

**IntoAction**

**3**

**Early-warning  
communication system  
for the  
Kingdom of Tonga**

Completion of TEARS  
(Tonga Early Warning HF/RANET System)

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**Munich Re  
Foundation**  
From Knowledge  
to Action

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### Overview – Tonga project

**Duration**  
 May 2006–August 2008

**Continuation**  
 The government of the island kingdom has already approved a scheme to extend the system to include Niuafu’ou, Niuatoputapu and Eua

**Project management**  
 Munich Re Foundation:  
 Thomas Loster

**On site:**  
 Ofa Fa’anunu, Tonga Meteorological Service  
 Pene Lefale, Meteorological Service of New Zealand Ltd.  
 Maliu Takai, Tonga National Emergency and Management Office

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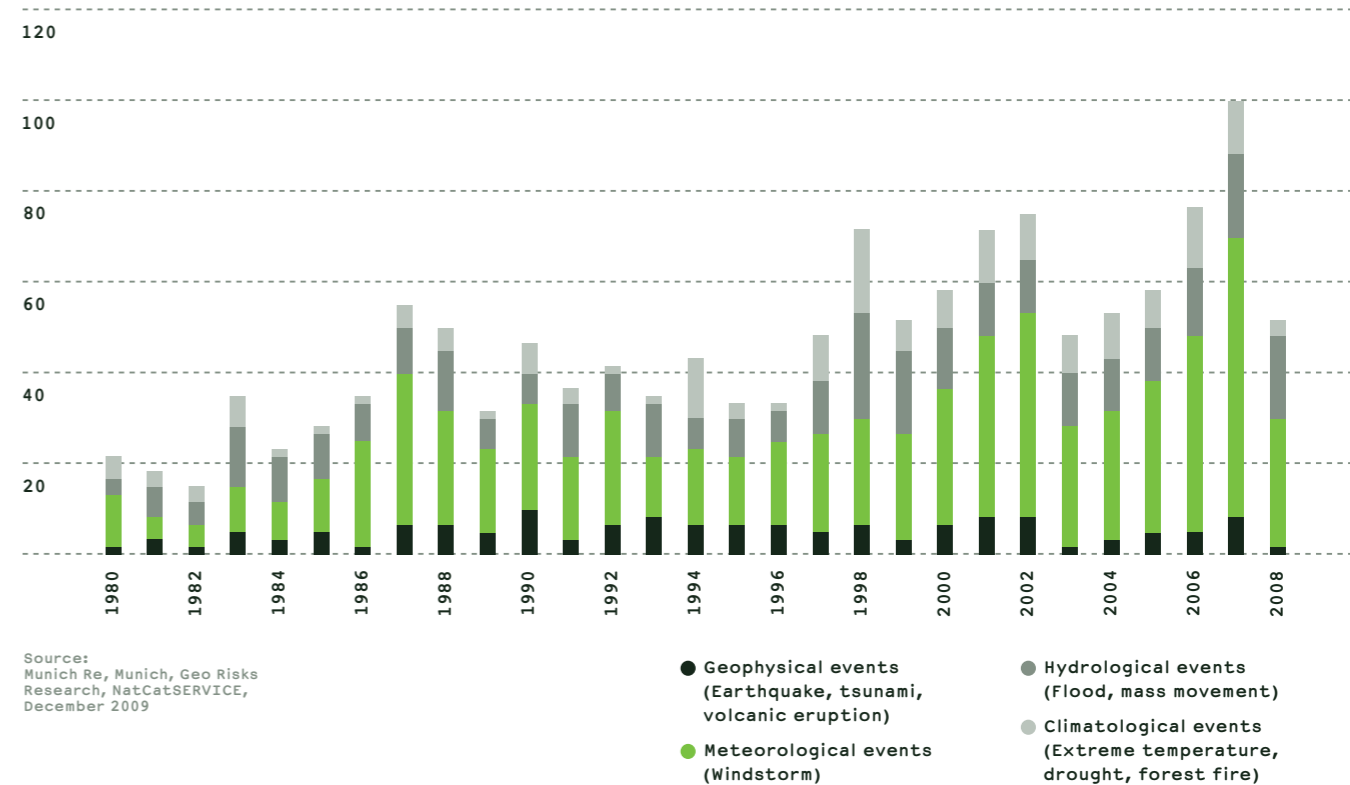
## People at risk

Recent decades have seen a significant increase in the number of natural catastrophes with devastating consequences. Tsunamis and earthquakes have resulted in major losses and high death tolls in the past few years. Weather-related events are becoming more frequent and more severe also due to climate change.

