= 1996 Oman cyclone =

The 1996 Oman cyclone (also known as Cyclone 02A) was a tenacious and deadly system that caused historic flooding in the southern Arabian Peninsula . It originated from a disturbance in the Gulf of Aden , the first such tropical cyclogenesis on record . After moving eastward , the system interacted with the monsoon trough and became a tropical storm on June 11 . Later that day , it turned toward Oman and struck the country 's southeast coast . It weakened over land , dissipating on June 12 , although it continued to produce rainfall ? heavy at times ? over the next few days .

Offshore Oman , the storm 's rough waves disabled an oil tanker and damaged a fishing boat , killing one person in the latter incident . Striking Oman , the storm produced significant rainfall totals well above the monthly average , peaking at 234 mm (9 @.@ 2 in) in the Dhofar region . Strong winds where the storm moved ashore damaged buildings and the local water plant . The rains washed out roads and isolated villages , killing two people due to drowning in Al @-@ Ghubra . However , the effects were more severe in Yemen , where the floods were considered the worst on record . The storm produced the heaviest rainfall in 70 years , reaching 189 mm (7 @.@ 4 in) in Ma 'rib . Flood waters washed away or damaged 1 @,@ 068 km (664 mi) of roads and 21 bridges , some of them dating back 2 @,@ 000 years to the Roman era . The storm washed away the topsoil or otherwise wrecked 42 @,@ 800 ha (106 @,@ 000 acres) of crop fields , accounting for US $ 100 million in agriculture damage . At least 1 @,@ 820 houses were destroyed , many of them built on wadis , or dry river beds . Overall damage was estimated at US $ 1 @.@ 2 billion , and there were 338 deaths in Yemen . The World Bank assisted in a project to rebuild the damaged infrastructure in Yemen and to mitigate against future floods .

= = Meteorological history = =

On May 31 , a weak circulation persisted over the warm waters of the Gulf of Aden between Yemen and Somalia . Its origins were unknown , possibly the convergence of the sea breeze along the coast of Somalia with the monsoon flow . The system produced convection , or thunderstorms , along both coasts of the body of water . As it moved east @-@ northeastward along the coast of Yemen and Oman , the disturbance brought dry air from the north , which decreased the convection . It moved farther offshore on June 7 into the open Arabian Sea , where it interacted with the south @-@ west monsoon and developed more convection .

The area of thunderstorms persisted about 1 @,@ 480 km (920 mi) northeast of Somalia by June 9 . It became circular as the circulation became more defined , fueled by the instability from the monsoon trough . Wind shear was expected to prevent significant development , although the system organized enough that the Joint Typhoon Warning Center issued a tropical cyclone formation alert on June 10 . On the next day , the agency initiated advisories on Tropical Cyclone 02A about 160 km (100 mi) from the Oman coastline . This marked the first occasion that a tropical cyclone originated from a system in the Gulf of Aden .

After becoming a tropical storm , the system 's structure became more aligned as it developed an anticyclone aloft . Fueled by water temperatures of 29 ° C (84 ° F) , the cyclone intensified further . At 03 : 00 UTC on June 11 , the Omani city of Fahud recorded sustained winds of 75 km / h (45 mph) , and a station on Masirah Island recorded a pressure of 994 mbar (29 @.@ 4 inHg) . On this basis , the JTWC estimated that the storm attained peak winds of 75 km / h (45 mph) . However , a nearby ship reported sustained winds of 85 km / h (50 mph) , and the well @-@ defined structure on satellite imagery suggested winds as strong as 120 km / h (75 mph) . Moving northwestward , the cyclone made landfall around 09 : 00 UTC on June 11 about 130 km (80 mi) southwest of Masirah Island in southeastern Oman , at a location named Ras Madrakah . It quickly weakened over the desert terrain and dry air , and the circulation dissipated by June 12 over the central portion of the country . However , the remnants turned to the southwest , steered by a northerly flow . It entered the Rub ' al Khali , or Empty Quarter , of Saudi Arabia late on June 12 , and continued slowly westward . The storm 's interaction with the monsoon brought the intertropical convergence zone northward into Oman and Yemen , bringing unusually heavy rainfall until the

system gradually wound down .

