

PROTOCOLS AND PARTNERSHIPS FOR ENGAGING PACIFIC ISLAND COMMUNITIES IN THE COLLECTION AND USE OF TRADITIONAL CLIMATE KNOWLEDGE

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*Traditional weather and climate knowledge remains important
for environmental decision-making in the Pacific.*



In many regions of the world communities rely on traditional or locally based weather and climate forecasts based on observations of the world around them, such as the behavior of plant and animals or meteorological variables, including the direction and strength of winds (Chang'a et al. 2010; Gearheard et al. 2010; Lefale 2010; Garay-Barayazara and Puri 2011; Pennesi 2012). Recent extreme events have illustrated the importance of traditional knowledge (TK) for increasing community resilience [e.g., Cyclone Pam (McLellan 2015; Handmer and Iveson 2017), tsunamis (McAdoo et al. 2009), and in general (Nurse et al. 2014)]. Continued use of traditional forecast methods is, in part, due to warnings from national meteorological services (NMSs) being either not fully accepted, understood, or obtainable by communities (e.g., Gilles and Valdivia 2009; Lefale 2010; Orlove et al. 2010). However, the rapid loss of traditional forecast knowledge, environmental change, and the deterioration of the generation and transfer of TK (e.g., Ziervogel and Opere 2010; Gyampoh and Asante 2011; Berkes 2012; Pennesi et al. 2012) decreases the capacity for communities to plan for and respond to extreme events (Gómez-Baggethun et al. 2012).

NMSs are tasked with issuing public warnings, seasonal forecasts, and other weather and climate communications as a public service to their communities and stakeholders. Realization that in some regions these product messages are not being fully utilized has led to increased consideration for the role that traditional weather and climate knowledge has in relation to contemporary forecasts (e.g., Gilles and Valdivia 2009; Chang'a et al. 2010; Kanno et al. 2013; Chand et al. 2014; Plotz et al. 2017; Plotz and Chambers 2017). At the same time, international organizations, such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Intellectual Property Organization,

and many national governments are concerned over the loss of cultural heritage and the misuse of TK and have set up policies around its collection and storage (UNESCO 1972, 2017; WIPO 2009; Ruiz Muller 2013).

While several studies have attempted to document traditional weather and climate knowledge to increase its recognition and use in contemporary climate products in the Pacific (e.g., King and Skipper 2006; King et al. 2008; Lefale 2010) and elsewhere (e.g., Anandaraja et al. 2008; Chang'a et al. 2010; Garay-Barayazara and Puri 2011; Risiro et al. 2012), we are unaware of any previous use of a standardized data collection methodology across multiple countries with sociocultural complexities and consideration of the entire process needed to facilitate this collection. However, there are some relatively recent publications in the gray literature from other regions of the world that provide a good starting point for this (e.g., National Science Foundation 2005; Nickels et al. 2007).

While numerous authors have argued that there is a need to incorporate TK into environmental decision-making (King et al. 2008; Valdivia et al. 2010; Zuma-Netshiukhwi et al. 2013; Nurse et al. 2014; Plotz et al. 2017), some argue that this is inappropriate because of the need to preserve TK within its current context, that is, embedded within specific communities to keep it culturally and contextually bound (Agrawal 1995). Others (e.g., Sillitoe 2002) argue that the different knowledge systems can have similar essential elements and content, that contemporary science also has a cultural background, and that there are similarities in the methods used to investigate (observe) the environment. In addition, there is an opportunity to improve our overall understanding of environmental problems by embracing the strengths and weaknesses of the different knowledge systems (UNESCO 2017) and, in the case of climate forecasting, producing products that are based upon

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collaborative community-driven relationships and mutually agreed-upon benefits (King et al. 2008; Plotz et al. 2017).

There have been many discussions in the literature as to the most appropriate term to cover knowledge held by those living on the land (e.g., Nadasdy 1999; McCarter et al. 2014). We prefer the term *traditional knowledge*, as defined by Brahy (2006), as it covers both indigenous and nonindigenous peoples but we recognize that this knowledge is not static and can evolve over time. While the authors acknowledge all domains of TK, this paper focuses solely on weather- and climate-related TK.

This paper explores the intricacies involved in the development and implementation of projects concerned with the collection, archiving, and use of traditional weather and climate knowledge. We use our experience in the Pacific Islands to illustrate this. Communities in the Pacific are concerned about the intergenerational loss of traditional weather and climate knowledge (King et al. 2008; Tanaki 2013) and the NMSs are interested in working with the communities to preserve and reinvent the use of this knowledge, and to provide a platform for producing climate products that improve the communication of NMS forecasts and warnings to better serve their communities (Plotz and Chambers 2017). As such, this paper is written from a NMS perspective, based on long-term interactions with the communities they represent. The NMSs led all aspects of their project's development and implementation through consultations with their communities, governments, and other organizations.

Systematic collection and archiving of TK was achieved through four main considerations that were identified by the Pacific NMSs, project stakeholders, and communities during project development and implementation. These are general considerations that are expected to apply to other locations within the Pacific and globally. These included consideration of the national or legal context within which the projects will operate, required partnerships, community involvement, and protocols and methodologies. Starting with a broad context, we first consider the legal and national contexts within which the projects will exist, including where/if projects of this nature fit within national laws or policies and the protection of community rights, national constraints with respect to permissions to implement the project, and each government's reporting requirements. Second, we look at the need for organizational partnerships. These may be mandated partnerships (e.g., with ministries associated with culture) or may arise for other

reasons (e.g., are resource driven). Next, we consider the role of the community in the process, including why their involvement is essential and how to ensure that the process is respectful and benefits all parties. Finally, we consider methodologies and protocols for community engagement and data collection. While the experiences described here are based on Vanuatu, Samoa, the Solomon Islands, and Niue, it is expected that the knowledge obtained applies more generally across the Pacific and beyond.

PROJECT CONTEXT. Small island states in the Pacific are particularly vulnerable to natural hazards, such as cyclones, earthquakes, and tsunamis, and face serious impacts from climate change, such as coastal erosion, flooding, sea level rise, water scarcity, rising temperatures, seasonal variability, and extreme weather (Nurse et al. 2014). The UNFCCC (2013) identifies that, until recently, local and indigenous communities have had limited opportunities to include TK in climate change adaptation and mitigation processes (i.e., using traditional ways of coping and reducing impacts of environmental changes).