Warning systems have always played a key role in reducing casualty figures and preventing or minimising losses. Since the massive Tsunami of December 2004, which caused over 220,000 deaths in Asia and Africa, effective early warning has been an important factor in disaster prevention.

The Munich Re Foundation supports the installation of warning systems tailored to the circumstances of those at risk. Successive warning systems are being set up along rivers in central Mozambique whilst, in Tonga, we sponsored the installation of the high frequency (HF) RANET warning system.

Natural catastrophes in Pacific/Australia/Oceania 1980–2008  
 Number of events



## Early warning is important

From 27 to 29 March 2006 some 1,000 experts from over 140 countries gathered in Bonn at the Third International Early Warning Conference. The aim of this conference, which was organised by the UN ISDR (International Strategy for Disaster Reduction, Geneva) and DKKV (the German Committee for Disaster Reduction), was to promote early-warning systems and provide practitioners and decision-makers with useful tools. In his opening address, former US President Bill Clinton, UN Special Envoy for Tsunami Recovery, stressed the importance of efficient early warning in a phase marked by a rising number of extreme weather events. Just a few months before the meeting Hurricane Katrina had killed more than 1,300 people and devastated the city of New Orleans and Louisiana, although good warning systems were in place.

On the evening of the first day of the conference, the Munich Re Foundation awarded a prize worth € 50,000 to Tonga. As part of the “early-warning communication system for the Kingdom of Tonga”, the prize money will go towards linking the island nation to a warning system – called RANET – already in place in the Pacific.

The Munich Re Foundation selected the winning project from a total of 130 proposals submitted to the conference organisers. “Our intention was to close a gap”, said Thomas Loster, Chairman of the Munich Re Foundation. “Although international early-warning efforts have been stepped up considerably, there are still a number of bare patches on the map, especially in remote areas”.

The foundation selected this system because it is clearly defined, effective and can be easily reproduced elsewhere. Takai Maliu, a member of the National Disaster Management Office in Tonga: “Thanks to the prize, we can get to work immediately. We will now be able to implement the early-warning system, even on our remotest islands, in a little over a year.”



The prize for the Tonga early-warning system was awarded at a German Foreign Office reception. The picture shows Mr. Maliu Takai of the Tonga National Disaster Management Office and Thomas Loster from Munich Re Foundation.

### The Munich Re Foundation shortlist

A number of interesting early-warning projects from all over the world were presented and discussed at EWC III. The Munich Re Foundation’s “Early Warning Prize” was awarded to Tonga, one of several eligible projects. This among others promoted awareness within the community (see table).

Country	Action
Sri Lanka	Improving the Disaster Resilience of Coastal Schools in Sri Lanka
Turkey	Implementing a Real-time Flood Forecasting System for the East Black Sea Region
Iran	Flood Warning System as a Sector of Flood Integrated Action Plan in Imamzade Davood Basin, Tehran Province
France / Niger, Haiti	The Loire Prevention Ambassadors
Cambodia	Flood disaster preparedness for the vulnerable communities in the province of Kampong Cham

