

Weekly Cat Report

December 3, 2021





Executive Summary



	Affected Region(s)		Economic Loss (USD)	Page
Flooding	Canada & United States	0	Millions	3
Earthquake	Peru	2+	Millions	6
Flooding	Australia	1	100s of millions	8
Windstorm Arwen	United Kingdom, France	3	10s of millions	10
Flooding	Vietnam	18	Millions	12
Winter Weather	China	0	Millions	12
Severe Weather	South Africa	0	Millions	12
Severe Weather	Turkey	6+	Millions	12
Flooding	Thailand	0	Unknown	12
Flooding	India	21+	Millions	13
Flooding	Indonesia	6	Unknown	13
Windstorm Christian & Daniel	Germany, Denmark	2	Millions	13

Please note that any financial loss estimate is preliminary and subject to change. These estimates are provided as an initial view of the potential financial impact from a recently completed or ongoing event based on early available assessments. Significant adjustments may inevitably occur.

Along with this report, we continue to welcome users to access current and historical natural catastrophe data and event analysis on Impact Forecasting's Catastrophe Insight website: <u>http://catastropheinsight.aon.com</u>



Flooding: Canada & United States

Overview

A stalled low-pressure system brought torrential rainfall to Atlantic Canada between November 22-25, while a series of atmospheric rivers continued to enhance ongoing and devastating flooding in parts of British Columbia in Canada and Washington in the United States through the beginning of December. The recent stretch of flooding in the Pacific Northwest added a non-negligible economic toll on top of extensive losses due to flooding since November 13.

Meteorological Recap

Pacific Northwest

The final week of November featured the arrival of a trio of atmospheric river events which impacted the Pacific Northwest beginning November 24 and intermittently continued into the start of December. Parts of southern British Columbia in Canada and northern Washington in the United States were most impacted. Multiple locations, particularly in the Lower Mainland and on Vancouver Island in British Columbia reported an additional 100 to 200 millimetres (4 to 8 inches) of rainfall during this period.



Visible satellite imagery of the atmospheric river on November 30 (21:00 UTC) Source: NOAA/RAMMB

Atmospheric rivers are phenomena which feature a narrow plume of deep moisture hundreds of miles (kilometres) long. In the Pacific, these conveyor belts of moisture originate in the sub-tropics and tropics and can produce exceptional precipitation when they interact with the rugged terrain in western North America. While atmospheric rivers are common in the fall and winter, a succession of highly impactful events have affected the Pacific Northwest in recent weeks. This resulted in historical precipitation totals and multiple episodes of life-threatening flooding – particularly as rainfall continued to fall on already saturated soils.



In the United States, the National Weather Service (NWS) indicated that Bellingham (Washington) reported its wettest month on record in November 2021 with 14.56 inches (370 millimetres) of precipitation – beating the previous record of 11.60 inches (295 millimetres) set in November 1990. Officials from Environment and Climate Change Canada (ECCC) indicated multiple stations in southern British Columbia witnessed their wettest fall on record in 2021 (September-November).

Canadian Maritimes

Flooding in the Canadian Maritimes began on November 22 and was enhanced by an elongated trough of low pressure which streamed moisture from the tropical Atlantic northward. The low meandered near Atlantic Canada for several days due to a strong blocking pattern over the North Atlantic. Parts of New Brunswick, Nova Scotia, Prince Edwards Island, and Newfoundland and Labrador were impacted.

Multiple locations recorded rainfall totals which approached and exceeded 100 to 200 millimetres (4 to 8 inches) by November 25. A record two-day rainfall total of 165.1 millimetres (6.5 inches) ending November 24 was recorded in Port aux Basques (Newfoundland), breaking the previous record set in 1982. According to data from Environment and Climate Change Canada (ECCC), a two -day rainfall total of 278.4 millimetres (11 inches) was measured in Cape Brenton, Nova Scotia near the Ingonish River through the afternoon of November 24. A low-pressure system tracking through the Gulf of St. Lawrence brought additional heavy rainfall to the region on November 30.