Currently, climate change may have an impact on local knowledge and local practices, for example, fruit trees flowering out of season (King et al. 2008; Percival 2008). The changes are noticeable, but they are often not documented and more research is needed to explain the behavioral changes of species used for traditional practices. However, there is increasing concern that the rapid loss and reduced intergenerational transfer of TK is constraining the wider utilization of TK and the benefits it can bring to climate adaptation (King et al. 2008; Plotz et al. 2017; UNESCO 2017).

In response to this, the TK for weather and climate forecasting projects was developed under a partnership between the NMSs of four Pacific Island countries, local stakeholders (e.g., cultural centers and community members), and the Climate and Ocean Support Program in the Pacific (COSP-Pac), administered through the Australian Bureau of Meteorology. In addition to community concern over the loss of traditional weather and climate knowledge, community consultations led by the NMSs identified that many communities in the region were not using their contemporary scientific products, including forecast information and warnings for preparedness and adaptation to weather and climate-related events, to their full extent or at all. This has the potential to reduce community resilience to extreme weather and climate events (Nurse et al. 2014). Community feedback from surveys

TABLE 1. Country summaries and background information highlighting similarities and differences across Niue, Samoa, the Solomon Islands, and Vanuatu.					
	Niue	Samoa	Solomon Islands	Vanuatu	
Geography/population	Polynesian	Polynesian	Melanesian	Melanesian	
Population size (approx)	1,600	197,000	621,000	282,000	
Latitudinal range (°)	<1	<1	5.1	17.3	
Land area (km ²)	259	2,840	28,400	12,190	
No. of islands	1	9	900+	80+	
No. of languages spoken (excluding English)	1	1	~70	100+	
Governance					
Government approval process	Government of Niue (endorse) Statistics Department (inform)	Attorney general Ministry of Women, Community and Social Development Division of Internal Affairs (includes community representatives) Ministry of Natural Resources and Environment (Legal Services Division)	Ministry of Culture and Tourism Provincial Executive	Ministry of Internal Affairs Ministry of Justice and Community Service Vanuatu Kujjoral Senta Research Committee Provincial government Area council of chiefs	
Community approval process	Village council Set up committee of local elders Individuals	Village council Community representatives Heads of households (Matai) Individuals	Council of chiefs Head of households Individuals	Community chief Head of Nakamal (tribe) Heads of households Individuals	
Policies and frameworks covering TK					
National legislation	Tāoga Niue Act 2012	—	—	—	Draft only
National frameworks or guidelines	(Regional only)	(Regional only)	(Regional only)	(Regional only)	Vanuatu Cultural Research Policy
Project details					
NMS climate staff	5 (total No. of NMS staff)	7	5	8	
In-country partners	Ministry of Natural Resources; Tāoga Niue (Culture and Heritage); Department of Education	Ministry of Women, Community and Social Development; Ministry of Education, Sports and Culture; Ministry of Agriculture and Fisheries; Disaster Management Office; Red Cross	Ministry of Culture and Tourism; Department of Museum, Red Cross; National Disaster Management Office; World Vision; Solomon Islands Broadcasting Corporation	Vanuatu Kujjoral Senta, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH; Red Cross; Vanuatu Broadcasting and Television Corporation	
Community protocols*	Face-to-face interviews preferred	May need an orator to speak on your behalf (e.g., when speaking to a high chief); the community would provide bread and tea and after the orator has spoken you would pay the orator; best time to approach community members is during the day	Face-to-face interviews preferred; avoid monetary payments to individuals	Kava ceremony/session may be required; best time to approach community members is at night when not busy with chores	

* Protocols common across all countries include understanding local cultural practices; being fluent in local language, including cultural expectations around language; dressing appropriately; understanding appropriate use of gifts/incentives (traditional gifts vs payment to community or individual); working closely with local authorities; sleeping and eating with the community; and respecting the confidentiality of information provided and always acknowledging the source of the information.

by the NMSs on their products and services and national community consultations suggested that meteorological forecasts currently lacked relevance because they were too technical to interpret or were distrusted due to a lack of exposure (Plotz and Chambers 2017). NMSs recognized that the relevance, accessibility, and local accuracy of their forecasts could be enhanced by incorporating TK into their contemporary forecasts and warnings, a view shared by many community members (see the appendix). This approach acknowledges that neither indigenous or western strategies alone are likely to successfully address environmental problems, and both are needed in disaster risk reduction strategies to reduce the vulnerability of indigenous communities in small island states to environmental hazards (Mercer et al. 2007; Nurse et al. 2014; UNESCO 2017). Therefore, one of the partnership's main aims was to preserve and to increase the usage and relevance of TK. One way to do this was to increase the NMS's capacity to communicate effectively with communities in the region in ways that meet the community's needs (i.e., through the consideration of TK).

Under this mandate, COSPPac allocated funding for a traditional weather and climate knowledge pilot project to develop a framework for TK data collection, storage, and improved seasonal forecasts (Chand et al. 2014; Chambers et al. 2017; Plotz et al. 2017; Plotz and Chambers 2017). Official expressions of interest were sent to all COSPPac participating countries (14 in total) and selections of countries for financial support were made according to those that identified high levels of existing community reliance on TK. Available resources allowed four Pacific partner countries to participate: Niue, Samoa, the Solomon Islands, and Vanuatu.

Achieving the ongoing collection and use of traditional forecast knowledge in the Pacific (and elsewhere) is hampered by a limited understanding of the necessary protocols and partnerships required to engage with communities from a national to a regional level (UNESCO 2017). As such, how each of the four countries developed and implemented their TK of weather and climate projects, within their government institutions under which NMSs are

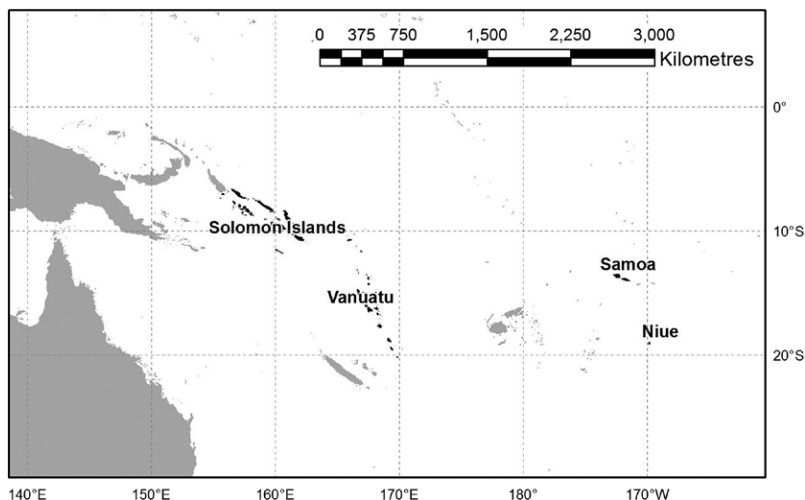


FIG. 1. Map of the Pacific region showing locations of Niue, Samoa, Solomon Islands, and Vanuatu.

administered, including the methods and procedures used to engage with communities, forms the basis for this paper.

