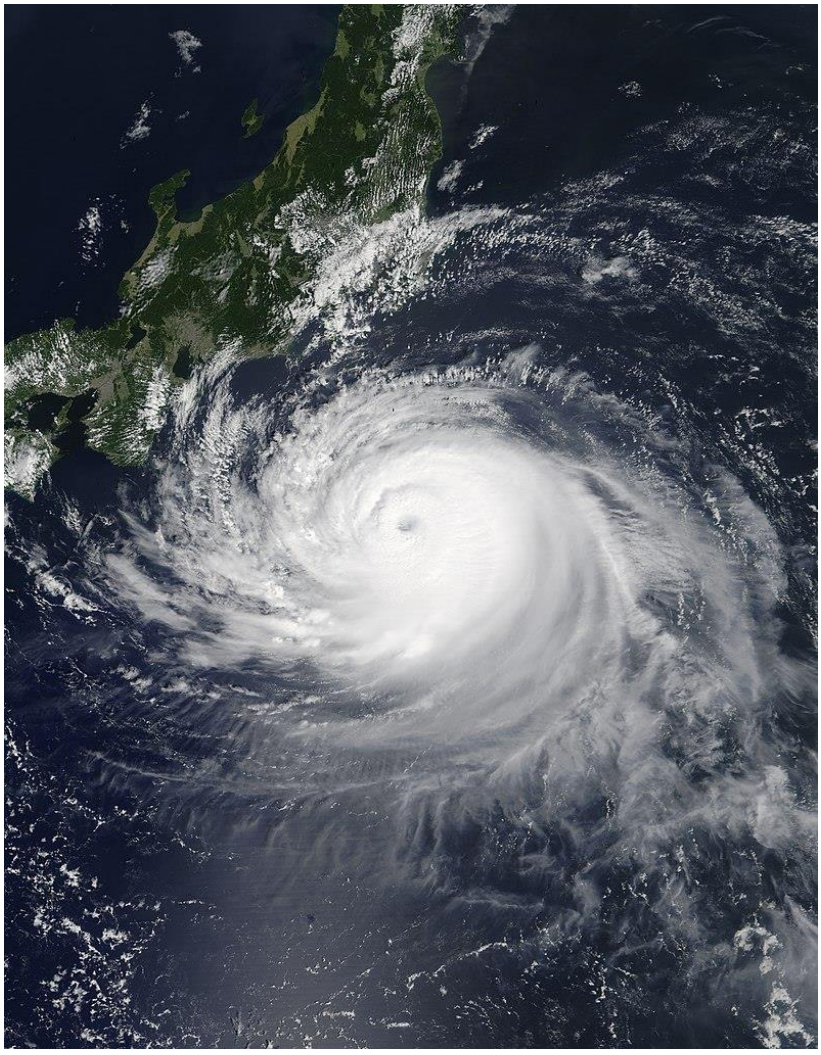

Photo: Typhoon Faxai bearing down on Japan. Nasa.

In September and October, Japan was hit by two unusually strong typhoons, Faxai, followed by Hagibis. Faxai was one of the strongest storms to hit Tokyo for decades, with winds up to 216km/h.[94] Hagibis was even stronger, with wind speeds up to 225 km/h;[95] it dropped close to one metre of rain in places within 24 hours.[96]

The storms caused widespread damage. Faxai killed at least three people,[97] left 900,000 homes without power and disrupted transport. The damage has been estimated at $5-9 billion.[98] Typhoon Hagibis was even more destructive: it is estimated to have cost at least $15 billion[99] and killed 98 people.[100] It also caused widespread disruption, including for the Rugby World Cup and Japanese Grand Prix. Other estimates suggest the costs of the storms may have been even greater.[101]

Scientists have connected these typhoons and climate change. Piers Forster, a leading climate scientist, said “Super Typhoon Hagibis bears the hallmarks of climate change”[102], while Xie Shang-Ping, another climate scientist, said: “It's no coincidence that new records have recently been set in tropical cyclone intensity. I think we are seeing the climate change effect. The warmer the ocean gets, the stronger tropical cyclones will become."[103] Among the features connecting Hagibis with climate change is its rapid intensification: it gained wind speed of 160km/h in a day, which is the fastest rate in 23 years[104] and reflects a pattern driven by climate change.[105] Powerful winds in both storms also reflect the global trend of the most intense typhoons becoming stronger,[106] a shift that is likely to continue with rising temperatures.[107]

North America: Hurricane Dorian

Hurricane Dorian was the second-strongest storm on record in the Atlantic,[108] making landfall in the Bahamas on September 1 as a Category 5 Hurricane with wind speeds up to 297 km/h and a storm surge of 5.5 to 7 metres.[109] It stalled to almost a standstill over the islands for 40 hours before moving west to pass close to the east coast of the US and reaching Canada.

