= Cyclone Hudah =

Cyclone Hudah was a strong and destructive tropical cyclone that affected Southeast Africa in April 2000 . It was the last in a series of three cyclones that impacted Madagascar during the year . Hudah first developed as a disturbance embedded within the monsoon trough on March 22 , within the Australian region cyclone basin . Moving westward as the result of a strong subtropical ridge to its south , the storm quickly intensified , and reached Category 2 cyclone intensity on March 25 before entering the Southwest Indian cyclone basin . For various reasons that remain unknown , the cyclone was only designated a name by the time it had crossed into the area of responsibility of the Regional Specialized Meteorological Center in Réunion . Nonetheless , Météo @-@ France (MFR) assigned the name Hudah to the cyclone . An eye formed , and the storm intensified into a tropical cyclone on March 27 well to the southeast of Diego Garcia . On April 1 , the MFR upgraded it to a very intense tropical cyclone , estimating peak 10 minute winds of 225 km / h (140 mph) . By contrast , the Joint Typhoon Warning Center (JTWC) estimated 1 minute winds of 235 km / h (145 mph) . Cyclone Hudah maintained peak winds until making landfall just southeast of Antalaha , Madagascar on April 2 . It weakened greatly over land , but re @-@ attained tropical cyclone status on April 5 after moving over the Mozambique Channel . Hudah reached 10 minute winds of 160 km / h (100 mph) by the time it made landfall on Mozambique near Pebane , Mozambique , on April 8 , and dissipated by the next day .

While in the vicinity , Hudah brought moderate winds to Rodrigues , St. Brandon , and Tromelin Island . The cyclone affected the same parts of Madagascar that were previously impacted by cyclones Eline and Gloria . Waves reached at least 8 m (26 ft) in height along the coast . The storm was considered the worst to affect the Antalaha region in 20 years , where 90 % of homes were destroyed . It was estimated that the storm left at least 100 @,@ 000 people homeless in Madagascar , and there were 111 deaths . In Mozambique , damage was much less than expected , and the storm affected areas farther north in the country than where Eline struck . Heavy rainfall occurred along the coast , but was insufficient to cause river flooding . Strong winds damaged roofs and downed trees , mostly around Pebane , and the storm killed three people .

= = Meteorological history = =

At 1800 UTC on March 22 , the Joint Typhoon Warning Center (JTWC) began monitoring an area of disturbed weather in the central Indian Ocean , approximately 685 km (425 mi) southeast of Christmas Island . The system was embedded mostly in the monsoon trough , surrounded by favorable environmental conditions , which prompted the JTWC to issue a Tropical Cyclone Formation Alert at 0030 UTC on March 24 . Convection increased as vertical wind shear decreased , and the system developed a curved band pattern . Throughout the day , the storm showed signs of potential rapid intensification , due to its quick organization . The Bureau of Meteorology 's Perth Tropical Cyclone Warning Center (Perth TCWC) noted the system as a tropical low at 1000 UTC on March 24 , and the JTWC issued its first warning two hours later . However , for reasons which remain unclear , the Bureau of Meteorology did not extensively monitor the system .

Initially , the storm moved westward under the influence of a strong subtropical ridge to the south . Despite having reached tropical cyclone intensity according to Perth TCWC , it was not assigned a name . Once the storm crossed 90 ° E on March 25 , the Météo @-@ France 's La Réunion Regional Specialized Meteorological Center (MFR) began tracking the system as a moderate tropical storm , giving it the name Hudah . Gradually intensifying , Hudah developed an eye with an eyewall primarily in the northern semicircle , indicated by a Tropical Rainfall Measuring Mission (TRMM) pass over the system . On March 26 , Hudah ceased strengthening as cloud tops warmed and the eye became no longer evident . Atmospheric divergence remained favorable , and Hudah eventually restrengthened , attaining tropical cyclone intensity at 0000 UTC on March 27 , while located approximately 1 @,@ 200 km (750 mi) southeast of Diego Garcia . This period of strengthening was short @-@ lived , likely due to dry air . The cloud structure fluctuated as well , with a poorly @-@ defined eye appearing at times on satellite imagery . Hudah was able to attain an

initial peak intensity of 155 km / h (95 mph) at 0600 UTC on March 29 according to the MFR , shortly after passing 1010 km (630 mi) south of Diego Garcia . An anticyclone that had been over Hudah showed signs of weakening later that day , spurring an increase in wind shear and causing weakening . This period of weakening was short @-@ lived , and Hudah resumed its former strengthening trend by the night of March 30 as shear decreased and convective organization and areal extent increased . After passing 275 km (170 mi) north of Rodrigues Island , Hudah attained intense tropical cyclone status by 1200 UTC on March 31 . Satellite imagery indicated a large , cloud @-@ free eye , indicative of a strong tropical cyclone .