Country context. The Pacific region is made up of around 25,000 islands spread throughout the world's largest ocean basin (Percival 2008). Based on linguistic, ethnic, and cultural differences, the Pacific can be divided into three subregions: Micronesia (to the north), Melanesia (to the west), and Polynesia (central and southeast). Most countries have predominantly indigenous populations who retain ownership of their land, and this was particularly true for the TK Pilot Project countries—Vanuatu, Solomon Islands, Niue, and Samoa—which represent a variety of cultures across a wide region that covers both Melanesia and Polynesia (Fig. 1). These countries are described below and in Table 1.

NIUE. Niue is located at 19°S, 169°W with a land area of 259 km² (Fig. 1; Table 1). It is known as the Rock of Polynesia, where coral encircles the island at 30–60 m above mean sea level. Niue is home to a population of 1,607 people (Government of Niue 2011), with more than 10,000 Niueans now residing overseas in New Zealand and Australia. Subsistence living on land and sea provides the lifestyle and livelihood of a Niuean person.

Culture is of great significance to the Niue people. Arts, food making, crafting, weaving, music, dance, sports, hunting, fishing, farming, religion, and communal fellowship are integral in preserving Niue culture and traditions. The Niuean people expressed a sense of urgency to record the wealth of TK held

by their elders before it is completely lost. “I have yet to share TK information to my children and grandchildren, but I am thankful the Niue Meteorological Service has initiated this project because it will leave a legacy for our future generation” (elder interviewed during the Niue TK Survey in 2015).

The Niue TK project covered all 14 village communities with the intention of obtaining a representative view of TK to assist in the communication of weather and climate and climate change. The NMS recognizes the value of recording the information and the local words used to describe the weather and climate. This is useful for translating (English) climate terms into the local language.

The project approach consisted of gaining government endorsement of the project, appointing a local TK consultant, translating the TK survey forms into the local language, setting up a TK committee composed of local elders, and working with partners and the community to document TK related to weather and climate via one-on-one interviews and community workshops. Additional details of various aspects of this process are used throughout this paper to illustrate key concepts.

SAMOA. Previously known as Western Samoa, Samoa was first settled around 3,500 years ago and since then has developed a unique language and culture. This Polynesian country is made up of two main islands, Savai'i and Upolu, and seven smaller islands (Table 1). The traditional Samoan way, *fa'a Samoa*, is a central part of Samoan life and politics, with the Legislative Assembly consisting of 54 matais (chiefly titleholders) elected by the public. At a local level, village councils have authority over village law and order, as well as health and social issues, through the 1990 Village Fono Act (Government of Samoa 2016).

Samoan people depend on the “*tomai tuufaasolo*” or TK for farming, fishing, and daily livelihoods, with observation of the behaviors of plants, animals, and the atmosphere, which relate to the dynamics of the weather and climate, guiding decisions in their daily chores. For example, Samoans have their own traditional names for the wind directions and bad weather is expected when there is a sudden change in wind direction. Through their community consultations, the Samoa Meteorological Services noted the concerns of the community elders and chiefs that TK related to weather and climate needed to be recorded and stored before it was completely lost. These consultations also sparked an enthusiasm and interest from the community in learning more about the linkage between contemporary science and TK pertaining

to the behavior of environmental, ecological, and astronomical indicators. The Samoa Meteorological Services uses TK to help address the communication gap between the NMS and the community, by making the terminology used in contemporary forecasts and warnings more understandable and relatable.

SOLOMON ISLANDS. The largest of the four pilot countries by population and land area, the Melanesian country of the Solomon Islands, has been inhabited for thousands of years and is composed of over 900 islands (Table 1). Over 94% of the population is Melanesian with a smaller mix of Polynesian and Micronesians. The country has a history of ethnic violence and political instability. Classified as a lesser developed nation, much of the workforce relies on subsistence farming and fishing. The culture of the Solomon Islands is diverse and varies according to language used, island, and topography. TK, and associated customs, remain strong and have been handed down through the generations.

The aims of the Solomon Islands project are to document and archive TK for current and future generations, to promote and encourage cultural revival that builds community resilience to extreme weather and climate, and to monitor and integrate traditional methods of weather forecasting into NMS forecast products. Three (remote) pilot communities, from three provinces, were selected for initial inclusion in the Solomon Islands project. These communities represent three different cultural groups that are keen to maintain a strong cultural heritage.

VANUATU. Vanuatu is a Y-shaped archipelago made up of over 80 islands between the latitudes of 13° and 21°S (Fig. 1; Table 1). Vanuatu was founded on “Melanesian values of respect, harmony, unity and forgiveness. These values shape our cultural heritage, which is the country’s strength. They are expressed through our oral traditions, languages, performing arts, social practices, rituals, festive events, TK, and our deep connections with our ancestors, land and place, as well as the skills to be productive with our natural resources” (Department of Strategic Policy, Planning and Aid Coordination 2016, p. 3).

The Ni-Vanuatu have thousands of years of experience in adapting to changing climatic conditions and natural disasters and have developed *kastom* (traditional custom) practices and TK to maintain sustainable livelihoods and to deal with the socio-economic and environmental stressors of a changing environment. The use of TK for weather and climate forecasting is very common, particularly among the

indigenous subsistence farming communities, where traditional culture is mostly intact and unaffected by western influences and religion systems. Although traditional farmers may listen to contemporary weather and climate forecasts via radio broadcasts, they usually ignore this advice due to their strong dependence on TK. The Vanuatu Meteorological and Geo-hazards Department (VMGD) aims to provide climate information at a scale relevant to the needs of the communities and is working toward establishing long-term locally relevant climate data, including through the use of a community-based rainfall observer network, but also recognize that TK plays an important role.

The Vanuatu project intends to store commonly held TK in an open-source database with associated books, posters, pamphlets, videos, etc. being stored at the community or island level, where Internet and computer access can be limited or nonexistent.