## Tonga Project

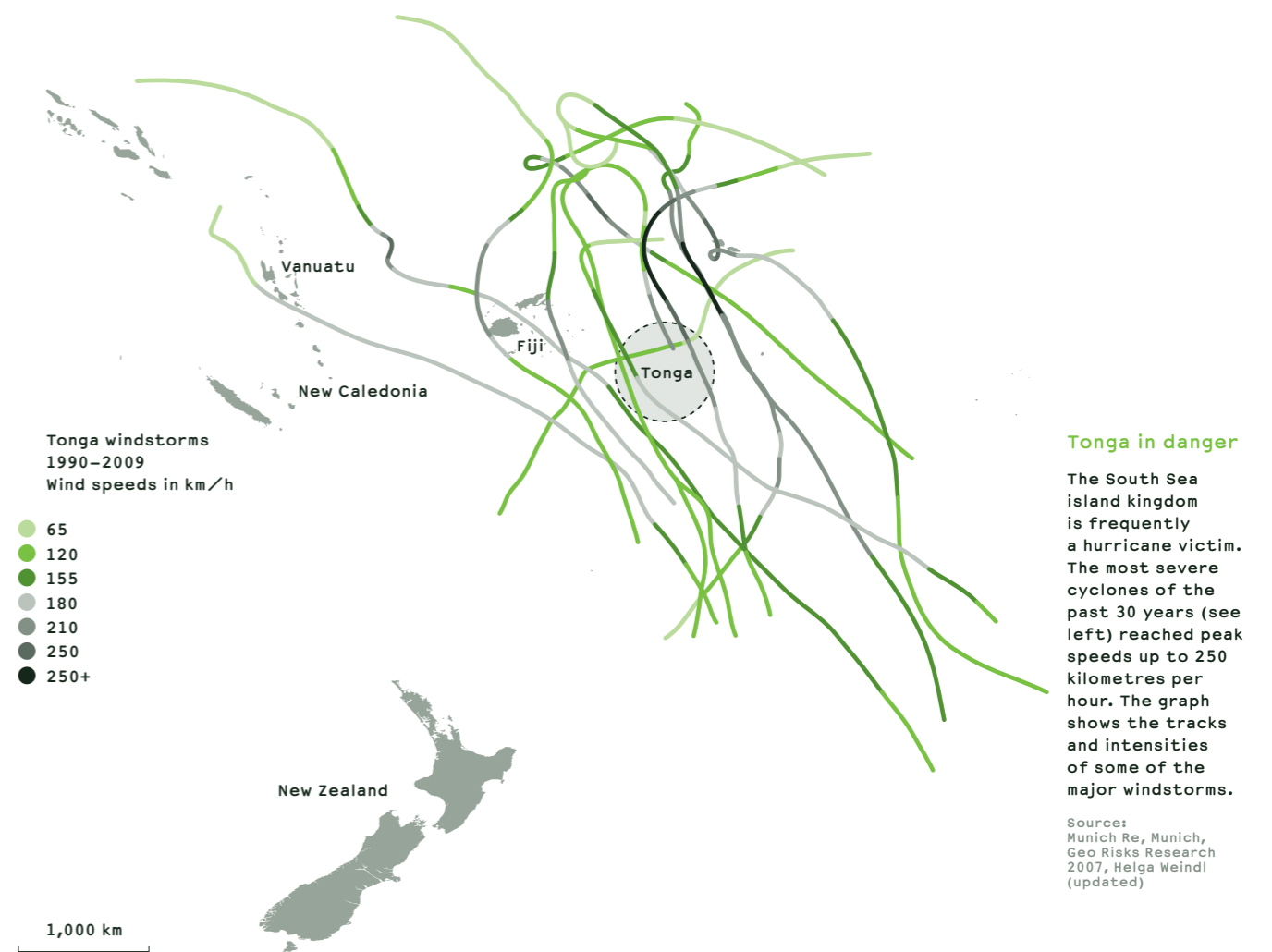
Past experience has shown how important such an early-warning system is for Tonga in particular. Since 1980, at least nine cyclones, one tornado, two larger storm floods and several major earthquakes including tsunamis have struck the archipelago state with its widely scattered islands. The Foundation prize awarded in 2006 put Tonga in a position to develop an effective early-warning system against tropical storms and floods. Up to then, the national disaster protection service had not been able to properly assess the actual threat because the satellite system employed did not usually function in strong winds.

By contrast, the early-warning project launched with the help of the Munich Re Foundation has a communication network that uses high-frequency radio data circuits to provide more exact forecasts and broadcast warnings.

Several tests of the material and computers in the tropical and humid climate had led to delays in the original timetable, the technical equipment finally used arrived in Tonga in October 2007. Parallel to this, an expert from Tonga received training from the Australian Bureau of Meteorology and RANET specialists.

On that basis, the first two RANET warning systems were installed on the main island, Tongatapu, in March 2008, with the help of Meteorological Service of New Zealand. The new radio stations located at the meteorological service offices in Nuku’alofa and at Fuamotu airport are now operational. Vava’u and Ha’apai, the last stations to go on air in the latest phase of the new warning system, were installed and tested in August 2008.

