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The Myth of the “First Climate Refugees” – Population Movement and Environmental Changes in the Torres Islands (Vanuatu, Melanesia)

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Abstract
Since the late 1990s, rising sea levels in the Torres Islands, which are situated at the northern end of the Vanuatu archipelago, has been a concern for local and international communities. In 2004, the village of Lateu on the island of Tegua was moved several hundred meters with the assistance of the Vanuatu Government and Canadian aid. On the international stage, these villagers became history’s “first climate refugees,” and were presented as victims of global warming. Our study focuses on two villages on two different islands in the group, where coastal morphology has undergone changes over the last 12 years, a phenomenon attributed to global warming and its corollary, rising sea levels. This paper presents an analysis of the geophysical and eustatic data explaining the relative variation in the sea level. While global warming is a factor in rising sea levels, it does not play the dominant role attributed to it in the Torres Islands floods. In fact, tectonic movements, both sudden (earthquakes) or slower interseismic (between earthquakes) ones, plus temporary changes in sea level in the Pacific basin, connected for example to the El Niño/La Niña Southern Oscillation, are the main reasons for the rapidly rising waters observed over the 1997-2009 period. The Torres Islands are a sparsely populated group of islands whose demographic vicissitudes have greatly influenced the current distribution of inhabitants. Although most Torres Islanders now live near the coast, this was not always the case, and they are more sensitive to environmental changes in the coastlines than when they lived further inland. Furthermore, their beliefs, in certain supernatural powers able to control the natural elements, remain in the background of their acquired Christian values, which themselves are not particularly oriented toward modernizing the islanders’ perception of environmental threats.

Keywords
environmental changes, traditional societies, vertical tectonic motion, sea level rise, climatic refugees, El Niño, Torres Islands, Vanuatu.
Introduction

Environmental changes are complex phenomena to diagnose, requiring researchers several years of observation, measurement, and analysis. Currently, however, since climate change, and more specifically global warming, have been at the center of environmental debate, there is a tendency to attribute the majority of environmental changes to these causes. For example, the 2005 UN Climate Change Conference in Montreal served as a media springboard – with little science behind it – for the story of localized environmental change that brought the small island of Tegua (less than 32 km$^2$) in the Torres Island group in Vanuatu onto the international stage. The population of the only village on the island became known as the “first climate refugees” in the history of the global fight against the warming climate. The spoken and written media attention that followed (still available on the Internet) reveal a lack of professional distance, running headlines such as: “Climate Barbarity Underway” or “Global Warning: Devastation of an Atoll,” despite the warnings of climatologists against jumping to over-simplified conclusions.1

In a world fearful of global warming, the announcement of the “first official case of forced displacement” of coastal populations is not harmless. It suggests that an anticipated chain of events has already started, reinforcing global pessimism about climate change. The islanders, who for their part no longer have any point of reference for understanding the environmental upheavals they are undergoing, rely on state authorities and international aid for responses to the situation. This article does not dispute that climate change is taking place, but it does intend to clarify, in the specific case of the Torres Islands, the various mechanisms at work in this geographical area. It documents environmental changes affecting the Torres Islands and how they are perceived by the local population.

1 Population and presentation of the sites

The Torres Islands are the northernmost islands of Vanuatu. Located between 13°04’ and 13°27’ south, and 166°32’ and 166°43’ east, the group comprises six small islands (Hiw, Metoma, Tegua, Linua, Loh, and Toga) with a total area of 111.8 km$^2$, and extends over 45 km along a north-south axis. The islands form the province of Torba with the Banks Islands, located less than 100 km away to the east-southeast. This province, the least populated of the six provinces of the

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The archipelago, represents only 4 percent of the total population of the country (0.6 percent of the total population for the Torres Islands) (VNSO\(^2\) 2009).

1.1 The Population of the Torres Islands

1.1.1 A Turbulent Demographic History

The results of archaeological excavations on the islands of Toga and Tegua show ancient settlements dating to 2400 BP and 2000 BP respectively (Galipaud 1998). Apart from this work, we know little about the prehistoric settlement of the island group. As for the population at the time of first contact with Europeans, the estimates are more varied, whether well-founded or speculative, and follow the pattern of population estimates for the whole archipelago at the end of the nineteenth and beginning of the twentieth centuries. Sailors, missionaries, and anthropologists provided the first historical estimates before the condominium administration undertook official counts. Captain James Goodenough (1876) of the British Navy was thus the first to estimate, in 1875, the population of the Torres Islands, at around 1,500 inhabitants. This figure is the closest to the estimate made a few years later by the German anthropologist Felix Speiser (1913), who refers to 1,000 inhabitants. On the other hand, in 1894 and 1910 two other population estimates suggest the more sizeable figures of 4,500\(^3\) and 3,500\(^4\) inhabitants, respectively. Then in 1922, according to Buxton (1929), there were only 253 Torres Islanders on the four main islands. Taking the example of Toga, he adds that only 16 inhabitants remained there in 1926 after seven people in the village were “recruited” the previous week. Over the following decades, the population of the Torres Islands further dropped, with no more than 200 inhabitants up to 1967, the date of the condominium’s first census (McArthur and Yaxley 1967). Since the 1970s, decennial censuses published by the Department of Planning and Statistics (1983) and the VNSO (1989) show that the population is slowly growing, reaching 826 in 2009, or 6.8 people/km\(^2\).

