

## = Tropical Storm Domoina =

Severe Tropical Storm Domoina in 1984 caused 100 year floods in South Africa and record rainfall in Swaziland . The fourth named storm of the season , Domoina developed on January 16 off the northeast coast of Madagascar . With a ridge to the north , the storm tracked generally westward and later southwestward . On January 21 , Domoina struck eastern Madagascar , the third storm in six weeks to affect the nation ; collectively , the storms caused 42 deaths and \$ 25 million in damage ( 1984 USD ) . After crossing the country , Domoina strengthened in the Mozambique Channel to peak 10 minute sustained winds of 95 km / h ( 60 mph ) . On January 28 , the storm made landfall in southern Mozambique , and slowly weakened over land . Domoina crossed into Swaziland and later eastern South Africa before dissipating on February 2 .

In Mozambique , Domoina dropped heavy rainfall in the capital Maputo that accounted for 40 % of the annual total . Floods in the country destroyed over 50 small dams and left widespread crop damage just before the summer harvest . Later , the rains caused the worst flooding in over 20 years in Swaziland , which damaged or destroyed more than 100 bridges . Disrupted transport left areas isolated for several days . In South Africa , rainfall peaked at 950 mm ( 37 in ) , which flooded 29 river basins , notably the Pongola River which altered its course after the storm . Flooding caused the Pongolapoort Dam to reach 87 % of its capacity ; when waters were released to maintain the structural integrity , additional flooding occurred in Mozambique , forcing thousands to evacuate . Throughout the region , Domoina caused widespread flooding that damaged houses , roads , and crops , leaving about \$ 199 million in damage . There were 242 deaths in southeastern Africa .

## = Meteorological history =

In January and February 1984 , conditions were favorable for tropical cyclogenesis in the southwest Indian Ocean , including warmer than normal sea surface temperatures and an active monsoon trough . On January 16 , a spiral area of convection persisted off the northeast coast of Madagascar , associated with the intertropical convergence zone . That day , it organized enough to warrant a satellite @-@ based Dvorak rating of T2.5 , prompting the Réunion Meteorological Service to name it Domoina . Around that time , Météo @-@ France ( MFR ) estimated winds of about 65 km / h ( 40 mph ) . Domoina initially tracked to the west @-@ northwest , passing near Tromelin Island on January 18 . Around that time , the storm had begun moving to the southwest , and MFR estimated that it weakened to tropical depression status . On January 19 , the Joint Typhoon Warning Center ( JTWC ) began warning on Domoina , designating it Tropical Cyclone 14S . The same day , MFR again upgraded Domoina into a moderate tropical storm . On January 21 , the storm made landfall just south of Tamatave in southeastern Madagascar .

While crossing Madagascar on a westward trajectory , Domoina weakened ; JTWC estimated the winds decreased to 55 km / h ( 35 mph ) , after earlier estimating winds of 95 km / h ( 60 mph ) before landfall . On January 23 , the storm emerged into the Mozambique Channel near Belo , and due to a ridge to the north , it resumed its southwest motion . Domoina executed two small loops off the western coast of Madagascar while progressing generally southwestward . On January 25 , MFR estimated that Domoina attained peak 10 minute sustained winds of 95 km / h ( 60 mph ) near Europa Island ; this made it a severe tropical storm . Two days later , the JTWC estimated peak 10 minute winds of 100 km / h ( 65 mph ) . Early on January 28 , Domoina made a second landfall on southeastern Mozambique near peak intensity . It slowly weakened over land while moving across southern Mozambique . The JTWC discontinued advisories on January 29 when the storm was near the border of Mozambique and Swaziland . The next day , Domoina crossed into Swaziland and subsequently into eastern South Africa , weakening into a tropical depression while passing near Durban . At around that time , the system was dissipating , although MFR continued tracking Domoina until February 2 , when it dissipated just offshore the east coast of South Africa .

## = Impact =

Throughout its path , Domoina left thousands of people homeless , and caused widespread flooding due to drawing moisture from the Indian Ocean and the Mozambique channel . The rains led to rivers bursting their banks , which isolated tens of thousands of people . In the months before Domoina struck , dry conditions persisted across southeastern Africa .