As a result, a radio network capable of transmitting a range of measurement data has now been established on three island groups in the Kingdom of Tonga (Tongatapu, Vava’u and Ha’apai). The radio network is linked to the RANET Pacific data network and to the EMWIN (Emergency Managers Weather Information Network) catastrophe warning service. It will ensure the efficient and reliable transfer of key environmental data, including air pollution and sea temperature readings, aviation information, weather readings and forecasts.



## September 2009: Tonga hit by tsunami

The Pacific's most severe 2009 earthquake, measuring 8.3 on the Richter Scale, triggered a tsunami on 29 September which caused major damage and claimed over 170 lives in Samoa, American Samoa and Tonga. Many of Tonga's islands escaped more or less unscathed. This was not, however, the case for the thousand or so inhabitants of Niuatoputapu in the north of the Kingdom. In the early hours of 29 September, the island bore the full brunt of a metre-high wall of water. Houses were swept away, cars washed into the sea and infrastructure destroyed. Nine people were killed. A hospital, a school and a number of low-lying areas were flooded on another Ha'apai-group island, where one of the RANET systems had been installed, but there were no casualties.

### Did the early-warning system work?

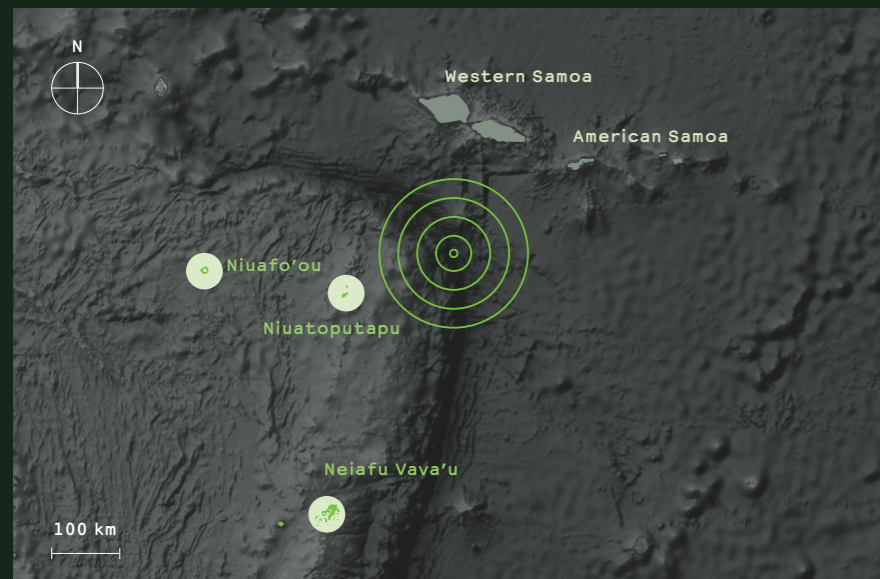
Although the warning system set up with the aid of the Munich Re Foundation was fully operational, it was not able to prevent losses in the regions affected. So far, the system has only been installed on the southern islands, around the capital, and thus Niuatoputapu did not benefit from the enhanced early-warning facility.

### Human factor in early warning

One general difficulty encountered with effective early warning is that time is of the essence. The devastating tsunami quake occurred only 200 kilometres off the coast of the affected region. Within minutes of the tremor, the first Tsunami wave had reached the Samoan Islands and the coast of Niuatoputapu. With so little time available, successful early warning became a difficult if not impossible task, a fact brought home by the many recent events in the Pacific and Indian Oceans.

Apart from the technical issues that Tonga faced, such as slow data transmission, the human element also remains a key factor in early warning. The Samoa quake occurred at 6:48 a.m., before staff had arrived at the radio and television stations and other public facilities that normally issue alerts. Even the presence of a large number of RANET stations would have been of little use on 29 September, since it was the human link in the warning chain that broke down.

Nevertheless, the tsunamis of 2009 again underscored the importance of having a well-organised, comprehensive warning system. It is to be hoped that the RANET system will be extended to cover the entire Kingdom of Tonga as soon as possible, and will be more reliable in preventing losses when future events strike.