The depopulation of the island group from the late nineteenth to the early twentieth century is due to two historical events. Firstly, the recruitment of manual labor, mainly to Australia, known as “blackbirding,” which lasted from 1863 to 1904; and secondly, epidemics of disease contracted from passing sailors, missionaries, and people returning from the Queensland plantations. We do not know how many people were recruited in the early years of labor trafficking, but very conservative figures mention approximately 752 departures over the period from 1873 and 1903, or an average of 25 people per year over 30 years. By 1903, about 452 Torres Islanders were said to have come back from the plantations, or an average of 15 people a year for over 30 years (McArthur and Yaxley

\(^2\) Vanuatu National Statistics Office.


\(^4\) Official figure according to McArthur and Yaxley (1967).
1967). The Torres Islands thus lost, in absolute terms, 10 people a year during the final 30 years of blackbirding. These figures do not take into account the lack of births due to the absence of a large proportion of the young men (in 1912, Rannie counted more than 10 women for every man on a Torres island in the late nineteenth century), or the excess mortality caused by the foreign diseases, in particular influenza and dysentery.

Today, if we only consider recent figures, the population of the Torres Islands is growing faster than the average annual growth rate of the country, namely 2.62 percent per year compared to 2.3 percent in urban areas and 1.9 percent for rural areas of the archipelago. This figure is explained by a very small starting population, resulting in statistics that are unrepresentative. Thus the island of Tegua increased from 39 to 58 inhabitants between 1999 and 2009, an increase of 19 people and an annual growth rate of 4.05 percent. This figure does not take into account the disparity between islands, however, and helps mask the loss of 22 people in 10 years from the island of Toga, consisting of 17 men and 5 women. Further, all the islands of the group show anomalies in the ratio of males to females. They show the reverse of the other islands of the archipelago, where there are an average of 104 men per 100 women. In the Torres Islands in 2009, there were 88 men for every 100 women (VNSO 2009). We know that this discrepancy is not due to excess male mortality, because the life expectancy of men in the Torres group is 66.6 years, while that of women is 51.9 years, the lowest in the archipelago (Siméoni 2009a). Further, we can note that between 1967 and 1999 the ratio was 112 males to 100 females, so it seems that the group is experiencing a significant exodus of men. This situation can be explained by the modern geographical organization of the country into a center and a periphery, which is in turn exacerbated by the morphology of the archipelago. Since the second half of the twentieth century, the inter-island transportation network has neglected marginal areas such as, among others, the northern and southern extremities of the country (Siméoni 2009b). As the state of inter-island communication deteriorates year by year, the Torres group appears in the twenty-first century as a backwater of Vanuatu. The sea link takes place once or twice a year. Similarly, the Linua airfield, located more than four hours away by twin-engine aircraft from Vanuatu’s capital, Port-Vila, is the farthest point from the capital in distance and time, and much farther away in terms of flight time from international destinations such as Noumea (New Caledonia) and Brisbane (Australia), which take 55 minutes and three hours respectively to reach by jet. From the Linua runway, it takes 1-3 hours more by speedboat, weather conditions permitting, to reach the coastal villages of the islands of Hiw, Tegua, and Toga. Moreover, the cost of transportation is unaffordable for the vast majority of people on these small islands. The current socioeconomic marginalization of the Torres Islanders has weakened the population by causing profound anxiety about its future prospects (Mondragón 2003), which may explain both the Torres Islanders’ sensitivity to catastrophist messages and the departure of the young men who have the means to leave.
1.1.2 Contemporary Upheavals in the Distribution of the Population