On April 1 , Hudah continued intensifying while approaching eastern Madagascar , and by 0600 UTC that day , the MFR upgraded the storm to very intense tropical cyclone intensity ? the highest rating on the agency 's cyclone classification scale . Shortly after , at 1200 UTC , the storm was analyzed to have reached its peak intensity with maximum sustained winds of 225 km / h (140 mph) and a minimum barometric pressure of 905 mbar (hPa ; 26 @.@ 73 inHg) , ranking Hudah among some of the strongest tropical cyclones ever recorded in the Southwest Indian Ocean . The JTWC listed a similar intensity for the storm , with winds of 235 km / h (145 mph) , though these winds were for 1 @-@ minute sustained winds instead of 10 @-@ minute sustained winds . This intensity was later analyzed to have been very near the theoretical maximum for tropical cyclones in the environmental conditions Hudah was in . At the time , TRMM imagery indicated that the storm featured two concentric eyewalls . Cyclone Hudah maintained peak intensity up until it made its first landfall approximately 28 km (17 mi) southeast of Antalaha , Madagascar at 1730 UTC on April 2 . Hudah substantially weakened as it traversed the mountainous terrain of northern Madagascar , and was downgraded to tropical depression status by the time it entered the Mozambique Channel at 1200 UTC on March 3 .

Despite losing much of its convection over land , Hudah maintained a well @-@ organized cloud structure once in the Mozambique Channel on April 3 . As a result of moving back over warm waters , the system began to re @-@ intensify , and attained moderate tropical storm intensity at 0000 UTC on April 4 . Meanwhile , a large central dense overcast developed , and Hudah began to track west @-@ southwestward as opposed to its previous westward trajectory . Despite computer forecast models suggesting that Hudah would continue westward , the storm instead turn to a southward drift , giving it time to strengthen in the Mozambique Channel . This was the result of a mid @-@ latitude trough weakening the nearby subtropical ridge . By 1800 UTC on April 5 , Hudah was upgraded back to tropical cyclone intensity . A banding eye began to appear on satellite imagery , though it remained generally unstable , and a large banding feature formed over the western half of Hudah . The nearby trough later weakened in intensity , causing the tropical cyclone to move north @-@ northwestward towards the Mozambique coast on April 7 . It was at this time that Hudah reached a tertiary peak intensity with winds of 160 km / h (100 mph) . The tropical cyclone accelerated northwards throughout the day , eventually making its final landfall near Pebane , Mozambique at 0600 UTC on April 8 as a slightly weaker storm . Once inland , Hudah rapidly weakened , and was no longer tracked by the MFR by 0000 UTC on April 9 . The JTWC issued its final warning on the system six hours later , as the remnants of Hudah moved through northeastern Mozambique , producing spotty convection .

= = Preparations , impact , and aftermath = =

= = = Rodrigues Island , Saint Brandon , and Tromelin Island = = =

Passing north of Rodrigues Island on March 30 , Hudah produced moderate winds , though effects to infrastructure and crops on the island were minimal . During the night of the following day , Hudah passed near the Saint Brandon archipelago . A weather station on the island maintained by the Maritius Meteorological Services reported a minimum pressure of roughly 996 mbar (hPa ; 29 @.@ 42 inHg) and a maximum sustained wind measurement of 70 km / h (45 mph) . During the night of April 1 , the cyclone passed approximately 35 km (20 mi) south of Tromelin Island , producing

strong winds . A Météo @-@ France station on the isle recorded sustained winds of 125 km / h (80 mph) and a gust of 180 km / h (110 mph) . A minimum pressure of 972 mbar (hPa ; 28 @.@ 71 inHg) was also recorded . Due to a lack of sustainable infrastructure on the latter two islands , damage was minimal .

= = = Madagascar = = =

As the cyclone moved closer to Madagascar on April 2 , Radio Madagascar called for residents of Toamasina to take precautionary measures . At the time , forecasts predicted that Hudah would make landfall in northern Madagascar later that day .

Upon making landfall , Hudah impacted the same regions that were affected earlier in the year by Cyclone Leon ? Eline and Severe Tropical Storm Gloria . The cyclone produced waves at least 8 m (26 ft) in height , which impacted the coast . Across affected areas , coffee plantations , fruit trees , and rice crops in low @-@ lying areas were damaged . Food warehouses in the northeastern areas of Madagascar were destroyed . In the small town of Antalaha , up to 90 percent of all homes were destroyed , and two people were killed . The city 's water and electrical systems were cut off . Only eight homes remained intact along a stretch of road leading from the town to the local airstrip . As a result , only concrete structures remained standing , while those made of iron sheeting or wood materials were destroyed . Thus , the road was covered in debris , slightly delaying airlift operations to the region in the storm 's aftermath . Nearby vanilla fields were also severely damaged .