Event Details

Pacific Northwest

In British Columbia, ECCC issued its first ever 'red alert' for the province as flooding worsened on November 26 and heavy rainfall continued to affect highly vulnerable areas across the Lower Mainland and Fraser River Valley. The provincewide State of Emergency was extended until at least December 14 and included a gas rationing order due to the prolonged closure of the Trans Mountain pipeline. By November 29, numerous roads, including sections of Highway 3, Highway 1 and Highway 99 were closed due to flooding. In Abbotsford, a temporary 'tiger dam' was constructed across Highway 1 (Trans-Canada Highway) on November 28 to hold back floodwaters from the Sumas River. Hundreds of new evacuation orders were issued as rising water encroached upon residences - particularly in localities near Abbotsford and Hope. Thousands of residents remained displaced from the devastation flooding which occurred in mid-November.



Satellite derived precipitation: Nov 13-30, 2021 (UTC) Source: NASA/GPM Graphic: Aon, Catastrophe Insight



In **Washington**, flood sirens were sounded in the border town of Sumas as roads leading in and out of the town were inundated. Sections of the Nooksak and Sumas rivers burst their banks, leading to additional damages to infrastructures and property in parts of **Whatcom County**.

Canadian Maritimes

In **Newfoundland & Labrador**, heavy rainfall and strong winds flooded and damaged structures and homes across the region and resulted in numerous power outages between November 22-25. At least four sections of the Trans-Canada Highway (Highway 1) were washed out.

In **Nova Scotia**, no fewer than 12,000 customers lost electricity service by November 23 a majority of which were in Victoria, Antigonish and Inverness Counties. The provincial Emergency Management Office declared a State of Emergency for Victoria County on November 23 due to extensive damage to roads and infrastructure. At least a dozen roads in the county were washed out, including sections of Cabot Trial. Multiple bridges were compromised or destroyed. Several communities in the region were subsequently cut off by inundated and damaged roadways. Rising waters damaged vehicles and stranded motorist, while numerous residences reported basement flooding and failing sump pumps. Local officials indicated repairs were likely to take weeks to months. Ferry services between Cape Brenton and Newfoundland were suspended.



Washed our roadway in Nova Scotia Source: Nova Scotia Government

Financial Loss

Extensive flooding in southern British Columbia in Canada and northern Washington in the United States over the past week added a non-negligible economic loss to what has already been a costly month for the peril. It was anticipated that it will be weeks or months until a complete view of the impacts is realized, however since mid-November damage to property, infrastructure, and direct business interruption were likely to result in an economic toll reaching into the billions (USD).



Earthquake: Peru

Overview

A magnitude-7.5 earthquake struck Peru's Loreto Region on November 28. Shaking was felt widely throughout northern Peru and as far away as Ecuador and Colombia. Nearly 2,600 homes were damaged or destroyed, along with significant impacts to transportation and infrastructure. As of this writing, two deaths and dozens of injuries were directly contributed to the earthquake. Total economic losses were expected to be in the millions (USD).

Seismiological Recap

A strong United States Geological Survey (USGS) magnitude-7.5 (M7.5) earthquake struck in a remote region of Peru's Loreto Province at 5:52 AM local time (10:52 UTC) on November 28, at an intermediate depth of 112 kilometers (70 miles). No fewer than 1.25 million people experienced Strong (intensity: VI) or greater shaking on the Modified Mercalli Intensity (MMI) scale during the event. Shaking was widely observed throughout northern Peru and was felt as far away as Lima, and in neighboring regions of Ecuador and Colombia. Several hours earlier, a separate magnitude-5.1 (M5.1) earthquake struck approximately 28 kilometers (17 miles) off the coast of Peru, near the capital city of Lima. Earthquakes are common in Peru, which is located within the Pacific Ring of Fire – an area known for extensive and frequent seismic activity.



According to the USGS, the M7.5 northern Peru earthquake occurred as the result of normal faulting at an intermediate depth, approximately 110 kilometers (70 miles) beneath the Earth's surface within the subducted lithosphere of the Nazca plate. This earthquake occurred in a segment of the subducted plate that has produced frequent earthquakes with focal depths of 100 to 150 kilometers (62 to 93 miles).



Event Details

In Peru, notable damge was reported in parts of the Amazonas, Loreto, San Martín, Lambayeque, La Libertad, Cajamarca, Ancash, Piura, and Lima Regions. A State of Emergency was declared in no less than four regions due to extensive damages to infrasturture and property. As of this writing, at least two fatatlies and dozens of injuries were confirmed. Preliminary damage surveys from the the National Civil Defense Institute (Indeci), indicated no fewer 223 homes were destroyed, 772 uninhabitable, and 1,597 damaged. In addition, at least 25 schools were impacted and no less than 32 health establishments incured damage.