Population distribution across the islands was strongly influenced by the arrival of Christianity. In the 1870s, the Torres Islands were brought under the influence of a branch of the Anglican Church known as the Melanesian Mission. At that time villages were spread over the islands’ inland plateaus, as evidenced by both archaeological traces (Galipaud 1996) and the travel accounts of Bishop Selwyn in 1880, which counted 22 to 25 villages on Tegua and 32 on Toga (Montgomery 1896, 104). Each hamlet comprised an extended family of about 25 people. The missionaries regrouped their new converts into larger villages – such as Vipaka on Loh, established in 1872, and later on Toga and Tegua, in the 1890s – and relocated them to the coastal terraces, which offered easier access by sea; and also the benefit, rare on these coral islands, of a few sources of water, which allowed priests to instil concepts of hygiene in the local population. The near-absence of water on the plateaus adversely affected the health of inhabitants, and the mortality rate from skin infections was very high (Armstrong 1900, 203-204). Unfortunately, coastal population distribution of the new converts also facilitated the work of ships recruiting labor for Queensland, to the great dismay of the first missionaries, leaving them only the elderly, women, and young children (Montgomery 1896, 119-136; Armstrong 1900, 204 and 297).

Map 1 – The Torres Islands in the Vanuatu archipelago.
After this, it seems that the Torres Islanders’ entry into the cash economy drew them a little closer to the shore. From the first decades of the twentieth century, the few survivors of these major cultural and demographic upheavals established their own commercial coconut plantations on the coastal terraces, and new villages under the plantations. These include the present-day large villages of Lungharigi, on Loh, founded in 1930; Lateu (or Lataw), probably from the same period, on Tegua; and Yeu Gavigamena (1950), on Hiw.5

1.2 Presentation of the Two Inhabited Sites on the Coast

Seven or eight superimposed coral terraces are observable in the Torres group. Their peaks reach variable altitudes depending on the island: 366 m on Hiw, 240 m on Tegua, 115 m on Metoma, 135 m on Loh, and 254 m on Toga. Abrupt cliffs border the steps and plateaus. The recent coastal terrace where the studied sites are located are made up of 3-4 levels: 0-2 m, the floodplain; 3-7 m, the most extensive level; 10-15 m and 20-25 m, the relatively older plateaus (Quantin 1980).

1.2.1 The Site of Lateu on the Island of Tegua

All that remains of the village of Lateu, at the heart of the bay of the same name, is a makeshift shelter. Having had their village flooded multiple times, the residents moved a few hundred meters to the south, on the same coastal terrace. Following an earthquake in 1997, whenever there was a tide with a high coefficient or a passing low atmospheric pressure system, seawater flooded the village to waist height. These repeated incidents led the village chiefs to consider relocating the only village community on the island (39 inhabitants according to the 1999 census) to a place known as Lirak. The residents of Lateu did not move until 2004, however, as they were unwilling to leave the fresh water source, despite the occasional risk of rising water and their awareness of the potential dangers of the ocean. It was a 2001 visit by a Vanuatu government official in charge of national environmental issues, in the context of a regional project on adaptation to climate change led by SPREP (Secretariat of the Pacific Regional Environmental Program) and funded by CIDA (Canadian International Development Agency), that helped convince the population of the urgency to move – by attaching the words “climate change” and “rising sea levels” to the events they had experienced. After this, in 2002, one of the village chiefs moved permanently to Lirak, followed in 2004 by the entire community (fewer than 60 people). Thus it took seven years, between 1997 and 2004, for the villagers to reconcile themselves to the move; and it was only eased by the installation of six 6,000-liter tanks and six tin-roofed sheds for collecting rainwater, thereby solving the problem of access to fresh water. Ultimately, according to Richmond Selwyn and Reuben Selwyn,

5 Respectively: Chief Pita Watego (Lungharigi), Chief Richmond Selwyn (Lirak), and John Atkin, (Yeu Gavigamena), personal correspondence.
who are Lirak’s chiefs, the flooding problems apparently stopped following the earthquake of October 2009.

1.2.2 Lungharigi Lagoon in the Extension of Ngerein Bay between Loh and Linua

To the north of the village of Lungharigi, the lagoon that separates the islands of Loh and Linua made inroads into the coconut plantation adjacent to the village, gradually asphyxiating the trees over an area over 400 meters long and about 100 meters wide. Since the 1997 earthquake, the villagers, about 80 of them, observed this finger of seawater slowly progressing year by year into the northwest extremity of their village. Similarly, some small low-lying areas around the village evolved into wetlands that were increasingly subject to flooding since the tectonic event. Dramatic images of the coconut plantation as victim to “rising sea levels” have circulated throughout the region on SPREP (2003) or SPC (Secretariat of the Pacific Community) (2009) brochures. The village is not under immediate threat, but when questioned the residents of Lungharigi say that they have really become aware of “global warming since 1997” and that they had front-row seats to a global phenomenon that deteriorated until 2009, the date of another Torres Island earthquake, at which point, according to them, “everything went back to normal.”