The projects conducted in Vanuatu and Niue are used to provide additional in-depth examples throughout the remainder of the paper. We concentrate on these two countries because of their representativeness of both different heritages, Melanesian and Polynesian, and their size. Niue is a single small Polynesian island with a small population and one local language. Vanuatu has a considerably larger population spread over a much larger area, with many island groups and languages resulting in a more complex government setup. Samoa sits between these two extremes and the Solomon Islands has a number of similarities with Vanuatu.

RECOGNIZING A LEGAL CONTEXT. When projects involve TK, there is a need to be aware of any legal frameworks that may apply, including those designed to protect cultural and intellectual property (IP). Regulatory frameworks associated with the protection of TK in the Pacific are of great importance due to the social, economic, and cultural implications they have on Pacific communities (PIFS 2010; Techera 2013). While regional and national laws exist to protect the environment in most countries, specific national legal frameworks setup to protect intangible heritage are less common (Forsyth 2012; Techera 2013; Table 1).

In the Pacific region, three legal instruments exist and were adopted by Forum Trade Ministers in 2003 and 2008 and approved in principle by the Melanesian Spearhead Group (MSG) in 2011. These instruments focus specifically on the protection of culture and TK. These are i) The Pacific Regional Framework for the Protection of Traditional Knowledge and Expressions

of Culture (TKEC; the regional framework), ii) Traditional Biological Knowledge, Innovations and Practices (TBKIP) Model Law (model law), and iii) the MSG draft Treaty on Traditional Knowledge 2011 (SPC 2002; PIFS 2010; Forsyth 2013).

The regional framework and the model law established a new range of statutory rights for TK owners and provided the basis for individual Pacific Island countries wishing to enact the model law. Countries are free to adopt/adapt the provisions in accordance with national needs and wishes of its traditional communities in a sui generis system (SPC 2002; PIFS 2010). The regional framework and the model law also took into account developments at the international level of the various treaties concerning IP rights agreements, international conventions, and agreements (Intergovernmental Committee–World Intellectual Property Organization, www.wipo.int/tk/en/igc/; World Trade Organization–Trade-Related Aspects of Intellectual Property Rights, www.wto.org/english/tratop_e/trips_e/trips_e.htm; Convention on Biological Diversity, www.cbd.int/) relating to the protection of TK (Xiong 2008; Forsyth 2013). The MSG framework applies the regional framework and the model law to the Melanesian context. Awareness of these frameworks and how they are applied within the Pacific countries is important to those planning to document, store, or use TK within the region.

In terms of IP, it is not acceptable in Pacific society for the person recording the information to own the rights to that information. According to customary norms, the person/community who provided the information owns the information and therefore holds the IP and their name must be recorded against that information in any database. Much information is custodial (acting as custodians of knowledge to be passed onto future generations) rather than owned by an individual and therefore issues of ownership and copyright become problematic in a western sense. In some countries, including Papua New Guinea, there is a belief that this knowledge dies if copyrighted, owned, and recorded in a database (P. Malsale 2013, personal observation).

Legal protection of TK at the national level. When setting up projects on TK of weather and climate, it is important to consider the national context within which the project will operate. This includes understanding any legal requirements associated with the collection, storage, and use of TK, and obtaining the necessary government and community approvals.

At the national level, Niue is the only one of the four pilot countries that has enacted national

legislation (Department of Tāoga Niue 2012) that considers both the protection of traditional culture and knowledge and IP. Legislation is currently being drafted for Vanuatu. While the Solomon Islands and Samoa do not have specific national legislation for the protection of TK and IP, TK and IP are covered under existing laws, such as the Copyright Act 1998 (Samoa Law Reform Commission 2010).

Obtaining approval to collect TK. Receiving approval to conduct research on and to collect TK requires consideration of the governance structure of the country in which the project operates. Generally, this means first approaching the relevant ministries, for example, the Ministry of Internal Affairs (Samoa Ministry of Women Community and Social Development, Division of Internal Affairs) or Culture (Tāoga Niue, Vanuatu Kuljoral Senta) (see Table 1).

In countries where there are provincial government or area councils, these may also need to be approached to obtain consent, which may be possible through the national ministries. Once approval has been granted to access the communities, it is necessary to obtain permission to collect their TK and it is important to be aware of community hierarchies. These may vary between countries and may consist of approaching the council of chiefs, village chiefs, and heads of families (e.g., matais in Samoa) (see Table 1). Church leaders and public servants implementing activities within the communities may also need to be informed. Before any information is collected, it is important that prior and informed consent is obtained.

Within Vanuatu, TK related to climate change and disaster preparedness belongs to individuals, families, lineages, and communities, and any research on TK must in the first instance respond to and respect the needs and desires of those people to whom the knowledge belongs (www.wipo.int/export/sites/www/tk/en/databases/creative_heritage/docs/vanuatu_policy.pdf). TK research should be a collaborative venture involving researchers, individuals and groups of informants, local communities, chiefs and community leaders, cultural fieldworkers, cultural administrative bodies, and local and national governments. In fact, the Vanuatu Cultural Research Policy stipulates that this must be the case for those working in Vanuatu.

Prior consent for the collection of the information within countries, such as Vanuatu and the Solomon Islands, must be obtained from the chief of the community with details provided, including how the information might be used, the benefits of sharing

arrangements that must be put in place, and how the information is to be disseminated. The traditional owners decide what can be accessed and released and in what format the information is collected and stored. Any potential risks associated with the sharing of TK, and how these will be mitigated, should also be communicated clearly to the knowledge holders and their communities.

Communities and individuals should always be allowed to decide on what levels of information they may be willing to disclose. For the Pacific TK projects, where appropriate, this happened through a community meeting/consultation process. For example, in the Shefa Province of Vanuatu a community meeting would authorize the person who could provide the TK. A community meeting could also act as an avenue to publicly declare what TK is available to share, to collect that information, and to gain consent for its disclosure.

In the past, written consent was not required in Vanuatu, as the oral permission of the chief was considered customary consent. In a contemporary context written consent from all people interviewed is required to mitigate any potential disputes and because many people are not necessarily based in their community. Recording consent in oral and video form is considered a form of written consent. If written consent is to be sought, the process and ramifications of signing a consent form for the use and access of the information must be fully explained, this includes specification of procedures for confidential/taboo knowledge, rules around ownership of IP, and any data access restrictions. The ideal situation is a combination of customary and written consent.