Damage to Peru's Paita-Yurimaguas highway Source: Peru Ministry of Transport

Multiple roadways in the Amazonas and Cajamarca regions were blocked by fallen stones and debris. Impacts included the collpase of a 14-meter (46-foot) tower in a protected four-century-old church in northern Peru.

In **Equador**, damages to roadways and buildings, which included collapsed masonary and concrete walls were reported in parts of the Loja, Zamora-Chinchipe, and Azuay Provinces. In several locatios, rockslides and landslides blocked roadways and disrupted transportation.

Financial Loss

The United States Geological Survey (USGS) estimated the highest probability of economic losses due to the M7.5 earthquake was in the category of USD10 to 100 million, based on the PAGER methodology.



Flooding: Australia

Overview

November 2021 was the wettest November for Australia since records began in 1900. Established La Niña conditions coupled with a combination of an upper-level trough and surface easterly trough contributed to the heavy thunderstorms over much of eastern and southern Australia. New South Wales and Queensland were particularly hit by the severe weather. Two lives were lost with thousands of people evacuated or displaced. Total economic losses were expected to be in the hundreds of millions (AUD).

Meteorological Recap

Eastern Australia continued to be battered by heavy thunderstorms over the week as a high pressure in the Tasman Sea directed moist onshore flow towards the low surface easterly troughs near Queensland between November 28 and December 1. Accumulated rainfall in excess of 100 millimetres (4 inches) were recorded mainly in central and eastern Queensland, and in central and north-eastern New South Wales. Together with the first three quarters rainfall in November, New South Wales had its wettest November. Some stations in Queensland also broke rainfall records this year, with the Samuel Hill Aerodrome in Queensland registering 627 millimetres (24.7 inches) monthly rainfall. More than one third of Queensland recorded more than the 97th percentile rainfall by November 30.



Left: Two low pressure troughs (in blue dashed lines) over Queensland and eastern Australia. Right: Dense cumulonimbus clouds producing intense rainfall observed over eastern Australia on November 29. Source: BOM, NOAA/RAMMB

Event Details

In **New South Wales,** the flooding of the Lachlan river and Namoi river has affected towns including Eurowra, Forbes, Gunnedah and Wee Wah. Large swathes of cropland around the region, from Jemalong to Mullaley, were submerged in floodwaters. Elsewhere, Sydney's biggest dam, the Warragamba Dam, breached on the night of November 26, causing moderate flooding downstream.



Evacuation orders were also issued for around 2,000 residents along the Hunter River as the river peaked at 12.7 meters (41.7 feet) on November 28. Large swathes of farmland were inundated.



In **Queensland**, around 1,000 residents in Ingleswood were evacuated on the night of November 30 as the Macintyre Brook peaked at 11.2 meters (36.7 feet), breaking previous records. One victim was killed in floodwaters a day after, taking the total death toll to two since November 26.



Flooding near Inglewood Source: QLD Fire & Emergency

Percentage area in New South Wales and Queensland above 97th percentile rainfall. Source: BOM

Financial Loss

At the time of this writing, it was difficult to assess the actual extent of the flooding due to the ongoing nature of the event. Swaths of cropland in some areas were expected to remain submerged as the wet weather continues. The New South Wales' Department of Primary Industries tentatively estimated that the event will likely result in significant agricultural damage, although additional damage assessments in the coming days and weeks will determine whether these losses will eventually materialize. Additionally, insurance claims from the Insurance Council of Australia (ICAUS) were yet to be made available at the time of writing.



Windstorm Arwen: United Kingdom, France

Overview

Arwen, the first windstorm event of the current season to be jointly named by the UK Met Office, Met Éireann and the Dutch KNMI, primarily affected parts of the United Kingdom with strong winds, and brought wintry conditions and disruption on November 26-27. There were nearly one million power outages in the country. Total economic and insured losses from the event were expected to reach into the tens of millions EUR, notably lower than initially feared from forecasts.