Field surveys show that for both sites concerned, the environmental changes began with the seismic event in 1997 and disappeared with the event in 2009. The geophysical and eustatic data have thus been analyzed and compared over the same period to obtain a better understanding of the phenomena causing the upheavals experienced by the Torres Islanders.

1.3 Natural Events Affecting the Torres Island Group
and the Environmental Changes Connected to Them

The islands of the Vanuatu archipelago are located on the western edge of the Pacific Plate, in an area called the North Fiji Basin. They run along the New Hebrides Trench, which, situated to the west of the country, reaches a depth of nearly 7,500 meters. Along this trench, the Australian Plate subducts under the North Fiji Basin. The average rate of plate convergence between the Australian Plate and the North Fiji Basin is 12 cm per year (Dubois et al. 1977), and varies depending on local tectonics (Pelletier et al. 1998; Bergeot et al. 2009). The many earthquakes affecting the region are connected to this rapid subduction.

1.4 The Vertical Motions of the Islands

1.4.1 The Geodynamic Context and Long-term Vertical Motion

As is classically observed directly above subduction zones, there is a chain of active volcanic islands on the overriding plate. In the north of the archipelago, this active volcanic chain is represented by islands in the Banks Islands group.
The Torres Islands, like the islands of Santo and Malakula in the center of the archipelago, are in a less typical position. Their uplift is related to the presence of submarine reliefs (the West Torres Plateau and the d’Entrecasteaux Ridge) on the subducting plate, which impede the subduction and push up the overriding plate. This uprising can be created directly by the volume of the subducting relief or by flexures due to the blockage caused by the relief (Taylor et al. 2005).

The Torres Islands are formed on a former volcanic basement that has been covered over by quaternary limestone reefs (< 1.8 million years) (Pelletier 2009). Their morphology of superimposed terraces is typical of coral islands that have undergone significant and rapid changes in relative sea level, whether caused by eustatic factors or related to tectonic upheavals. Coral dating has indicated an average uplift of the Torres Islands of around 1 mm per year over the last 125,000 years (Taylor et al. 1985). This vertical motion is the cumulative effect of several movements taking place on different time scales.

1.4.2 Short-term vertical motions: the role of the seismic cycle

In tectonically active zones, the vertical motions of the earth’s crust are, in the short term (about 10-100 years), usually dominated by the seismic cycle. During this cycle, strain due to the slow movement of the plates accumulates between two earthquakes (the interseismic phase) and generates slow movements. This strain is then released during the rupture (earthquake), which is accompanied by sudden movements (coseismic deformation).

On April 21, 1997, a strong, 7.8-magnitude, earthquake affected the whole Torres Island group (Kaverina et al. 1998). With the epicenter located about 50km west-northwest of the group, and at a depth of 20-30km, it is one of the strongest known seismic events in Torres Islander memory. Following the earthquake, Jean-Michel Boré (ORSTOM, Port-Vila) carried out an assessment mission and observed that some coastal areas had subsided, such as Picot Bay (northwest coast of Hiw), on Tegua, and in the Lungharigi lagoon between Loh and Linua, which could no longer be crossed at low tide on dry land as before. From the testimonies of residents and observations made from dives, Boré was able to estimate the coseismic vertical displacement of the April 1997 earthquake to a subsidence of between 50 cm and 1 m to the north of the island Loh. A geodetic marker was installed at that time on the island of Linua to monitor the post-earthquake deformations. The position of this marker was measured by GPS (Global Positioning System) in 1997, 1998, and 1999, again in May 2009, and then after the seismic event of October 2009, when three strong earthquakes with magnitudes of 7.6, 7.8, and 7.4 (occurring within 70 minutes) affected the Torres group.

Office de la Recherche Scientifique et Technique Outre-Mer (Office of Scientific and Technical Research Overseas), now IRD (Institut de recherche pour le développement, Research Institute for Development).
As the vertical component is the least accurate in the GPS system, the data were collected and processed using a strategy tailored to the measurement of vertical motions (Ballu et al. 2011). In order to compare measurements taken at different times, the daily coordinates were combined in the ITRF2005 (International Terrestrial Reference Frame 2005) (Altamimi et al. 2007). Assuming the deformation between two seismic events is linear, an estimate of the interseismic velocity and possible coseismic displacements is obtained for each calculated site.