Crossing Madagascar as a moderate tropical storm , Domoina dropped rainfall along its path , reaching 98 @. @ 8 mm ( 3 @. @ 89 in ) in Mahanoro on the east coast and 166 @. @ 8 mm ( 6 @. @ 57 in ) in Maintirano along the west coast , both over a period of 24 hours . In the latter city , a station recorded winds of 100 km / h ( 62 mph ) . The storm caused heavy damage in Marovoay , which was later affected by Cyclone Kamisy . Domoina was the third storm to strike the country in a six @- @ week period , after cyclones Andry and Caboto . The three storms collectively caused 42 deaths and \$ 25 million in damage , much of it from crop damage .

As Domoina made its final landfall in Mozambique , it dropped heavy rainfall reaching 430 mm ( 17 in ) in the town of Goba over a five @- @ day period . Rainfall in the capital Maputo , reaching 300 mm ( 12 in ) over two days , was about 40 % of the annual total . After flooding occurred further south in South Africa , waters were released from the Pongolapoort Dam without warning . This caused many farmers to drown in southern Mozambique . Officials later advised residents along the Maputo River to evacuate to higher grounds , and thousands had to leave their houses . The storm flooded the Maputo , Umbeluzi , Incomati river basins , causing widespread power outages . The storm left the capital Maputo without clean water for several days after a pumping station was damaged , and the main harbor in the city was closed . Also in the city , the storm downed hundreds of trees , wrecked roofs , and damaged houses ; about 10 @, @ 000 people were left homeless nationwide . The storm damaged 28 pumping stations nationwide and destroyed over 50 small dams . Floods affected the railroad connecting Maputo to South Africa , disrupted the construction of a dam , and damaged portions of a bridge near Boane . Transport was disrupted in the northern and southern portion of the country . There was widespread crop damage in Mozambique , affecting 350 @, @ 000 farmers , and flooding about 250 @, @ 000 ha ( 620 @, @ 000 acres ) of fields . After an extended drought , many farmers had moved closer to river beds , making their fields more vulnerable . About 119 @, @ 000 tons of fruits , vegetables , and other crops were wrecked , consisting of much of the summer crop , and about 5 @, @ 000 cattle died . About 49 @, @ 000 people lost everything they owned . In the country , the storm caused 109 fatalities , and damage was estimated at \$ 75 million .

Later , the storm dropped heavy rainfall in Swaziland , reaching 906 mm ( 35 @. @ 7 in ) at Piggs Peak ; there , rainfall reached 615 mm ( 24 @. @ 2 in ) in a one @- @ day period . These were the heaviest rainfall totals on record in the country . Described as the worst flooding in over 20 years , the precipitation increased levels along most rivers in the country , some of which rose 30 m ( 98 ft ) in a few hours . The floods washed out or damaged over 100 bridges , and two railways had cuts in their lines . The floods closed at least 20 major roads and the country 's primary airport . Most schools nationwide were also closed during the storm . There were initial difficulties in determining the extent of the damage due to cut communications and disrupted transportation . For several days , southeastern Swaziland was only accessible by air travel , while rural parts of the country lost access to fresh water . Thousands of livestock died during the storm , and thousands of acres of croplands were flooded . About 10 @, @ 000 citrus trees were destroyed , and crop damage was estimated at \$ 2 @. @ 5 million . About 500 people were left homeless in the small nation , after many homes were damaged or destroyed . Schools and health clinics were also damaged . The storm 's high winds knocked down trees and power lines , leaving power outages . Overall damage was estimated at \$ 54 million , of which \$ 47 @. @ 5 million from infrastructure damage , and Domoina killed 73 people in the country .

While Domoina was moving through South Africa , it drew an area of moisture from the northeast , which produced heavy rainfall that peaked at 950 mm ( 37 in ) between Richards Bay and Sodwana Bay . Totals of over 700 mm ( 28 in ) were reported along the upper Umfolozi , Mkuze , Pongola and middle Usutu and Komati rivers , and along the upper and lower Ingwavuma river . Precipitation spread as far south as Durban , but did not penetrate far into the center of the country . An area of about 107 @, @ 000 km<sup>2</sup> ( 41 @, @ 000 sq mi ) received 370 mm ( 15 in ) of rainfall . Along the