On the morning of 30 September 2009, about 6:48 a.m. local time, an 8.3 magnitude quake struck underwater in the South Pacific, 200km from Samoa. About 10 minutes later, a powerful tsunami generated by the seismic event hit the islands of Samoa, American Samoa and Tonga.



Relief workers cleaning up a beach area after the tsunami had hit Samoa and Tonga levelling villages, devastating infrastructure, and claiming the lives of more than 170 people.

Leala Ioane, from Poutasi Village, surveys the damage on the South Eastern coast of Upolo, Samoa. He lost members of his family, and many are still missing. Too little time was available, efficient early warning became an almost impossible task.

## What is RANET?

RANET is the abbreviation for “Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information”. Its aim is to optimise meteorological services in designated regions and improve early-warning processes.

A number of countries are working together to increase the availability of warning and climate data, primarily to ensure that even those who live in remote areas are better protected. A key feature of the system is its use of modern technology. Another important factor is the involvement of local communities and partners.

However, RANET is far more than a data-optimisation tool. A major concern for those involved in the scheme is to ensure that the local population is given adequate training. Another concern is to create model projects that will facilitate implementation of the system elsewhere. RANET’s partners include the water and meteorological services, NGOs and local communities.

The RANET system relays information between local sites and the AsiaStar satellite via HF radio using simple HF antennas. From the satellite, the information is broadcast to WorldSpace Singapore or the NOAA in Virginia, USA. It is now available via the internet as well. Community FM radio stations in Tonga broadcast the information directly in local dialects. This variable system of data-stream options is designed to ensure that early-warning alerts reach the people at risk.

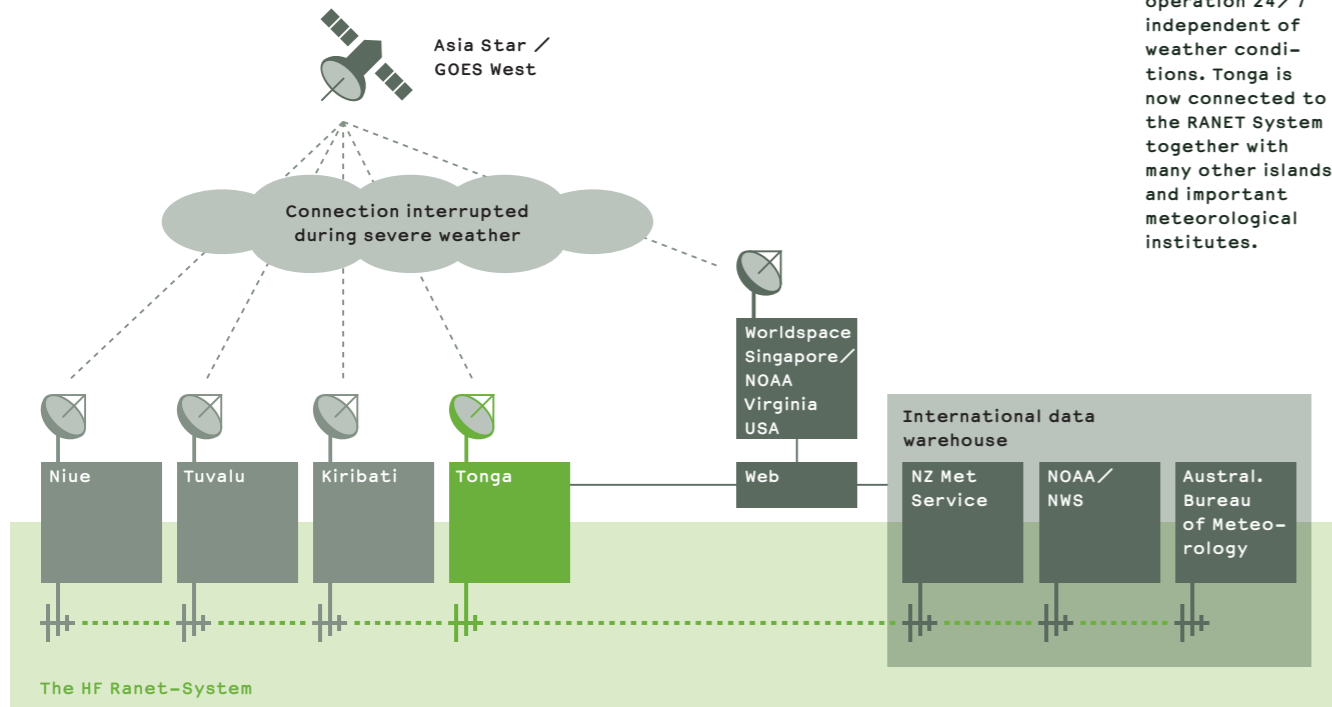
RANET was initially developed in and for Africa. However, it was soon realised that the system could also be of real benefit in Asia, and particularly in the Pacific Islands states. Since 2003, more and more local meteorological services in that region have been linked up to RANET, now a fully fledged information system.