For the Torres Islands point, our results show that between 1997 and 2009, the site underwent subsidence of $0.94 \pm 0.25$ cm per year, or about 11 cm in 12 years. This rate of subsidence, linked to the seismic cycle, is among the largest observed on earth (along with West Sumatra [Natawidjaja et al. 2007]). The vertical coseismic deformation associated with the earthquake of October 2009 is estimated at $19 \pm 0.5$ cm. The testimonies of the villagers on Loh and Linua are consistent with this observation of uplift. In fact, they refer to the drainage of wetlands and certain wells and observe some “return to normal,” referring to the years prior to 1997 when concerns about flooding were nonexistent.
The incursions of the sea into the islands’ coastal fringes, the increase in the number of floods experienced by some coastal villages, and the expansion of the wetlands had until then been considered only in terms of “global warming.” However, our results suggest that the sudden subsidence caused by the 1997 earthquake, and the following slow subsidence during the interseismic period from 1997 to 2009, greatly contributed to the relative sea-level rise in the Torres Islands. Also worth noting is that the sudden rise of the relative sea level and the tsunami associated with the 1997 earthquake could also have caused the more slowly evolving erosion phenomena, altering local hydrodynamics and damaging or weakening natural barriers. This has undoubtedly contributed to the population’s thinking that the origin of the change in sea levels could not be tectonic (sudden), but was due rather to climate change.

### 1.5 Changes in Sea-surface Height: Global Warming and Decadal Variations

According to the Intergovernmental Panel on Climate Change (IPCC), the sea level has risen across the globe by an average of 0.18 cm per year since 1961 and 0.31 cm per year since 1993, as a result of global warming, thermal expansion, and the melting of glaciers. According to the IPCC (2007), the acceleration of the rate between 1993 and 2003 may reflect either a decadal variation or an increase in the long-term trend. The rise in sea levels is not uniform across the globe, and global maps produced by different agencies based on satellite altimetry data are used to analyze trends by region (Fig 1). Over the 1992-2010 period, there is clearly a sea-level rise greater than the general trend in the western Pacific and lower than the general trend in the eastern Pacific. In order to look at the chronological evolution of the sea level in the Torres Islands region, we have used a temporal series of anomalies in the sea level, obtained by combining altimetry data from several satellites (the combined product of the satellites Topex/ Poseidon, Jason1, Envisat, and Jason2). These data show that in the region of the Torres Islands, the trend over the 1992-2010 period is in the order of 0.8 cm per year, which is well above the global trend of 0.31 cm year estimated by the IPCC over a comparable period. Over the 1997-2009 period, which corresponds to the interseismic period that concerns us, the observed trend for the area is even higher, on the order of 1.2 cm year.

We should note that the recording period of satellite data that allows sea-level variations to be quantified is short (less than 20 years) in relation to the temporal constants of the observed phenomena. In fact, the Pacific Ocean is the site of meteorological phenomena that occur over periods of several years, such as the Southern Oscillation, which is accompanied by a balancing effect on sea levels on either side of the Pacific. In neutral periods, the sea level is higher in the west

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7 Data produced by Ssalto/Duacs, distributed by AVISO, with support from the CNES (Centre national d’études spatiales/National Centre for Space Studies).
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of the basin because the trade winds, blowing westwards, push the surface water and create a “pile-up” of ocean water on the Australia-Indonesia side. The sea level there is 60 cm higher compared to the level on the Peru-Ecuador coastline (McPhaden 2004). During an El Niño, the sea level rises in the eastern Pacific basin from the combined action of thermal expansion and the weakening of the trade winds, and there is a corresponding decrease in the sea level observed in the west of the basin. Although these anomalies in the sea level are more significant in areas near the equator, regions in tropical zones and sometimes beyond may be affected, as observed by tide-gauges services in San Francisco (Ryan et al 1999) or Port-Vila (SPSLCMP\(^8\) 2009) during the 1997-1998 El Niño, the first reporting a rise in the sea level of 15 cm, and the second a drop of 12 cm. During La Niña periods, the trade winds become stronger and push surface water even more towards the west so that the sea level is slightly higher than normal in the western basin. During the interseismic period we are concerned with, from April 1997 to October 2009, the Pacific experienced an alternation of five El Niño episodes (a strong one in 1997-1998, moderate ones in 2002-2003, 2004-2005, 2006-2007, 2009-2010) and two La Niña episodes (1998-2000, 2007-2008).\(^9\)

Given the time scale and the magnitude of the phenomena associated with the Southern Oscillation, the regional trend of rising sea levels currently estimated from 20 years of satellite data is not significant, insofar as it does not reflect a long-term trend that would be linked to global warming, but is strongly influenced by the strong El Niño episode of 1997-1998.

The altimetry data of sea-level rises cover a period of less than 20 years and do not yet indicate long-term environmental changes. In this article, we will use these data for the interseismic period being studied (1997-2009) in order to understand the environmental changes experienced by the Torres Islander population during this period.