The IMD ? the official warning agency for the basin ? did not track the cyclone . In general , tropical cyclone forecast models failed to predict that the storm would form .

= = Impact = =

The precursor to the storm dropped heavy rainfall in Oman , reaching 29 mm (1 @.@ 1 in) in Khaftawt on May 31 . The storm later produced intense precipitation across the coast and desert regions of the country . Masirah recorded 48 mm (1 @.@ 9 in) of rainfall over 36 hours , compared to the average monthly average of 1 mm (0 @.@ 039 in) , while Salalah reported 36 mm (1 @.@ 4 in) , or 600 % of the average June rainfall . However , the heaviest rainfall occurred on June 11 and into the following day , when the system drew moisture into mountainous parts of the Dhofar region . A station called Jebel Ashor recorded 234 mm (9 @.@ 2 in) over 48 hours , including 143 mm (5 @.@ 6 in) on June 11 . Farther north , heavy rainfall occurred in the Al Hajar Mountains , where 201 mm (7 @.@ 9 in) was recorded , mostly over eight hours ; there , 71 @.@ 8 mm (2 @.@ 83 in) of precipitation was recorded over two hours .

Offshore the Arabian Peninsula , the cyclone produced rough waves that disabled an oil tanker ; the crew was rescued by the Omani Coast Guard after being stranded for a few days . A fishing boat was damaged after being washed ashore near Ras Madrakah , killing one person in the crew of nine . Near where the storm moved ashore , the storm 's strong winds heavily damaged the village of Ras Madrakah . Considered the worst storm in memory , the cyclone wrecked workshops and buildings , including damaging the roof of the desalination plant , leaving residents without water for several days . Strong winds of over 93 km / h (58 mph) knocked down 20 trees in Rima that were planted to provide shade for government buildings . Across the storm 's track through Oman , the rains replenished water levels in aquifers , while also washing out roads and isolating villages . This lack of transportation prevented prompt repair work . The Jiddat al @-@ Harasis desert was flooded for over a month due to the storm , killing two people due to drowning in Al @-@ Ghubra . The floods provided grazing for the endangered oryx population , although many livestock were killed . Three airports in the country were closed due to floods up to four days .

Damage was heaviest in Yemen , where the storm 's remnants dropped the heaviest rainfall in 70 years . Ma 'rib recorded 189 mm (7 @.@ 4 in) of rainfall , and the capital Sana 'a reported 164 mm (6 @.@ 5 in) of precipitation . Widespread flooding affected much of Yemen , the worst on record for the country . Damage was heaviest in three governorates ? Hadhramaut , Shabwah , and Ma 'rib ? with lesser effects in three other governorates . The waters washed away or damaged 1 @,@ 068 km (664 mi) of roads and 21 bridges , including the primary road crossing Hadhramaut . Some of the damaged roads were built 2 @,@ 000 years prior under the Roman Empire . Primary highways were damaged in 16 locations . Thousands of cars and other vehicles were inundated , necessitating boat travel to transport injured residents . About 2 @,@ 300 m (7 @,@ 500 ft) of power lines was cut . The floods washed away 113 power poles , and four main generators were affected , causing widespread outages . Storm debris contaminated also many drinking wells and damaged 1 @,@ 357 water pumps damaged . About 80 % of Shabwah Governorate lost water access , forcing some residents to drink from contaminated wadis , or formerly dry river beds . About one @-@ third of gabions ? structures to help with flood control ? were damaged or destroyed , as were 634 dykes .

