EVENT BRIEFING

Event: Cyclones Idai and Kenneth

Region: Southeast Africa

Authors: Ian N. Robertson, University of Hawai'i at Manoa
David Prevatt, University of Florida
David Roueche, Auburn University
Tracy Kijewski-Correa, University of Notre Dame

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Key Lessons

- Tropical cyclones in the Southern Hemisphere occur far less frequently than in the Northern Hemisphere, but they can be as intense and hazardous. In the 30% of tropical cyclones occurring in the southern hemisphere, air flows in clockwise direction around the eye, so the most damaging portion of the storm is the Southwest quadrant.
- Two tropical cyclones successively struck coastal Mozambique in East Africa, resulting in extensive flooding, wind damage, over 1000 fatalities during Cyclone Idai, and less than 50 fatalities during Cyclone Kenneth.
- The immediate lessons and media attention of the first disaster may have prompted more effective evacuation procedures ahead of Cyclone Kenneth, hitting only six weeks after Idai.
- Many casualties during Cyclone Idai were the result of landslides and rockfalls in inland regions due to the heavy and sustained rainfall over a two-week period.
- Longitudinal studies of the societal effects and rate of recovery of the affected communities could shed light on effective mitigation measures to improve resilience in developing nations exposed to tropical cyclones.

StEER Response Strategy

The objectives of this event briefing are:

1. to summarize the meteorological characteristics of the two cyclones
2. to overview damage to buildings and other infrastructure
3. to summarize key lessons learned.

Information provided herein was gathered from various websites and news outlets. Unless new information reveals significant structural damage to engineered structures, StEER does not intend to deploy any Virtual or Field Assessment Structural Teams for these events.

Cyclone Details

Two major tropical cyclones made landfall on the Mozambique coastline within a six weeks of each other resulting in over 1000 fatalities and causing significant wind and flooding damage to the coastal cities of Beira and Pemba (Fig. 1).

Cyclone Idai made landfall on March 14, 2019 as a Category 3 tropical cyclone (hurricane) with the eye passing just North of Beira, the second largest city in Mozambique. Because cyclones rotate clockwise in the Southern Hemisphere, the Southwest quadrant of the storm has the highest wind speeds and most severe storm surge and waves. Over 1000 fatalities were reported in Mozambique, Zimbabwe and Malawi.

Cyclone Kenneth made landfall just north of the city of Pemba in northern Mozambique on April 25, 2019 as a Category 4 tropical cyclone, the strongest to make landfall in Mozambique in recorded history. Local authorities were able to evacuate over 30,000 people from coastal areas exposed to the storm, possibly as a result of the lessons learned from Idai. At the time this briefing was authored, only 41 fatalities had been reported in Mozambique with another 7 fatalities in the Comores as Cyclone Kenneth passed North of the island nation.