1.6 Combined Vertical Motions of the Islands and Sea Level Changes during the Period Studied

The relative variations in the sea level, as perceived by the islanders, are the result of a combination of absolute movements in the sea level and the vertical motions of the islands themselves. For the Torres Islands, these variations are strongly determined by the vertical motions of the islands. While the absolute sea-level rise was estimated to be about 14 cm between 1997 and 2009, the islands underwent a subsidence estimated at more than 50 cm in 1997 (coseismic deformation), then a slow descent of 11 cm over the same period (interseismic subsidence). In 2009, during a strong earthquake, the islands were raised by

\(^{8}\) South Pacific Sea Level and Climate Monitoring Project.

about 20 cm, leading the local population to believe that climate change was “slowing down” (Ballu et al. 2011).

Fig. 1 1992-2010 Mean sea-level trend (in mm/y)

Measuring the various contributing factors to relative sea-level changes in the Torres Islands in the recent period does more than allow us to understand the phenomena involved and explain the observed floods. It is also crucial for giving the residents of the Torres Islands tools to understand these phenomena better, including what future changes they will inevitably face, thereby acquiring a greater ability to adapt. Firstly, for the ocean, the oscillations between El Niño and La Niña will continue regardless of global warming, and cause noticeable short-term changes in sea level. Added to these disturbances lasting from one to several years are variations of shorter duration, related to tides and meteorological phenomena. Tropical low-pressure systems raise the sea level by about 1 cm per mb of pressure, and the storm tides caused during strong hurricanes can raise the sea level by up to several meters above normal. Life on the coastal terraces is thus threatened by a series of climate phenomena that existed long before people settled on the islands, and can logically be expected to continue.

Secondly, there is now a better understanding of the seismic cycle of the Torres Island group. Generally speaking, the placement of these islands on the edge of
an overriding plate should cause them to be lifted up. Special events, however, such as that occurring in 1997, can cause them to subside. It is effectively the interplay of the many faults around this group of islands that determines the direction of the vertical motion, depending on their location in relation to the epicenter of an earthquake. Overall, given the location of the islands in relation to subduction, the accumulation of strain between two earthquakes results in a generally downward movement as seen between 1997 and 2009.

Fig. 2 Contribution of different environmental factors to relative sea-level variations

Thus the conjunction of meteorological and tectonic factors, coming on top of a slow rise in sea levels due to global warming, lead to changes in sea levels that sometimes give the impression of an abnormal rise. A better understanding of
these phenomena by the local populations should enable them to understand the risks that may result from settling at altitudes lower than about 10 m.

2 The Islanders’ Perception of Environmental Changes: A Mixture of Traditional Beliefs and Media Reportage

The Torres Islanders who live on the coast have settled in high-risk areas, a hazardous choice dating from about half a century ago and connected to contemporary history. What awareness do they have of this risk, and what is their current perception of their environment?

2.1 The Loss of Traditional Historical and Geographical Points of Reference

Numerous factors explain why some populations have naively chosen to settle on the seafront in the Torres Islands. For one, the animistic religion of an oral society with low levels of hierarchical organization was not able to withstand the powerful preaching of dogma by the Anglican Church. In less than a century, demographic erosion, and the acculturation of those who did not leave, thrust the Torres Islanders into an environment in which history is accessible only in fragments, so that their points of reference lie somewhere between old beliefs and modern information. Conversion to Christianity removed some magic from the islands, for better or worse. The disappearance of supernatural powers attributed to men or particular locations may be rationally understood, but the loss of the accumulated empirical knowledge of a people, transmitted orally from generation to generation, presents a more alarming situation for those concerned about the value of maintaining knowledge diversity. Similarly, depopulation (from labor trafficking and disease) continued the work of cultural erosion started by the Church, upsetting the process by which traditional knowledge was transmitted. This is true not only in the Torres Islands; the same phenomena were occurring in the early twentieth century in the other islands of the archipelago. Deacon (1934), an anthropologist based on the island of Malakula, for example deplored the fact that a large number of victims of devastating epidemics were “old men who knew the various ancient rites.” Durrad drew the same conclusions in the Torres Islands, adding that with the impact of depopulation on traditional culture, it proved “extremely difficult, if not impossible to conduct scientifically sound investigations.”

Pessimistically, he went so far as to say that his own field notes would have “collected what will soon be no longer possible to observe” (Durrad 1940, 391-392). Today, while some of the legends that in former times went into making up history are still passed on, they are never preserved in all their details, and only the key highlights are

10 Reverend W. J. Durrad was a missionary to the Torres Islands from 1905 to 1911.
remembered. Likened to pre-Christian beliefs and the “dark ages,” as the islanders say, the risks evoked in these supernatural stories seem to appear to the Torres Islanders as no longer existing for islands now living in the peace of the Lord. Fragments of these traditional stories that have survived tell of events that could have been experienced by recent ancestors or the first settlers; their historical distance is unknown.