Meteorological Recap

Windstorm Arwen (named Andreas by the FU Berlin) originated north of Iceland over the Arctic Ocean on November 25, to the north of a powerful and extensive high-pressure area that dominated over the northern Atlantic at the time. Due to this overall synoptic setting, the storm took a relatively unusual, nearly meridional (north to south) track towards the British Isles, while rapidly deepening to a minimum pressure of 980 millibars. Sharp pressure gradient over Scotland, northern England and Wales resulted in significant wind gust readings and extremely high waves in the North Sea. Prior to the storm's impact, the UK Met Office issued a rare, red weather warning for northeastern coastal areas and an amber warning for much of the country. Although forecasting models initially suggested potentially significant wind-related impacts, severe wind gusts were largely limited to exposed coastal and montane locations. In lowlands, winds peaked in Brizzle Wood in Northumberland with 98 mph (158 kph).





Event Details

The storm failed to produce severe winds inland, as expected from various forecasting models; and resulting property damage was relatively minor compared to historical windstorm events. At the same time, there was a significant number of power outages, which reached approximately **1 million households** and energy companies noted significant damage on the power grid in some areas. The Energy Networks Association noted that approximately 155,000 homes were without power in the afternoon of November 29 and 45,000 homes still suffered from outages on November 30, three days after the storm's impact.

Perhaps the worst affected areas were around Aberdeenshire, Angus, Perthshire and the Moray coast in Scotland, and also in the Northeast region of England. Additional property damage was also concentrated around Liverpool and parts of Wales. Elsewhere, minor damage occurred in parts of Ireland and on the north western coast of France, as the storm progressed further south.

Financial Loss

Arwen became the first notable windstorm of the season in the United Kingdom and was likely to generate a number of claims for local insurers from property damage and business interruption due to disruptions and power outages, although the eventual impact will likely be lower than initially feared from forecast data and will likely reach into the tens of millions (GBP).



Natural Catastrophes: In Brief

Flooding (Vietnam)

A monsoon surge coupled with an equatorial eddy in the South China Sea contributed to heavy rainfall over central Vietnam between November 27-30, triggering notable flooding and landslides in the provinces Quang Nam, Quang Ngai, Binh Dinh, Phu Yen and Kon Tum. Some places recorded total rainfall of more than 800mm. According to the local disaster management agency, at least 18 people were killed, 2,880 people were displaced, and more than 60,000 homes were inundated with floodwaters. More than 640 hectares of rice fields and 400 hectares of croplands were destroyed. In Bin Dinh alone, economic losses were estimated at minimally VND124 billion (USD5.5 million).

Winter Weather (China)

Heavy snowfall affected many parts of northern China since November 26. In Xinjiang, up to 10 centimeters (4 inches) of snow was reported and multiple flights had been being delayed or cancelled. Strong gale-force winds swept across Shandong and Henan on November 30, causing some infrastructural damage. Temperature across the northern provinces is expected to decrease further in the coming days, and snow depth between 30 and 50 centimeters (12 and 20 inches) are expected.

Severe Weather (South Africa)

A cut-off low pressure system generated flooding rainfall and severe weather in parts of South Africa's North West Province on November 25. In Klerksdorp, hailstones approaching the size of golf balls caused notable damage to homes and businesses. Concurrently, torrential rainfall inundated roadways, trapped motorists, and flooded multiple structures.

Severe Weather (Turkey)

A significant southwesterly windstorm which impacted Turkey on November 29-30 resulted in no fewer than 6 fatalities and 53 injuries. Localities in the Aegean and Marmara Regions, including Istanbul, were particularly impacted. At the peak, wind speeds approached and exceeded 110 to 120 kph (68 to 74 mph). The strong winds knocked down parts of buildings - including concrete slabs, tore roofs from homes and businesses, uprooted trees, and damaged vehicles. Turkish airlines reported notable disruption to air traffic. Total economic losses were expected to reach well into the millions (USD).

Flooding (Thailand)

A developing low pressure system over the Andaman Sea and strengthening of northeasterly winds from the high-pressure system in China have led to strong convergence of winds over southern Thailand between November 29 and December 1. Flooding was recorded in at least 4 provinces - Chumphon, Surat Thani, Nakhon Si Thammarat, and Songkla. More than 21,000 households were affected as residents evacuated to higher grounds. No injuries or deaths were reported. Southern Thailand has experienced continuous rainy weather since November 23 as the monsoon trough lies just to its south.