RECOGNIZING THE NEED FOR PARTNERSHIPS. Successful collection of TK within the Pacific relies on partnerships. Within the four pilot countries of Solomon Islands, Vanuatu, Samoa, and Niue, there were several similarities in terms of who were important partners to the TK projects. Important partners were identified as the ministry responsible for culture, the media, donor organizations, community-based organizations, and the community members themselves (Table 1). There may be variations and differences in the roles these partners play for each country, but it is agreed that these partners are important for the success of the project.

In all four pilot countries, the NMS and their partners (Table 1) are also members of the communities and so they already have ties to village elders. In this sense, they know who to interview and how to approach them for the opportunity to share their

knowledge (via prior informed consent). Through this process, not only do the interviewers create a relationship or partnership with these community members, but they also keep them updated on the progress of the project (Nickels et al. 2007).

The collection of TK in the Pacific often involved several government departments, with responsibilities for different climate-sensitive sectors. For example, the VMGD requires information on weather and climate, while the Department of Agriculture is interested in agricultural/gardening practices. Each sector needed to clearly define the types of data they required and for what purposes. Communities then decide what types of information they are willing to provide to each sector. The Vanuatu Kaljoral Senta (VKS)

fieldworker program, which is community appointed and works with chiefs and Malvatumauri (National Council of Chiefs), helped to facilitate this collection process in Vanuatu.

Recognizing the importance of good project design and partnerships, a national inception workshop was organized in Vanuatu in 2012 that included the VMGD, the Vanuatu rainfall observer volunteers (community members), and the VKS. This workshop identified the sites for TK data collection and discussed governance around collection and storage of TK. Memorandums of understanding (MoUs) were developed between key partners, including those related to funding or the process of TK collection to facilitate working together in terms of pooling human and finance resources. Under the MoUs, a core team of around four people (depending on the number of organizations signatory to the MoU) was formed to carry out the TK activities. This core team worked closely with cultural field workers and other partners from the TK collection sites to identify community protocols and collection procedures. This team was also involved in the development of a questionnaire used to guide the conversations with the TK holders (Fig. 2).

Partnerships in Niue were critical, due to too few people in any one organization to conduct a project of this size. The departments involved in the Niue project include the Ministry of Natural Resources (MNR), Department of Tāoga Niue (Culture and Heritage), and Department of Education. MNR is made up of the Niue Meteorological Service, the



FIG. 2. Vanuatu project officer discussing TK of weather and climate with an elder from Tanna Island, Vanuatu.

Department of Environment, and the Department of Agriculture, Forestry and Fisheries. The two departments considered to be the major local stakeholders are Tāoga Niue and MNR. The Niue Meteorological Service, along with COSPPac, held a 3-day workshop inviting members from different sectors to take part. The workshop not only taught interview techniques and lessons for data entry, but also allowed the project partners to share and discuss both local and scientific knowledge (Ambani and Percy 2011). Each group came to an agreement on the best approach to conducting the interviews and data collection that acknowledged both science and culture that will ultimately benefit Niue (Fig. 3).

Role of the ministry responsible for culture. In most Pacific Island countries, there is a government department responsible for cultural matters. Inclusion of this department or ministry in processes associated with the design and implementation of TK projects can be advantageous and may even be mandated. For the Pacific TK projects, inclusion of the ministry responsible for culture within each country was seen as essential as, for each Pacific Island, there are protocols and formalities that need to be followed, even those not formally defined within laws (see below for further details). In some countries, the ministry responsible for culture is seen as an express channel for reaching community members. They may also provide assistance in ensuring the most appropriate language is used for communications and ensuring appropriate storage and use of the data collected.



FIG. 3. Meeting of elders to discuss TK of weather and climate collection and use in Niue.

Under the Tāoga Niue Act (Department of Tāoga Niue 2012), the culture and heritage department is the legal custodian of Niuean knowledge. This department acts as a legal defense or guardian of Niuean knowledge that grants permission for any outside research done in Niue to do with TK. In this case, the Niue Meteorological Service under the MNR has taken charge of storing and keeping the data on TK for weather and climate conducted in Niue. Tāoga Niue will cooperate in any way it can should any legal issues come up in the future with the misuse of TK. These measures are put forward to prevent situations such as those presented by Moodie (2010), where the traditional rights of the indigenous people were abused, such as when the data collected were published in a degrading manner for the indigenous people without permission or consultation. The Niue Meteorological Service and Tāoga Niue will work together to protect the rights of their people.

Within Vanuatu the question of the administration and coordination of TK, both in its collection and storage at a national level, is unclear. From the consultations conducted to date the VKS seems to be the most trusted institution and is the institution with the mandate to hold this type of information. The fieldworker program has the mandate to preserve all data and practices and therefore has the organizing coordinating role across all kastom (traditional culture). As such, the VKS has a role in the provision of advice, training on how to go about collecting information within community/customary contexts, and how to approach a community.

Consultation or partnerships with cultural departments is also important when determining how the collected TK will be stored. Using Vanuatu as an example, the VKS has a database of TK that includes weather and climate indicators, disaster management, and adaptation/mitigation practices, and there is the potential to share a monitoring and enforcement mandate with VMGD/National Disasters Management Office, dividing up the responsibility for different levels and types of information. Other agencies may also hold commonly held knowledge, for example, on weather and climate indicators, in a database directly relating to their work in this field, such as VMGD's TK database specifically designed for the preservation of knowledge around weather and climate forecasting (Chambers et al. 2017). However, it is recommended that these agencies use the VKS fieldworker program to make the appropriate contacts in the community and the VKS must hold a copy of all information held in specialist databases.

Role of the media. The media can play an important role, as the media can reach a broad range of people and can help to raise awareness of the importance of sharing, preserving, and using TK (UNESCO 2001; Standley et al. 2009; U.N. Environment Programme 2013). For an appropriate and well-designed project, raising community awareness of the project is more likely to result in increased community participation (UNESCO 2001; DFHCSIA 2011; U.N. Environment Programme 2013). In addition, having the community involved in the production of media products

helps to ensure that the TK is related to the public in a way that respects the community's wishes (Standley et al. 2009; U.N. Environment Programme 2013).

Access to different modes of communication (e.g., radio, television, Internet, mobile phones) varies considerably across the Pacific. Communication infrastructure, and a reliable electricity supply, to support the more popular alternatives (television and Internet) is not always available for the more remote and isolated islands. Therefore, NMS staff and their partners used community engagement and surveys to identify a community's preferred media sources and products for disseminating TK and climate information.