Weather stations providing valuable meteorological data have already been set up in the capitals of many of the islands, including Tuvalu, Kiribati and Niue. However, one problem often encountered is that the data are of limited application and are not relayed to the remote areas.

In the Pacific, RANET is primarily intended to connect local communities to the data system. This can be done via a number of transmission channels that include radio stations and satellite communication systems. Information must be transmitted in a way that ensures it is correctly interpreted and understood by the recipients. Fluctuations in the supply of electricity to individual system components is another common problem. One of the major goals is therefore to ensure that weather stations have a basic power supply at all times, by installing standby generators for instance.

### RANET

Many remote islands rely on satellite communication systems. These systems often brake down during heavy winds. The HF RANET-System remains ready for operation 24/7 independent of weather conditions. Tonga is now connected to the RANET System together with many other islands and important meteorological institutes.



The HF RANet-System

## Technology in Tonga

Many Pacific states rely on a satellite data-communication system. However, the system has to be shut down when wind speeds exceed 120 kilometres per hour, and it is precisely in the run-up to and during cyclones, with their much higher wind speeds, that it is vitally important to maintain a reliable flow of data between the islands.

To prevent transmission breakdowns, a new HF system has been installed in Tonga, which is directly linked to the Pacific RANET system. A local system consists of an HF radio receiver, HF data modems and HF antennas. These in turn are connected to local computers and weather stations. Standby generators provide power even when normal supplies are disrupted.

Data communications are two-way: local weather stations have the benefit of receiving data from the Pacific information network whilst, at the same time, their data can be fed into the supraregional network. The advantages are that data quality is improved, and consequently people are better protected against natural hazard risks.

Not only will the RANET systems, which operate 24 hours a day throughout the year, transmit real-time warnings of windstorms and thunderstorms; they will also warn against the earthquakes, volcanic eruptions and tsunamis, to which Tonga is also prone. Generally, the warning system will also bring improvements for air traffic by providing enhanced meteorological readings in addition to warnings. Furthermore the system will improve the quality of meteorological forecasts for the island kingdom. Scientific circles, including meteorologists and universities, will also benefit from the data generated by the RANET systems.

The key issue for the Munich Re Foundation, however, is to provide better warnings for the people at risk.

The RANET-System at the airport of Fuaifua, Vava'u. Antennas receive data about hydrological, meteorological and seismic processes. Technical staff analyse the information, making detailed forecasts possible.