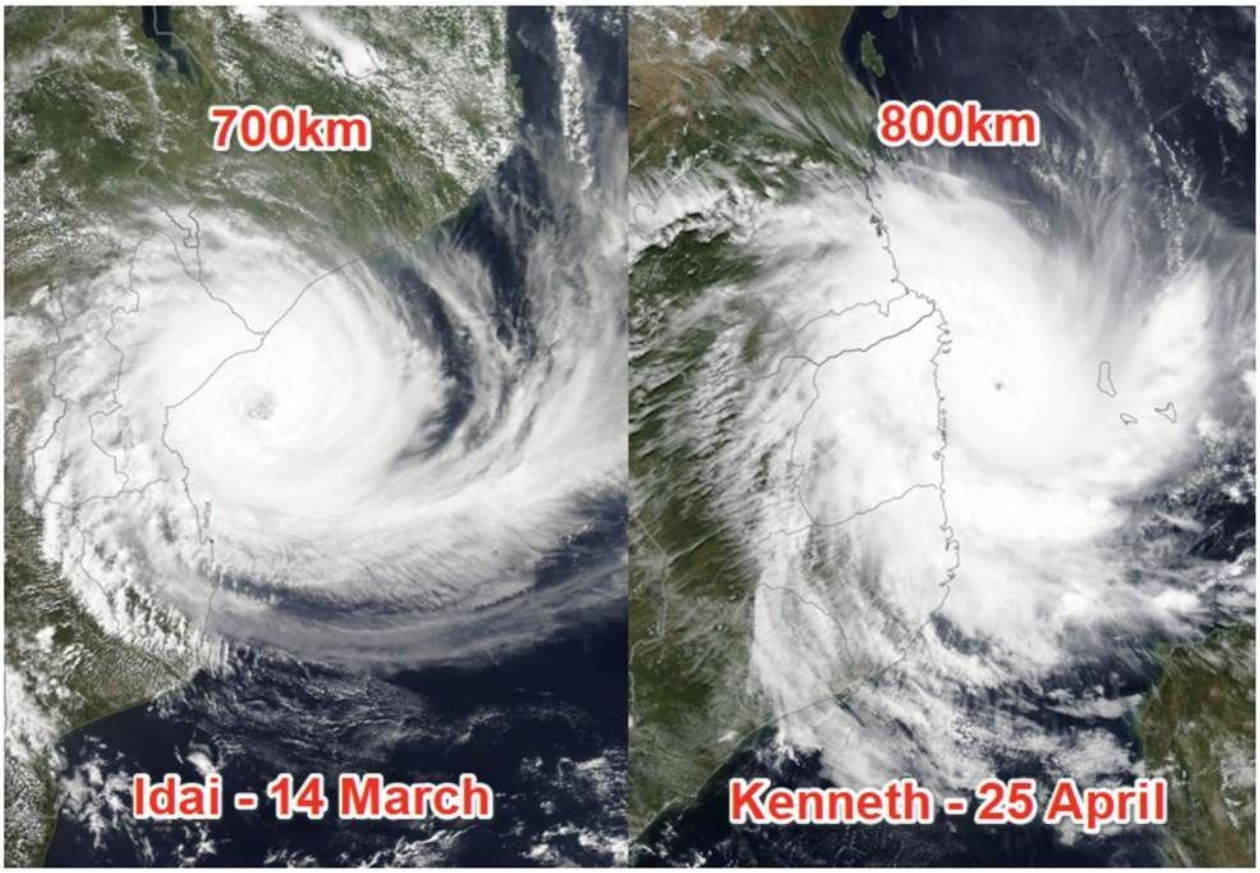

Figure 1: Cyclone Idai (left) on March 14th and Cyclone Kenneth (right) on April 25th, shown at the same scale, making landfall in central and northern Mozambique, respectively (Source NASA/Glenn Moncrieff)

Storm tracks recorded at 6-hour intervals for both storms are shown in Figure 2. Figure 3 shows these tracks along with the tracks of the record 17 tropical cyclones that developed in the Southwest Indian Ocean during the 2018-2019 season.