Role of donor organizations. With projects conducted over a national or regional scale in developing nations, it is recommended to have partnerships with donor organizations to ensure sufficient financial resourcing and support are available for the entire life cycle of the project.

In our experience, a project is more likely to succeed and attain sustainability in the long term when driven by national or local organization(s) that will ultimately be responsible for the sustainability of the project once donor support is no longer available. This local organization(s) should be involved in the design of the project to ensure that it meets its, and its community's, needs with the donor organization's role determined by the level of support requested (e.g., financial and/or through supply of materials or training). The local (indigenous) organization is much more attuned to its own needs, more likely to understand the cultural context of the country in which the project is conducted, and would be more aware of culturally appropriate methods of engaging with in-country stakeholders and community members, particularly around historically sensitive issues such as TK (e.g., biopiracy).

The major donor for the Pacific TK projects was the Australian Department of Foreign Affairs and Trade, administered through the Australian Bureau of Meteorology (COSPPac). Governance and management systems associated with COSPPac were designed to be inclusive and participatory to ensure maximum Pacific ownership of both the implementation processes and benefits (COSPPac 2012). The overall governance of the COSPPac program was the responsibility of the COSPPac Steering Committee, which included representatives of the key implementing partners (including Pacific regional organizations, with predominantly indigenous staff) and Pacific Meteorological Council representatives (indigenous

directors of Pacific NMSs). The Pacific Meteorological Council was responsible for the initial request to the Australian government for support.

COSPPac provided training, guidance, and support so that the NMSs could take charge of their TK projects. This approach goes further than Moodie's (2010) suggestion of effective research through aligning the project with the interest of the people. The project is owned and managed by the NMSs with the interests of the people in mind, as demonstrated through their dedication to community consultation on all aspects of their TK projects (e.g., several community workshops were held with elders to identify appropriate protocols and procedures for TK data collection). Through discussions with other government departments and the community, the NMSs identified the main project aims, for example, for Niue this was to prevent the ongoing loss of traditional weather and climate knowledge, while for some of the other countries it also included improving weather and climate forecasts and their communication. NMSs are aware and acknowledge that locals still practice TK related to weather and climate. The challenge is, that due to the countries' size and population, and the influence of western culture on younger generations, there is a great chance of TK being lost with the older generation. Therefore, there is a sense of urgency in carrying out and completing this project to preserve, and reinvigorate the use of, the TK for generations to come (a view particularly held by the Niue NMS and Tāoga Niue).

Partnership is the most effective way of achieving the goals set out by a large project. Having a funding agency like COSPPac that is willing to let the NMSs, in consultation with their communities, dictate how to conduct the TK collection process and the types of products produced gives them the opportunity to put the funding to where it matters most (Nickels et al. 2007).

Thus, the success of such projects relies on the contribution of partners within the country of interest and, in this case, also between countries of interest.

WHY COMMUNITY INVOLVEMENT IS CRITICAL. Previous studies have noted that many communities within the Pacific are interested in the preservation of existing TK and the prevention of further loss (King et al. 2008; Fletcher et al. 2013; McNamara and Prasad 2014). It is therefore critical to have community involvement in a project, for without community support it will not be possible to collect and preserve the required TK. Without community involvement, TK may lose its cultural

context and is subject to misinterpretation and potential misuse (Nickels et al. 2007). Community involvement in all aspects of the project is likely to result in increased levels of trust between partners and ensures the outputs are aligned with community needs (Nickels et al. 2007; DFHCSIA 2011). In addition, reconnection with TK has been shown to increase community resilience to environmental extremes, such as cyclones, floods, and droughts (UNFCCC 2013; Hiwasaki et al. 2014).

The collection of TK for climate change adaptation and disaster risk reduction is best achieved through avenues including interviews, workshops, consultation with chiefs, questionnaires, audio, video, photographs, and written information. Video and audio documentation is preferred, as it is able to record the knowledge custodian/holders, whether that be individuals/communities, accurately and within the cultural context, and thus reduces the likelihood of misinterpretation.

When the Pacific NMSs and their partners visited the communities and asked the older people questions around their TK, it generated interest among the broader community, in particular among the youth. By having an outsider from a government ministry wanting to learn about this TK showed that this knowledge was valuable and important (this project) and can assist in reducing tension in villages around privileging of traditional or western scientific knowledge (Janif et al. 2016). One interviewer from the Solomon Islands was struck by a conversation between an old man they had just interviewed and a middle-aged man who was heard to say “How come you never told that story?,” to which the old man replied “You never asked me” (www.solutionexchange-un.net/repository/pc/ccd/cr51-eng-19042016.pdf). This want of older community members to share their knowledge with others is not unique to the Pacific (e.g., Pennesi et al. 2012). Additional examples of how an NMS’s interest in TK has reinvigorated TK in the Pacific are seen through talk-back radio segments hosted by the NMSs. These have proved exceedingly popular with community members.

There are different types of knowledge in the Pacific, and different levels of access to that knowledge. Different types of information had different values. Commonly held knowledge, or common knowledge, did not require a payment although proper customary protocols for collection and access still needed to be followed. In many cases TK was not free and customary payment depended on the value of the information. Some knowledge was considered taboo (i.e., sacred, holy, or forbidden). Taboo TK in the

Pacific requires *kastom* (custom) payments to specific owners, typically determined by chief/island council of chiefs, and would need to have restricted access and use. This distinction should be respected at all times when collecting information. Taboo TK would relate to *kastom* practices or ceremonies, such as weather magic, spiritual material, and stories about land that can be used for harm, which are held by specific persons in the community or kept within bloodlines/kin and remain private/restricted information and were not collected as part of the Vanuatu TK project.

Within the Pacific context, it was found that community members were happy to share commonly held TK, which was generally not considered taboo and was applicable across much of the country. The collection of TK of this type was found to be best done in a public setting and, where appropriate, through dividing the community into groups of men, women, and youth.

In Vanuatu and the Solomon Islands, prior to a site visit, the project team met frequently with its community contact point, either the cultural fieldworker or a rainfall collector, to find out about the protocols within the community on obtaining permission to interview in the village. It also helped with travel and accommodation arrangements in the village. Common protocols included announcements in church, at a village meeting, or at a social gathering regarding the team visit. Depending on the village governance, the team may also need to visit the chief(s) council to inform it about the visit objectives and to provide awareness on the TK importance. In Vanuatu, the team would provide ceremonial kava and seek permission to start interviews.