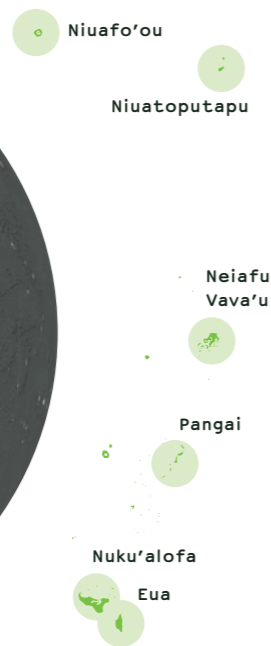
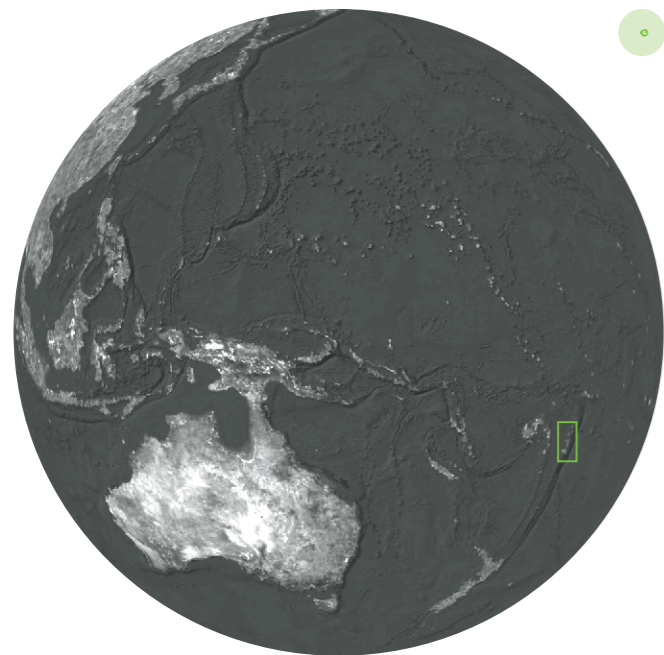


## Facts on Tonga

The South Pacific Kingdom of Tonga comprises more than 160 islands and atolls, only 36 of which are inhabited. The island kingdom is the only state in Oceania never to have been subject to European colonial domination. In 1845, the Friendly Islands, as they had previously been called, united to form a Polynesian kingdom which became a constitutional monarchy 30 years later. Although Tonga became a British protectorate in 1900 and joined the Commonwealth in 1970, it retained its original independent status. Since 1999, the island state has been a member of the United Nations.

The monarchy is very much a feature of Tonga's society and the country's ruling class wields considerable influence. Despite a substantial gap in income between the ruling class and the remaining, relatively poor sectors of the population, the existence of the monarchy is not in question. However, since 2006, the democracy movement, which is demanding greater transparency in politics and better parliamentary representation for the people, has been making headway. Economically, Tonga is very much dependent on agriculture and tourism, industry accounting for only 17% of GDP.

Tonga faces a number of natural hazards due to its exposed location in the Pacific Ocean. These range from storms, tropical cyclones and floods to earthquakes and tsunamis.



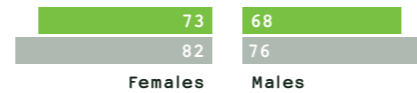
### Insights

Tonga / Germany

Urbanisation in %



Life expectancy in years



GDP per capita in US\$



Population below poverty line in %



### Tonga

Area  
748 sq km  
Population  
120,000  
Population density  
160 inhabitants per sq km

### Natural hazard risks

Cyclones (October to April), earthquakes, seaquakes and tsunamis, volcanic activity, floods

## Looking ahead – Incentives for further development

Now that the system is up and running, Tonga's Meteorological Service and National Disaster Management Office have been pressing ahead with plans to extend it further. The Tonga government has given the go-ahead for Niufo'ou, Niuatoputapu and Eua to be equipped with the RANET early-warning system as well.

Bearing in mind the disastrous consequences of the September 2009 tsunami for Samoa and the northern Tonga island of Niuatoputapu, such measures are needed as a matter of urgency. One key component of a fully functioning system is the need for a sustainable strategy. It is not enough to set up a system ill adapted to the needs of the people at risk. They have to be a part of the process. On remote islands, for instance, with no television or radio stations, alternative means must be found to reach the inhabitants such as private radio systems providing individual communications.

It is also important to demonstrate the point of such systems to those at risk. Only then will they gradually assume ownership themselves until the system can be effectively replicated elsewhere, closing the unfortunate gaps still to be found in the system.

## Our project partners

**MetService**  
Meteorological Service of New Zealand Ltd.

**TMS**  
Tonga Meteorological Service

**VMS**  
Vavau Meteorological Service

**NEMO**  
Tonga National Emergency and Management Office

**EMWIN**  
Emergency Managers Weather Information Network

**NOAA**  
National Oceanic and Atmospheric Administration

**Picture credits**

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Jocelyn Carlin, Panos Pictures  
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Maliu Takai, Tonga National Emergency  
and Management Office  
Page 9 left and right top

Garry Clarke, Meteorological Service  
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Page 9 right bottom

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