Due to the effects of Hudah , the cyclone was considered the worst to strike the Antalaha region in 20 years . The towns of Maroantsetra and Andapa were also hit hard , with 60 ? 70 percent of homes in the latter destroyed . Maroantsetra , a coastal town , was flooded by the storm surge , and as a result seven people died . The commune of Mananara Nord was completely flooded by the storm . Other isolated villages could not be reached via road or telecommunications due to the storm . One of these cities was Sambava , which suffered from a lack of available telephone links since late on April 2 . One person died in Sambava . A resort in the town of Cap Est was flattened . Initial estimates indicated that Hudah caused at least 100 @,@ 000 people to become homeless .

= = = Mozambique = = =

While Hudah was located in the Mozambique Channel , the cyclone was expected to cause flood conditions in the Mozambican provinces of Nampula , Cabo Delgado , and potentially Zambezia . Even prior to Hudah , Mozambique was already facing a widespread flood and resultant humanitarian crisis ; conditions which were further exacerbated by three tropical cyclones which impacted the country within the previous four months . The Instituto Nacional de Gestão de Calamidades (INGC) warned residents in potentially affected areas to take precautionary measures and secure fishing boats . The South African National Defense Force (SANDF) maintained 50 soldiers and other military personnel and a number of aircraft to monitor the ongoing floods in Mozambique and potential impacts from Hudah . An Australian contingency held operations for a hospital and water purification plant in Chibuto to assist potentially affected populations . Multiple other relief organizations began to supply Mozambique with relief supplies due to the threat of the impending storm . The UN World Food Programme (WFP) sent 1 @,@ 000 tonnes (1 @,@ 100 short tons) of food to Nampula Province and 500 tonnes (550 short tons) of food to Quelimane Province . The WFP also placed relief aircraft on standby . The Mozambican Ministry of Health sent 30 tents and 10 rolls of plastic to Cabo Delgado , Nampula , and Zambezia provinces . The United States Agency for International Development (USAID) dispatched a group of 12 @-@ member search and rescue team to Maputo in order to train local relief crews .

Just 46 days after Cyclone Eline 's devastating landfall in Mozambique , Hudah brought further flooding to the nation , although farther north than Eline . Before the storm moved ashore , Hudah dropped 80 mm (3 @.@ 1 in) of rainfall over 24 hours in Quelimane along the coast . Despite the heavy rainfall from Hudah , there was not a repeat of the deadly river flooding that followed Eline . The Licungo River rose due to the rains , but the water levels did not rise above the banks . Some

roads near Pebane were flooded , although not deep enough to disrupt travel . The storm 's strong winds knocked over many trees in its path , mostly in a 10 km (6 mi) radius around Pebane , blocking the main road into the city . The winds also damaged about 10 % of the roofs in Pebane , as well as four schools ; about 160 boarding school children had to be sheltered elsewhere due to damage . A damaged wall fell and injured four people . Outside of the city , the winds damaged the manioc crop , and about 60 ha (150 acres) of crop fields were destroyed . The cyclone destroyed around 100 huts in Pebane and nearby Moma , leaving 300 people homeless . There were three deaths in Mozambique related to Hudah ; strong winds knocked a coconut off a tree , killing a child . Overall damage was less than anticipated .

= = Aftermath = =

After the storm , the United Nations Disaster Management Team (UNDMT) assisted the Conseil National de Secours (CNS) in Madagascar with surveying areas affected by Hudah . The UNDMT also appealed for relief materials for at least 50 @,@ 000 ? 100 @,@ 000 people . Two light helicopters in Mahajanga and Sambava were dispatched to support two planes in providing assistance to affected populations . Médecins Sans Frontières (MSF) also provided food and medical aid . The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) served as a channel for donations to relief efforts , and also made available US $ 50 @,@ 000 from the United Kingdom 's Department for International Development (DFID) for immediate relief purposes . Although the Red Cross had appealed for relief materials for Madagascar before Hudah had hit , these materials would arrive in April , assisting residents affected by Hudah and serving as a backbone for a long @-@ term rehabilitation plan . Due to inclement weather , surveys by humanitarian organizations on the island were not conducted until April 4 , a full two days after Hudah first struck the island . A Malagasy aircraft delived 6 tonnes (6 @.@ 6 metric tons) of rice along with packages of other various supplies to affected regions . The CNS planned to deliver 10 tonnes (11 short tons) of rice to Antalaha . Although initial reports indicated that 24 people were killed due to Hudah , later reports raised the death toll in Madagascar to 111 .

In Mozambique , the country 's National Institute of Disaster Management distributed 10 tons of food products and plastic housing tents to Pebane , where damage was worst . Officials determined that the storm damage could be repaired by local governments .