Issues of ownership and inclusiveness. Ownership/custodianship for commonly held knowledge is categorized as being tribal, provincial, or national, rather than being owned by an individual. The Pacific projects recognize that knowledge can also be separated according to gender and concerted efforts were made to ensure fair and equitable representation of women within the networks used to collect and use TK, ensuring that women’s knowledge was collected by women.

In cases where the customary governance system is in dispute, or where there are many land claims, many people may claim to be chiefs and therefore hold certain information. In these instances—for example, in Sanmar Santo, Vanuatu—the first point of contact would be a chiefly council, such as the Sanmar Council of Chiefs, who provide details on the people

who have rights to the information and who should be approached to share their TK, based on their level of knowledge and practice. Any research on TK may also need to go through the appropriate government sections, such as the Department of the Environment in the case of Vanuatu. This procedure is important especially when a range of people may claim to be those who hold that information. Following this procedure will ensure that the community derives benefit from any transaction. In Vanuatu benefits are defined by the VKS to include booklets, photos, video, and programs to revitalize TK, etc.

In Niue, for example, inviting elders to the NMS office for the interviews worked well at first, but some elders did not have transport to get to the office so the strategy needed to change in order to approach these elders directly.

PROTOCOLS FOR COMMUNITY ENGAGEMENT AND DATA COLLECTION. Numerous protocols have been developed to deal with the collection, storage, and use of TK (e.g., Nickels et al. 2007; Hill et al. 2013). Below we discuss some of the key aspects of these strategies and how they are relevant to the Pacific region. This includes consideration of the following core principles of engagement: respect, informed, ethical, outcome focused, sustainable, and responsive, including by providing feedback (DFHCSIA 2011).

The collection of TK should be done in a way that respects the customary protocols over knowledge throughout the different communities: that people should be free to decide whether or not to share their TK, that people should be able to specify any conditions upon which they will share their TK, and that they should be clearly informed about the risks and benefits of sharing their TK and the purposes of any collection and database storage. These principles are not new and form the guidelines for working with indigenous communities in, for example, the Arctic (e.g., Schnarch 2004; National Science Foundation 2005; Nickels et al. 2007), the United States (CTKW 2014), and Australia (e.g., Hill et al. 2013). Most of these existing guidelines were developed to assist nonindigenous researchers and government employees to engage effectively and appropriately with indigenous knowledge holders. In the Pacific TK projects, the NMS researchers and their partners were *all* indigenous; however, we still believe that the guidelines can be informative when working with community members.

Prior informed consent is an essential component of any TK project (Holcombe 2009; AIATSIS 2012;

CTKW 2014; Aguirre et al. 2017). This includes notifying an individual or community of the type of questions that will be asked, who will be talking to them about their knowledge, what type of information/questions will be discussed, and what types of information will be recorded and used, while giving them the option to opt out at any point. For the Pacific projects, the information collected and how it was collected was dependent on the internal process chosen by the community, determined through repeated community consultation. In some instances, a small ceremony needed to be performed before information could be collected.

Based on existing literature (e.g., AIATSIS 2012) and our own experiences, we believe projects concerned with the collection and storage of TK should adhere to a set of guidelines that details the types of knowledge available; mechanisms for collection and consent; how the information can be used, shared, and stored; and the authorities that have the mandate to administer that knowledge and monitor the guidelines. These guidelines may be developed by the project and can be informed by existing guidelines (e.g., Schnarch 2004; National Science Foundation 2005; Nickels et al. 2007; Hill et al. 2013; CTKW 2014) but also need to consider the national context, including relevant laws and procedures related to TK. The resulting guiding principles for projects concerned with the collection and storage of TK in the Pacific should

- promote the involvement of indigenous peoples in key project roles, including in the design and implementation of the project;
- define the types of knowledge that are commonly held and can be shared with a range of stakeholders (i.e., recognizing differing levels of culturally sensitive information);
- protect the interests of TK users and ensure that their rights are protected;
- recognize that TK may belong to individuals, families, lineages, and/or communities;
- act as a verification process in regard to TK by ensuring the proper customary procedures for accessing information through the right people are followed;
- define clearly the rights and responsibilities over the knowledge and how it might be used;
- ensure benefit-sharing arrangements are made with knowledge holders and communities;
- provide mechanisms that recognize the value and importance of TK for climate change and disaster risk reduction;

- ensure awareness among stakeholders, such as nongovernmental organizations (NGOs), schools, the agricultural sector, academics interested in using TK, of their roles and responsibilities in regard to collecting, accessing, and using TK; and
- ensure fair and equitable representation of women in the networks used to collect the TK and in facilitating the participation of women, acknowledging any gender-specific TK and protocols.

It is recommended that storage of TK should be at the national level as well as at the community level (where possible; Holcombe 2009) so that, where appropriate, the knowledge can be easily accessed and used (but see below). The collection and storage of information should respect the IP of the knowledge providers and the desires of the communities involved, including restrictions on who can access what information and for what purpose (AIATSIS 2012; CTKW 2014). The collection of TK should benefit the local communities and the nation, as it is commonly seen as a mechanism to save TK for future generations, particularly within a context where traditional customary structures are unraveling due to, for example, the impact of cash economies and urban drift.

Not all countries will have the required resources to conduct a countrywide survey, particularly in the case of countries consisting of many small islands often with differing languages. Within this context, the best approach is to engage local experts, preferably from the same villages as the TK experts being interviewed, as they will have the necessary skills and understanding of protocols to conduct interviews and record TK. The use of these local experts may also ensure that any funding benefits the community directly (Nickels et al. 2007). These local experts will also be the voice of communication, through their contact with the project team, and will inform the community of how their knowledge is to be used.

In summary, we believe the following five steps should be followed when developing and implementing projects concerned with collecting TK, while also taking into account the guidelines listed above at every step.