Flooding (India)

Rainy conditions persist over south India for the first half of the week. The floods in Tamil Nadu, Puducherry, and Andhra Pradesh continued and claimed lives of at least 21 people and damaged more than 7,190 buildings between November 25 and 30.

Flooding (Indonesia)

Shower activities prevailed over Indonesia leading to continuing flooding across different provinces since November 19. Severe weather is expected to continue particularly over West Java under the influence of tropical cyclone Teratai. One death and two injuries were reported over the area due to landslide. Similarly, another five deaths and five injuries were reported from flood-induced landslides in South Kalimantan and South Sulawesi between 29 November and 1 December. The floods in recent days had damaged more than 2,700 houses and displaced more than 200 people.

Windstorm Christian & Daniel (Germany, Denmark)

Two low pressure systems, named Christian and Daniel by the FU Berlin, swept through northern Germany and Denmark in quick succession on November 30 and December 1, causing relatively minor property damage and disruption. Additionally, around 500 incidents also occurred in Bayern. At least two people were killed in storm-related car accidents.







-10 -3 10 18 -32 -24 -18 -14 -6 -1 0 1 3 6 14 24 32 Source: Climate Reanalyzer, Climate Change Institute, University of Maine, USA





Global Precipitation Anomaly Forecast

Source: Climate Reanalyzer, Climate Change Institute, University of Maine, USA



Weekly Sea Surface Temperature (SST) Maps (°C)



NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 30 Nov 2021



El Niño-Southern Oscillation (ENSO)

Overview

La Niña conditions have returned in the Central and Eastern Pacific Ocean, and NOAA has issued a "La Niña Advisory". NOAA cites a 90 percent chance of La Niña conditions persisting through the Northern Hemisphere winter months, and a 50 percent chance of lasting through the spring (March to May). The agency also anticipates a moderate strength La Niña at its peak before weakening and likely transitioning back to ENSO-neutral conditions by the Northern Hemisphere Spring of 2022.



Probabilistic ENSO Model Projections: November 2021

El Niño: Warm phase of an ENSO cycle. Sea surface temperatures of +0.5°C occur across the east-central equatorial Pacific.

La Niña: Cool phase of an ENSO cycle. Sea surface temperatures of -0.5°C occur across the east-central equatorial Pacific.

Neutral: A period when neither El Niño nor La Niña conditions are present.

El Niño (La Niña) is a phenomenon in the equatorial Pacific Ocean characterized by a five consecutive 3-month running mean of sea surface temperature (SST) anomalies in the Niño 3.4 region that is above the threshold of +0.5 °C (-0.5 °C). This is known as the Oceanic Niño Index (ONI).



Global Tropics Outlook



Source: Climate Prediction Center (NOAA)



Current Tropical Cyclone Activity



∮ Tropical Depression ∮ Tropical Storm ∮ Category 1 ∮ Category 2 ∮ Category 3 ∮ Category 4 ∮ Category 5

Storm Name	Location	Winds	Location from Nearest Land Area
TY Nyatoh	18.2N, 136.7E	115 mph	625 miles (1010 kilometers) NW from Agana
TD Teratai	9.5S, 100.4E	30 mph	410 miles (665 kilometers) S from Bengkulu

* TD: Tropical Depression, TS: Tropical Storm, HU: Hurricane, TY: Typhoon, CY: Cyclone

** N: North, S: South, E: East, W: West, NW: Northwest, NE: Northeast, SE: Southeast, SW: Southwest

Source: National Hurricane Center, Joint Typhoon Warning Center, Central Pacific Hurricane Center (NOAA)



Global Earthquake Activity (≥M4.0): Nov 26 – Dec 3



Magnitude · 4.0 - 4.9 • 5.0 - 5.9 ● 6.0 - 6.9 ● ≥ 7.0 — Tectonic boundary

Date (UTC)	Location	Magnitude	Epicenter
11/28/2021	4.49S, 76.85W	7.5	42 kilometers (26 miles) NNW of Barranca, Peru
11/29/2021	31.18N, 142.49E	6.3	Izu Islands, Japan region
11/29/2021	31.10N, 142.80E	6.6	Izu Islands, Japan region
11/30/2021	3.52S, 151.18E	6.3	SSE of Kavieng, Papua New Guinea

Source: United States Geological Survey



U.S. Hazard Outlook



- Moisture associated with an approaching Pacific system will generate heavy precipitation in the Pacific Northwest before spreading into the Rockies between December 6-7. Additional heavy precipitation is expected in northern Washington by December 8.
- A frontal boundary associated with a low-pressure system traversing the Great Lakes and Ohio Valley is expected to enhance heavy rainfall across the Southeast on December 8.
- Severe drought conditions remain across vast regions of the West and Northern Tier.