Umfolozzi River , a discharge rate of  $16 \times 10^3 \text{ m}^3 / \text{s}$  (  $565 \times 10^3 \text{ ft}^3 / \text{s}$  ) was recorded , which was three times the rate of a 100 year flood . The river avulsed , or changed its course , near where it met with the Msunduzi River . High rains in the mountains caused the largest flood to date along the Pongola River . The floodplain downstream of the Pongolapoort Dam was inundated to where the Pongola met the Ututu River , which filled many pans ? dry lakes ? in the region . Along 29 river locations in eastern South Africa , river heights were estimated to have been 1 in 50 year events . The river flooding moved sediment along many banks , and in one location the sediment reached 10 km (  $6 \times 10^3 \text{ m}$  ) in length . Due to the widespread flooding and the remoteness of the worst affected areas , there were minimal measurements on the river flow along the Pongola , although above the Pongolapoort dam , levels reached  $13 \times 10^3 \text{ m}^3 / \text{s}$  (  $460 \times 10^3 \text{ ft}^3 / \text{s}$  ) , which were 18 times higher than the previous record highest . There had been a planned release of water from the Pongolapoort Dam in March 1984 to provide adequate water to the floodplain , but Domoina prevented this from occurring . The dam had its highest hydrology on January 31 and reached 87 % of its capacity . Waters from the dam were released on February 2 to prevent the dam from exceeding capacity . With the future threat of Cyclone Imboa , dam levels continued to drop until returning to normal by February 16 , despite requests to hold the water to prevent further crop damage .

Near the South Africa border with Swaziland , flooding stranded about  $80 \times 10^3$  people on tribal lands . One road in the country was converted into a makeshift landing strip to allow helicopters and planes to drop off emergency supplies . A period of heavy rain flooded Umfolozzi River , which destroyed a rail bridge near Mtubatuba and a bridge crossing highway N2 . The floods were so strong that they washed a boat from Lake St. Lucia to a point 16 km (  $9 \times 10^3 \text{ m}$  ) away . At the lake , the floods washed away a dredge and severely damaged a nearly @-@ finished canal from the lake to the Umfolozzi River . Widespread crop damage occurred along the Umfolozzi river plains after being covered by up to 1 m (  $3 \times 10^3 \text{ ft}$  ) of sediment . The South African Weather Bureau considered Domoina as the " first tropical cyclone in recent history to have caused flooding and extensive damage . " Nationwide , the storm caused 60 deaths and damaged the properties of  $500 \times 10^3$  people , causing R100 million ( 1984 ZAR , \$ 70 million 1984 USD ) .

= = Aftermath = =

In Mozambique , workers assisted people in moving to higher grounds following flooding . Members of the Mozambique Red Cross helped distribute food and clothing to the affected residents , and planes helped drop off supplies to residents in isolated areas .

On January 31 , the government of Swaziland declared a state of emergency and requested assistance from the international community . South Africa provided two helicopters to the country to survey the affected areas . Various countries and United Nations agencies provided about \$  $1 \times 10^6$  million in cash and supplies to Swaziland . The United Nations Department of Humanitarian Affairs provided \$  $20 \times 10^3$  . The European Economic Community donated about \$  $80 \times 10^3$  to purchase tents and blankets . The Lutheran World Federation donated \$  $20 \times 10^3$  in cash , along with generators and blankets , while World Vision International sent \$  $10 \times 10^3$  in cash . Within a week , workers reopened most major roads to travel , and by February 24 , most roads were reopened . Workers also quickly restored the downed power lines . Relief items were distributed by both air and road in the weeks following the storm , coordinated by the Swaziland Red Cross and assisted by volunteer organizations . In part due to Domoina as well as the previously occurring drought , the economy of Swaziland stagnated through 1985 .

Following the storm in South Africa , workers restored the original course of the Umfolozzi River after it had moved . Officials later purchased a new dredge to remove sediment from Lake St. Lucia , and the canal connecting the lake to the Umfolozzi River was later finished . Local governments coordinated relief efforts in the country , including delivering food and providing shelter for those who lost their homes . The South African Red Cross provided food to storm victims , many of whom were beneficiaries of the food program during the extended drought . The South African government declared KwaZulu Natal as a disaster areas . The country 's military provided 25 helicopters to

rescue flood victims and donated 3 @, @ 000 tents . The government later authorized \$ 85 million to fund repairing damaged rails and roads . The American government donated \$ 100 @, @ 000 to the country , mostly to purchase supplies . West Germany also donated about \$ 231 @, @ 000 , mostly for the feeding program .