The storm had a devastating impact, particularly in the Bahamas. It killed at least 673 people across its path, causing damage worth at least $11.4 billion.[110] The damage in the Bahamas has been calculated at more than a quarter of the country’s GDP. [111] Initial estimates suggested 13,000 homes were destroyed or damaged in the Bahamas,[112] with nearly 70% of homes flooded.[113] In the US the damage was estimated at $1.2 billion.[114]

Scientists have shown how Dorian was driven by climate change. According to leading climate scientists Michael Mann and Andrew Dessler, “it’s not a coincidence that Dorian was one of the strongest landfalling storms ever recorded in the Atlantic”.[115] They point to five ways that climate change made Dorian more dangerous - warmer sea waters made it stronger than it would otherwise have been; they also allowed it to intensify more quickly; warmer air allowed it to contain more moisture and so drop more rain; higher sea levels

pushed the storm surges further inland; and warming may have led to the storm moving so slowly over the Bahamas.[116]

Spain: Floods

Photo: Damaged cars in Torrevieja, Spain, due to September floods. Alex Tihonovs.

Heavy rain hit southeast Spain in September, with extreme downpours falling in a short period. In some areas of Valencia, 40cm of rain fell in 24 hours, the equivalent of a year's worth of rain in just one day, while 52cm of rain fell over five days in one location. Six weather stations set new rainfall records.[117] The most affected areas included Valencia, Alicante, Malaga and the Balearic Islands.[118]

The floods killed seven people, with an estimated cost of $2.4 billion.[119] Floodwaters caused the closure of schools and airports with states of emergency declared in several regions,[120] and over 1,100 military personnel deployed.[121]

The extremely heavy rain reflects both trends and projections for parts of Spain. Intense rainfall has increased since the mid-20th

Century in parts of southern Spain, according to a 2011 study.[122] A separate study also projected that short bursts of intense rainfall will become more common in the Iberian Peninsula as temperatures rise.[123]

Texas, US: Tropical Storm Imelda

Tropical Storm Imelda, which made landfall in Texas in September, was the fifth-wettest cyclone in US history.[124] The storm dropped one metre of rain in some areas, with nearly 16cm falling in an hour in one location.[125] In Houston, the rainfall set a new record.[126] It comes only two years after Texas was hit by the country's wettest-ever storm, Hurricane Harvey,[127] meaning parts of the state were hit by two one-in-500-year rainfall events within 25 months.[128]

The flooding caused by Imelda left cities and roads underwater, damaging homes, businesses and farmland.[129] Five people were killed by the storm,[130] and the damage has been estimated at $8 billion.[131] Imelda also affected airports and seaports, with a knock-on effect on the area's extensive freight business due to flooding and road closures.[132]

Climate change made the extreme rainfall in Storm Imelda 2.6 times more likely to happen, according to rapid analysis by World Weather Attribution.[133] It also found that climate change increased the rainfall in the storm by 18%. Heavy rainfall is a well-established consequence of climate change, as a warmer atmosphere can hold more moisture. The trend is clear in Texas, for example four of Houston's six wettest days since 1888 have occurred since 2016.[134]

California, US: Fires

Photo: The Getty Fire, Los Angeles. Morphius Film.

After a quiet start to the fire season in the west of the US, several major fires broke out in October. The largest was the Kincade Fire, which burned over 30,000 hectares before it was contained in early November. It was the largest fire in Sonoma County's history.[135] Other notable fires around the same time were the Saddleridge, Tick and Getty Fires.

At least three people were killed by the fires[136] and the economic costs have been estimated at over $25 billion,[137] meaning they may have been the most expensive disasters of 2019. As well as direct damage from the fires, millions of people were left without power as California's electricity utility, PG&E, shut down its network to avoid sparking fires. It had been found responsible for starting devastating fires in previous years due to its failure to maintain towers and wires.[138]

There is a clear connection between climate change and the increasing threat of fires in California. According to an academic study published in July, the area of California burned each year has increased fivefold since 1972 and nearly all of this increase was the consequence of high temperatures drying out forests and so creating more fuel for wildfires.[139] Of the 20 largest fires in California's recorded history, 15 have occurred since 2000.[140]

Conclusion and recommendations

This report shows that 2019 was a terrible year for climate related disasters, but it was also the year that people took to the streets in huge numbers around the globe to demand that politicians started to respond to the science on climate change with the urgency required.

The school strikes, started by Swedish teenager Greta Thunberg, swept the globe and culminated with six million people going on strike in September. Their anger will not be assuaged by the current level of inaction from governments.

A report from the Global Carbon Project in December showed that greenhouse gasses continue to rise, which will cause climate disasters to get worse.

To minimize future climate impact risks, it's vital we see global emissions starting to fall soon and rapidly. 2020 offers the biggest hope for that, as countries meet in Glasgow, Scotland for the biggest climate summit since the Paris agreement was signed in 2015.

In order to make 2020 the year the world turned the corner on climate change, we need to see countries:

- Upgrading their national climate plans (known as NDCs) that make up the Paris agreement. Under the terms of the accord countries are required to strengthen their NDCs every five years. Currently the pledges of the Paris agreement will deliver a world of more than 3C of global warming. We need to see this figure coming down by the end of the Glasgow summit.

- Nations need also to commit to a net zero emissions target, the date at which they will stop making the climate crisis worse: globally this needs to be net zero by around 2050. A number of countries have already announced these targets, but we need others to follow suit and for them to publish plans of how they will be achieved. All need to implement deeper action faster, as it is the total amount of emissions released that matters more than the date for achieving net zero.

- Rich countries also have a responsibility to mobilise the $100 billion dollars a year they promised to developing countries to help reduce their emissions and also adapt to the climate impacts. This was promised back in 2009 and is vital to help poor countries become more resilient and help them follow a low-carbon development pathway.

End notes

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