Source: Weather Prediction Center (NOAA)





U.S. Wildfire: Significant Fire Risk Outlook & Activity

Annual YTD Wildfire Comparison: November 26*

Year	Number of Fires	Acres Burned	Acres Burned Per Fire
2017	54,919	9,155,287	166.71
2018	52,410	8,545,939	163.06
2019	47,063	4,614,913	98.06
2020	52,113	8,889,297	170.58
2021	52,729	6,631,430	125.76
10-Year Average (2011-2020)	53,675	7,122,253	132.69

Top 5 Most Acres Burned by State: November 30

State	Number of Fires	Acres Burned	Acres Burned Per Fire
California	9,087	2,389,406	262.94
Montana	2,506	721,607	287.95
Oregon	1,672	683,474	408.78
Arizona	1,711	532,196	311.04
Washington	1,772	447,899	253.76

*Most recent NIFC update

Source: National Interagency Fire Center





U.S. Current Riverine Flood Risk

 $A \ge 99^{th}$ percentile indicates that estimated streamflow is greater than the 99^{th} percentile for all days of the year. This methodology also applies for the other two categories. A steam in a state of severe drought has 7-day average streamflow of less than or equal to the 5^{th} percentile for this day of the year. Moderate drought indicates that estimated 7-day streamflow is between the 6^{th} and 9^{th} percentile for this day of the year and 'below normal' state is between 10^{th} and 24^{th} percentile.

Top 5 Rivers / Creeks: Highest Percentile for Water Height

Location	Current Stage (ft)	Percentile
Williams Fork near Parshall, Colorado	2.31	99.05
Stehekin River at Stehekin, Washington	22.48	99.00
Moyie River at Eastport, Idaho	6.87	98.92
Similkameen River near Nighthawk, Washington	10.01	98.92
Eagle River at Red Cliff, Colorado	8.93	98.91

Source: United States Geological Survey



Source Information

Flooding: Canada and United States

Environment and Climate Change Canada (ECCC) U.S. National Weather Service CatlQ Environment Canada issues 'red alert' for B.C. as more storms approach, *CTV News Vancouver* Could take 'days or weeks' to fix flood-damaged parts of Cape Breton, *CBC* B.C. flood update: Rain warning still in effect, *Vancouver Sun*

Earthquake: Peru

National Civil Defense Institute (Indeci) United States Geological Survey (USGS) Earthquake in the Amazon of 7.5, *Infobae* Earthquake in Peru, *Telemundo*

Flooding: Australia

NSW floods worsen with major flood warnings, rescues and pleas for people to play it safe, ABC News Bureau of Meteorology

Windstorm Arwen: United Kingdom, France

Thousands of homes still without power after some of the 'worst' disruption in 20 years, *Sky News* UK Met Office Deutscher Wetterdienst

Natural Catastrophes: In Brief

Vietnam Disaster Management Authority (VDMA) Serious hailstorm hits Klerksdorp, *The South African* South African Weather Service (SAWS) National Disaster Management Authority (NDMA) NSW floods: Sydney's Warragamba Dam spills as warnings issued in Upper Hunter, *The Guardian* Body found in Queensland floodwaters following police search, *9News* Extreme weather takes hold across Turkey after deadly storms, *Daily Sabah* Storm with high winds pounds Istanbul; 4 dead, several hurt, *Associated Press* Storm lows at the beginning of winter: Several dead and numerous injured in accidents. *Wetter.de* Department of Disaster Prevention and Mitigation, Thailand



Contacts

Steve Bowen Managing Director Head of Catastrophe Insight steven.bowen@aon.com

Brian Kerschner Senior Catastrophe Analyst brian.kerschner@aon.com Michal Lörinc Senior Catastrophe Analyst michal.lorinc@aon.com



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