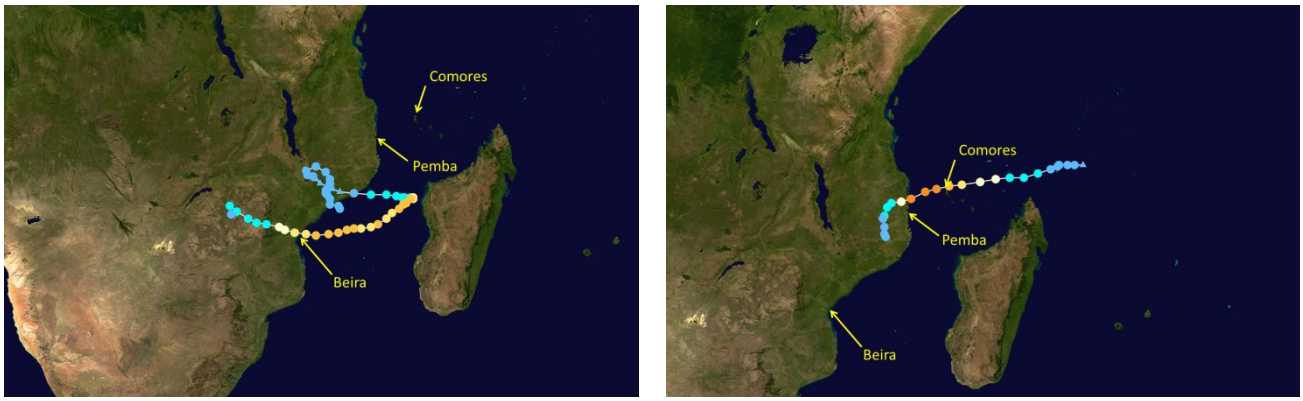

Figure 2: Storm tracks at 6-hour intervals for cyclones Idai (left) and Kenneth (right). (Blue dots – Tropical depression; Cyan dots - Tropical Storm; White dots – Cat 1; Yellow dots – Cat 2; Light orange dots – Cat 3; Orange dots – Cat 4)