In our study, we collected several versions of two traditional legends about earthquakes and tsunamis. These explain how, in former times, men had magical powers that allowed them to create these phenomena.¹¹ The first legend, which seems to be a universal tale in the Torres Islands, tells of an old man who has drunk a potion that has made him immortal. Later, no longer able to bear the great infirmity of his old age, he begs his sons to help him die. Performing a series of gestures and magical incantations, the sons conjure up a tidal wave that sweeps the old man away.¹² The second legend, collected on the island of Loh, is also about a father, who is so saddened by the death of his child that he generates a tsunami-causing earthquake at the funeral. This mythological episode has left a trace in the landscape in the form of a huge white rock that broke off the cliff at the time of the earthquake and is still visible on the northwest coast of the island.¹³ These two stories suggest the vulnerability of the Torres Islanders both to tsunamis caused by local earthquakes (legend two) and to teletsunamis (legend one) caused by more distant earthquakes whose shock is not felt locally. The possible occurrence of these natural events in the Torres Islands was confirmed by our field observations, with a visit to a site affected by the 1997 tsunami in Rinuha (Loh), and an area of land covered in coral debris in the village of Lirak (Tegua), which could be evidence of at least one major marine incursion that could have been the result of a tsunami. The village chief confirmed to us that this hypothesis was consistent with the oral traditions, and that the debris we saw covers the sites where the tsunami was said to have passed through in legend one. Similarly, archaeological evidence of ancient tsunamis has been revealed by excavations in Kurvot (southeast Toga). This site indicates two phases of human occupation, the first dated 2400 BP and the second in the last millennium, separated by a period of neglect evidenced by a layer of sterile sand that, according to Galipaud (1996), could plausibly have been caused by a tidal wave; a fact corroborated by an ancient legend collected at the scene.

If in the twentieth century the inhabitants of the coastal villages have settled almost on the beaches despite knowing these legends, it is because events such as earthquakes and tsunamis have never been regarded as natural hazards.

¹¹ Field surveys conducted among chiefs and other villagers (cited in the following notes) in a mission to the Torres Islands June 25-28, 2010.
¹² According to Chief Richmond Selwyn (Lirak on Tegua), John Atkin (Ye Gavigamenaon Hiw), William Collins (Lungharigion Lo).
¹³ According to Chief Pita Watego (Lungharigi on Loh).
They were effectively perceived as the result of supernatural magical powers that some men used for specific purposes, just as they used weather magic that could make clouds, wind, or rain (Mondragón 2004). The formal ban by the Anglican Church on all traditional practices intended to cause death was interpreted by the Torres Islanders as a liberation from the risk of deadly tsunamis, because in their collective memory it was humans who traditionally caused them. For this reason, and with no alternative framework for understanding natural phenomena offered in the missionaries’ educational system, the islanders naively settled in potentially dangerous areas.

2.2 The Role of International Organizations and the Media in Constructing the Myth of the “First Climate Refugees”

The news of a village threatened by the ocean caused a stir in a world fed on fears of global warming and rising sea levels, the leading themes of the major international meetings on the environment. The case of the Tegua “refugees” was ushered onto the international stage after being discussed in a meeting held under the auspices of the UNEP (United Nations Environment Programme), at the 11th session of the Conference of the Parties to the UN Framework Convention on Climate Change, in Montreal on December 6, 2005 (UNEP 2005). This date, proclaimed the first “Arctic Day,” was designated to launch UNEP’s new GRID-Arendal (Norway), Polar Programme’s “Many Small Voices” project, to raise awareness of the effects of climate change on two remote vulnerable regions and thus reveal a fate shared with Arctic communities and the populations of small developing island states (UNEP 2005). While linking the Torres Islanders with the Inuit in this context is not a problem in theory, the zeal in backing the idea of “first climate refugees” in the Teguan case presented by UNEP was surprising, and it heightened the story’s impact (George 2005). Such extraordinary news quickly echoed around the media as “the first example of a mass displacement due to global warming.” That month, the Teguans appeared in the international press as history’s first climate refugees due to rising sea levels.14

Unfortunately, the lack of scientific objectivity in the content of these sensational reports is a double-edged sword.15 On the side of the general public, it dramatizes the impact of climate change a little more, while on the side of a more informed public, it discredits the catastrophist campaigning by some activists in the environmental movement.

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The story was subsequently reproduced in the reports of large organizations, governmental, non-governmental, and international. In 2006, the US-AEPI (United States Army Environmental Policy Institute) presented the case of the first climate refugees of Tegua in its annual report on environmental security. AEPI reports are based on analyses of the international press and are intended to help the Department of Defense develop policies and strategies for improving or resolving environmental policy issues that may have a significant impact on the armed forces in the short or long term. Similarly, the 2006 IWGAI\textsuperscript{16} Directory (244) refers to the Teguans as “the first refugees of the Kyoto Protocol . . .”