- 1) Understand the governance structures. Within the Pacific context, though there may be a democratically elected government, the Pacific way of conducting research in the communities is likely to differ according to the culture of the country (e.g., Melanesian or Polynesian). Researchers will need to work within the governance structure to obtain permission to proceed (i.e., obtain government approval to conduct TK-related research within that country) and to ensure effective community engagement. Considering the community governance structure is also essential because, although permission may be granted at the national level, it is important to liaise with local authorities to ensure access to the selected community or site and to obtain permission to collect TK. It is important to engage with the community through their preferred channels.
- 2) Select appropriate communities/sites. Once permission is granted, it is critical to develop appropriate partnerships, both with the communities and with other organizations who have an interest in the project. One of the partnership's roles will be identifying who is most likely to benefit from that project, and what the community benefits will be. Some communities may have already been identified through previous engagement as key holders of TK or as part of national consultative processes.
- 3) Be prepared. Ensure that you have in place the necessary travel and accommodation arrangements, required equipment, and other materials essential to the project. It is also important to liaise with the community/site contact for the preparation of a community ceremony, if required.
- 4) Community level protocols. Engaging with the community can be challenging if the required information does not reach the appropriate people or follow the right channels. It is important to follow village or community protocols. Having a team member from the community, or engaging a local expert, who speaks the local language will significantly aid the progress of the project. Protocols are likely to differ from country to country (see Table 1) and it is important that this knowledge is understood before the team enters the village. Consideration should be given to the appropriate use of payments and gifts, to the use of appropriate behaviors and gender sensitivity, and to the development of two-way communication channels.
- 5) Two-way feedback. There should be clearly defined benefits to the community and specific products tailored to community needs. It is important that outputs and progress are reported back to the communities and the government through appropriate channels, including how the project has met the priorities of the communities and national government.

Procedures for managing disputes. Disputes can arise if people ask questions that are too sensitive. Disputes are best avoided by first seeking access and use through a “chain of command” from an appointed government agency, provincial officers, and island council of chiefs to specific chiefs or TK holders. When ownership is unclear, community participation is very important in information collection. If people violate or fail to follow customary procedures or present themselves as knowledge holders and do not have that authority, then there will be consequences—the community (or the spirits in the case of Vanuatu) will punish the perpetrators.

CONCLUSIONS. Traditional knowledge of weather and climate plays an important role in the everyday lives of many community members, including in the Pacific region. This knowledge, derived from observing biological and meteorological variables, has been used for weather and climate forecasting, and contributes to community resilience to environmental extremes. Most of this knowledge exists only in oral form and is held by an increasingly smaller proportion of the population, and there is an urgency to preserve it before it is lost, particularly given the important role this knowledge can play in forecasting, communicating, and responding to natural hazards [for practical examples see McAdoo et al. (2009), Maclellan (2015), and Handmer and Iveson (2017)]. However, there are intricacies involved in the development and implementation of projects concerned with the collection and archiving of traditional weather and climate knowledge.

This paper provides guidance on the successful collection and documentation of TK on weather and climate in the Pacific region by considering four key components: the legal and national context, the need for partnerships, the role of the community, and following in-country protocols. These four components form the basis for working effectively with organizations and communities in this region on culturally sensitive topics.

In terms of the legal and national context, it is important to acknowledge different cultures and the political settings or governance structures, while also considering legal frameworks linked with national policy and laws. There are regulatory frameworks that are associated with the protection of TK, though few are currently in place in the Pacific. Consideration of the national context also covers obtaining the necessary government and community approvals associated with the collection, storage, and use of TK. It is therefore important to be familiar with the

legal and national requirements before any activity can commence.

The establishment of partnerships is integral to the successful collection of TK. Our experiences across our four pilot countries of Solomon Islands, Vanuatu, Samoa, and Niue identified the importance of the following key partners to the TK projects: the ministry responsible for culture, the media, donor organizations, and the communities themselves. These partners play different roles in contributing to the success of the project. Community involvement in a project is critical, for without it TK may lose its cultural context and is subject to misinterpretation and potential misuse.

This paper identifies a set of guiding protocols. The protocols include consideration of the mechanisms for collection of TK; how the information can be used, shared, and stored; and the authorities that have the mandate to administer that knowledge. As part of the protocols and guidelines, it is important to consider appropriate ways of engaging with the communities. Although there may be many similarities across a region, such as we found for the Pacific, there can also be significant differences, making it important to understand the context within which the work is conducted.

The results from this study will aid others interested in preserving traditional weather and climate knowledge in the Pacific and beyond, ensuring that processes meet regional, national, and community needs. This study raises the importance of working within regional legislation and community protocols to safeguard TK in the Pacific and understand the context within which TK projects exist. This paper contributes to helping countries identify areas that they may need to develop further in terms of policy and legislation to safeguard their TK as national heritage and provides an important resource for those interested in preserving TK in the Pacific and elsewhere.

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APPENDIX: COMMUNITY VIEWS ON INCORPORATING TRADITIONAL KNOWLEDGE INTO CONTEMPORARY FORECASTS AND WARNINGS.

As part of the knowledge collection process, community members were asked to provide their viewpoint on combining modern forecasts with traditional ones. This question appeared as follows:

What are your views on combining modern weather and seasonal forecasts with traditional indicators (please circle all that are valid):

- (a) Is something that I try and do myself and I do not need this information from the government
- (b) I would like someone to provide this information to myself and my community
- (c) Would improve community awareness of weather and climate events
- (d) May increase the ability of the communities to deal with extreme events
- (e) Would not be accepted by some community members
- (f) Would make no difference to how my community deals with weather and climate events
- (g) I only use traditional methods and am not interested in modern forecasts

Responses were considered as supporting the combination of contemporary and traditional forecasts if option b, c, or d were circled. Conditional support was assumed if they responded by selecting option a (i.e., they felt the information should be combined but not by the NMS). Lack of support for combined forecasts was implied if the responses were option e, f, or g. The majority of community members surveyed fully supported the combination of contemporary and traditional forecasts, with most happy to have this service provided by the NMS or another government department (Table A1).

TABLE A1. Community support, or otherwise, for the combination of contemporary and traditional forecasts.

Country	No. of responses	Yes	Yes, but not by NMS	No
Niue	31	24 (77%)	5	2 (6%)
Samoa*	9	7 (78%)	1	1 (11%)
Solomon Islands	62	61 (98%)	1	0 (0%)
Vanuatu	55	55 (100%)	0	0 (0%)

* Most of the individuals surveyed used only NMS forecasts.

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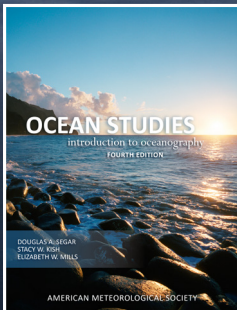
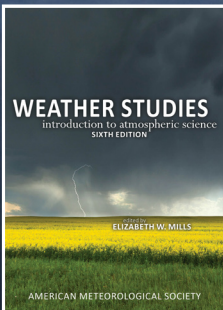


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