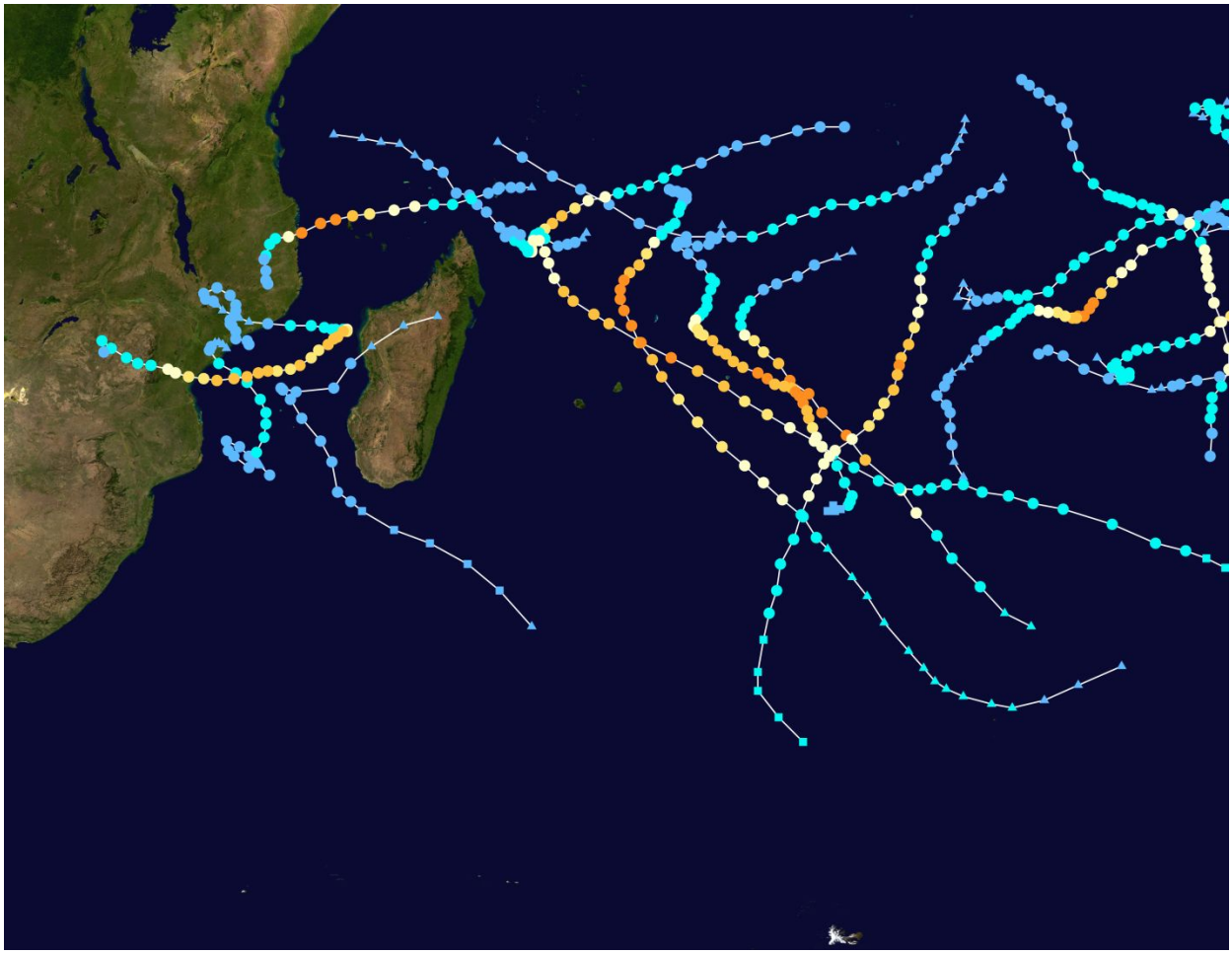

Figure 3: Tracks of all tropical cyclones in the 2018-2019 Southwest Indian Ocean cyclone season.

Damage to Structures

Construction in the affected areas ranges from multi-story reinforced concrete buildings to single-story adobe homes with metal roofs. The city of Beira has a number of engineered reinforced concrete multi-story buildings that survived structurally, though damage to windows and roof cladding was widespread. There is also a large quantity of rudimentary timber framed-adobe infilled or unreinforced masonry homes with corrugated galvanized iron (CGI) sheet metal roofing supported by timber rafters.

Damage to coastal structures resulted from a combination of high wind and storm surge. Figure 4 shows a typical stretch of coastline in Beira both before and after Cyclone Idai. Buildings and roadways exposed to storm surge suffered significantly more damage than those subjected to high winds only.

Figure 4: Google Earth images before (top, 3/12/2019) and after (bottom, 3/21/2019) Cyclone Idai

Most of the buildings damaged by these two cyclones was confined to non-engineered housing units (Fig. 5). The lack of effective load path to resist uplift forces on the roofs led to failure of many of these dwellings. Subsequent flooding due to the heavy rainfall and proximity to large river deltas, particularly along the Pungwe River, resulted in extensive flooding damage to additional damage and displacement of occupants, compounding the existing wind damage (Fig. 6).

Figure 5: Damage to non-engineered housing units consisting of adobe/timber walls and sheet metal roofing (Photo Credit: Reuters)

Figure 6: Residents seek refuge from flood waters on second level of damaged building (Photo Credit: National Institute of Disaster Management – INGC, Mozambique)

Other Infrastructure

A number of roads and at least one bridge were washed away by the flood waters, most likely due to scour (Figs. 7 and 8). The authors are not aware of any major failures of bridges due to structural damage caused by the wind or flooding.

Figure 7: Abutment to bridge span crossing the Umvumvu river washed away following Cyclone Idai in Chimanimani (Photo Credit: Reuters)

Figure 8: Damaged section of the road between Beira and Chimoio in Nhamatanda District in Central Mozambique after the area was hit by Cyclone Idai.

Power distribution and telecommunication systems were extensively damaged by both storms resulting in loss of power throughout the affected areas. Due to damage from Cyclone Idai, two hydroelectric power plants in Malawi were taken offline, removing 84% of the country's generating capacity (Malawi Floods, 2019). Damage to electrical distribution infrastructure in Beira left over 500,000 people without power.

References

Malawi Floods, 2019: Update 1 Briefing note – 19 March 2019 (PDF) (Report). ReliefWeb. Assessment Capacities Project. 19 March 2019. Retrieved 20 March 2019.

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