Some may find it surprising that these reports are based on newspaper articles rather than the scientific literature. There are in fact no scientific articles on the subject of rising sea levels in the Torres Islands. In an international environment ready to attribute any phenomenon to global warming, it seems both reasonable and necessary to call on international experts to conduct fieldwork, because incorrect diagnoses cannot solve problems in the long term. Finally, it is important to use terminology that is appropriate for the situations actually observed on the ground. Cournil and Gemenne (2010) warn against the misuse of the term “climate refugee,” which suggests an international migration like that of political refugees, whereas the most common strategy for adapting to environmental changes is often simply a local shift of the population at risk, which is what happened in Tegua.

2.3 A Solution for the Torres Islanders: Bringing Their Past and Present Geographical and Historical Knowledge into Alignment

Several villages in the Torres Islands are still vulnerable to destructive natural events. Having moved down from the upper levels of their islands over the course of the twentieth century, it is time for these villagers to realize the dangers by absorbing the lessons of the 1997-2009 interseismic episode. There is no need to refer back to ancient times in the Torres Islands to be aware of the environmental issues. The changes in the landscape are recent enough for one of our correspondents, age 63, to have seen major changes in the morphology of the northern coast of the island of Loh in his lifetime. In his childhood, he said, the northeastern tip of the island was a separate islet. Similarly, the wetlands located northwest of the present village, which the inhabitants saw progressively filled with water during the interseismic period, was apparently once a lagoon used by the former inhabitants to trap the dolphins they hunted.\textsuperscript{17}

\textsuperscript{16} International Work Group for Indigenous Affairs.

\textsuperscript{17} Bretin Wokmagena (Lungharigi), personal communication.
Today, even the most isolated communities are exposed to information that can distort their perception of their own environment. Equally, having been presented as victims of global warming has enabled some Torres Islanders to grasp their position from a global perspective, hearing a global resonance rather than that echoed by traditional beliefs. Some of the villagers we met during our visit were concerned about and more aware of the fact that the ocean could be a source of danger. In the village of Lungharigi, the residents living closest to the coast have decided to move back from the shoreline to one of the intermediate levels of the island. But the broader geographic, global perspective of the Torres Islanders has not kept them from preserving their dichotomous view of history. For them, there is always a “before” and an “after” Christianity, and some past events do not seem amenable to reinterpretation according to current knowledge. Despite their retreat inland from the coast (all homes are now located between 130 m and 200 m from the shoreline, but remain on the same coastal terrace), the case of the Teguan villagers is still worrying for this reason. On the north-south path between the old and new villages, covering about 200 m, we observed considerable coral debris that seemed relatively recent in geological terms. These deposits may be connected to a marine incursion caused by a tsunami or a cyclone. The same debris and larger blocks are visible on a large scale throughout the new village of Lirak, and there is a notable absence of soil, though the villagers say they cut down trees to establish the village. As he told us the legend of the immortal old man swept away by the teletsunami, the chief...
claimed we were standing on the site of this “mythological” episode and pointed out the path of the wave through his new village. There is much to suggest that the villagers are still not aware of natural hazards; that they still believe in the magic supernatural powers of the past as told in the legends, but at the same time accept that all of that is well and truly over. Education is critical for these extremely isolated islands, so that the islanders have new tools for understanding their environment and become active in the prevention and management of natural hazards. By replacing magical beliefs with scientific explanations of environmental hazards, the Torres Islanders could no doubt build a geographical culture that would improve their living situation on their islands, adapted to the natural changes rather than suffering from them.

**Conclusion**

These days, we too readily attribute certain environmental changes to global warming. In the Torres Islands, the main reasons for the rapidly rising sea levels observed between 1997 and 2009 were tectonic movements – both sudden earthquakes and slower, interseismic movements between earthquakes – and the El Niño/La Niña Southern Oscillation, causing temporary changes in sea levels in the Pacific basin.

The Torres Islanders’ perception of environmental change is distorted by several factors, not least the media coverage of the sea-level rise that linked it to global warming, but especially by the loss among these islanders of important historical and geographical points of reference. Independent of climate change, there are real risks associated with settling in lowland coastal zones in a tectonically active region (exposure to vertical ground motions and local tsunamis), which in addition opens onto an ocean basin where telesunamis, confirmed by ancestral legends, can propagate. Reflections intending to quantify risks in settled coastal zones, in Vanuatu as in other exposed areas, must thus take the geophysical parameters into account along with climate forecasts, in order eventually to suggest appropriate moves to the groups involved.

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