Many Yemeni villages were isolated , and the entirety of Ahwar and Qaishan provinces were inaccessible within Abyan Governorate . The floods destroyed 1 @,@ 820 houses , many of them washed away , and many others were damaged , leaving 22 @,@ 842 families homeless . The storm washed away the topsoil or otherwise wrecked 42 @,@ 800 ha (106 @,@ 000 acres) of crop fields . The storm also knocked over 37 @,@ 000 fruit trees and killed 13 @,@ 000 livestock , accounting for about US $ 100 million in agriculture damage . About 70 % of arable land in Shabwah Governorate was washed away . The floods littered about 25 km (16 mi) of irrigation canals with sand . Many of the houses and fields were built on wadis which were swept away when water levels rose . The floods also damaged or destroyed 43 health facilities and 53 schools . Overall , 338

people were killed by the floods in Yemen , and damage was estimated at US $ 1 @.@ 2 billion , according to the Centre for Research on the Epidemiology of Disasters . However , Yemen 's General Secretariat for Natural Disasters and Relief estimated damage at US $ 200 million , which accounted for 12 % of the country 's GDP .

= = Aftermath = =

After the worst of the floods ended , the Yemeni government created a Flood Relief High Committee to coordinate incoming aid and relief distribution . The Ministry of Health coordinated the transportation and storage of goods . Workers quickly repaired roads and airports . In Shabwah , CARE and Oxfam repaired damaged pumps and wells to restore access to clean water , and the German government sent a team to restore water access in Ma 'rib Governorate . The widespread destruction of crop fields caused many tribes to abandon their ancestral land . Many of the residents left homeless either stayed with families or relatives , or resided in temporary shelters , where there were reports of malaria , typhoid , and diarrhea . The government provided building materials to rebuild houses . In the immediate aftermath , the local Red Cross chapter distributed about 1 @,@ 300 blankets , 200 tents , and 200 sets of cooking tools . Stagnant waters in Yemen caused a locust outbreak in August 1996 that affected Saudi Arabia for the next three months . Officials used over 350 @,@ 000 l (92 @,@ 000 US gal) of pesticide in response to the outbreak . The heavy rural damage depressed the regional economy in 1996 and 1997 .

On June 17 , the government of Yemen issued an appeal for international aid , while also declaring four governorates as disaster areas . After the severe flooding occurred , 20 countries and various international organizations provided money or relief goods to Yemen , amounting to US $ 14 million . Yemen 's needs were determined by a survey between officials in the Ministry of Electricity and workers in the United Nations Office for the Coordination of Humanitarian Affairs . Several departments within the United Nations provided assistance as well toward a crop assessment , drugs , and wheat flour . The World Health Organization provided medical supplies to the country . The International Federation of Red Cross and Red Crescent Societies provided 3 million water tablets , along with cash and general supplies . The European Commission (precursor to the European Union) donated about US $ 186 @,@ 000 to the Yemeni Red Cross , and other European countries ? France , Germany , Italy , the Netherlands , Norway , Spain , Sweden , Switzerland , and the United Kingdom ? also provided assistance . Other countries in the Middle East also sent supplies to Yemen . Neighboring Oman sent 28 metric tons of food , and Qatar sent US $ 1 @.@ 2 million worth of food , blankets , and tents . Syria sent US $ 5 million worth of food aid . As part of a plan toward preventing future floods , the World Bank provided US $ 14 @.@ 5 million to rebuild roads , power and water plants , and regrowing lost crops .

In the months after the floods , the government of Yemen sought help from the International Development Association to prevent future floods from being as damaging . The government created an Emergency Flood Rehabilitation Project that was geared toward more long term solutions . Thousands of farmers benefited from the improved irrigation and from the employment opportunities . Roads and bridges were rebuilt to a higher construction standard using local builders and contractors , the first such occurrence in the country using competitive bidding . The project was completed in December 2001 at a cost of US $ 31 @.@ 59 million ; the International Development Association paid US $ 27 @.@ 44 million , and Yemen 's government provided the rest of the funding .