A Guidebook to Communicating the Risks of Storm Surge

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January, 2018

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Acknowledgement

The project team expresses its gratitude to Emma Katrine Phillips and Amal Ali of the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR), along with Tracy Thoman, program evaluator, for their guidance over the course of the project. The valuable support of the Philippine agencies, notably the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) and, in particular, Dr. Vicente Malano, Dr. Esperanza Cayanan, Maria Cecilia Monteverde, and Venus Valdemoro of PAGASA, is acknowledged. The project was funded by the World Bank GFDRR program through Award #1200696, Contract # 7177210.

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* Source: https:// environmental-communication.space

A Guide to Communicating the Risks of Storm Surge

PREVIEW

This Guidebook provides the conceptual and empirical basis for crafting a series of lessons on improving risk communication of extreme weather events, with a focus on storm surge. These lessons are found in the Tutorial document that is appended with this Guidebook. In this report, reference will be made to a number of Appendices, which provide details and data discussed herein. All of these documents can be found in the project's online portal, https://environmental-communication.space.

First, we walk through two contrasting scenarios, beginning with the one shown below.

SCENARIO ONE

Imagine you work in a local government office. A typhoon is forecast to make landfall near your town. The bulletin from the national weather agency also mentions something about a 1.5 meter storm surge. Since it is an official bulletin, and since the agency has the technical expertise in typhoon forecasting, the local government makes sure to send the bulletin to other offices. But the problem is that it looks and reads like a routine technical report. Some other issues:

(i) Many residents of the community assume it is another technical bulletin and ignore it.

(ii) No one in your or other agencies is willing to interpret the bulletin and use their own words in telling other offices and residents.

(iii) While there is an evacuation order, many residents stay mainly at home (including home-bound elderly residents) and news does not reach them.

(iv) To compound matters, at a preparatory meeting, a high-ranking government official reads the wrong report and mistakenly tells everyone that the typhoon would make landfall hours after the actual predicted time. Lower-ranking staff notice the mistake but are too hesitant to correct the official.

Typhoons are common, and most residents assume they will just do whatever they normally do during these events. The storm surge catches everyone by surprise. Many are caught by the rushing waves at home. Though you and your family survive, many of your neighbors do not. Most of their homes were destroyed by the fast moving surge, and they were caught inside these structures. Later that day, the mayor says, "This is the worst tragedy to have ever struck our community," and requests the national government for disaster relief aid.

Now, imagine a second scenario that differs significantly from that described above.

SCENARIO TWO

Now imagine a different scenario. You see the storm surge warning from the national weather agency. You make sure you understand what it is saying and, then, proceed to tell the story of what will happen when the typhoon arrives with its storm surge. You tell others and transmit a new message, telling it in your own words to make sure others understand it. You put your message in a memo that you then distribute to the people in your town. Some people say it is okay, they are used to typhoons, but you tell them this will be different from previous ones, and the storm surge will be unlike anything they have ever experienced. All the residents get involved in telling the message to others, especially people who stay mainly at home. At the preparatory meeting, staff speak up and correct the government official, saying the typhoon would actually arrive hours earlier.

The typhoon comes, but most people have left their homes in the high-risk area and stayed either at the evacuation center or with friends farther away from the coast. Though some are injured, there is no loss of life in your community. A day later, families return to their neighborhoods only to find many of their homes completely destroyed. A friend tells you, "We have lost everything. But, you know, we are all safe, we are very grateful."

Same situation, two very different outcomes.

The truth is, the first scenario describes events that actually occurred (and occur on a regular basis). As you will be discussed in this toolkit, the lessons for us are simple and, yet, so challenging to put into practice. We summarize some of these lessons below.

Lesson 1. EVERYONE must be involved in RISK COMMUNICATION. This way, messages penetrate the entire community, reaching even residents who are isolated at home or elsewhere. By everyone, we mean officials in every agency but, also, community residents (neighbors, children, teachers). In a word, we have to *democratize* risk communication.

Lesson 2. EVERYTHING has to be UNDERSTANDABLE. Risk information has to be communicated in understandable ways. The boundaries between agencies and between agencies and the public are too rigid. Agencies often communicate in only technical ways and fight over who is to communicate risk information. Members of the public are hesitant to receive and communicate information that they feel is something only for technical for them to manage. In short, we have to *popularize* risk communication.

In the following pages, you will find a guide to communicating risks of these types of events. You can go through it on your own or, even better, in a group of others from your organization or community.

One problem with warning people about something like a large storm surge is that, often, these warnings come in technical bulletins from the national agency. People can ignore these warnings because of a number of reasons:

- national weather agencies focus only on technical analysis and not on communication,
- the language is technical and does not provide information in easily understandable ways,
- the technical bulletin looks like something that is not meant for the public,
- local officials are afraid to interpret or add to the message from the national agency for fear of overstepping their bounds, and simply routinely pass it on,

- the communication looks like a routine agency bulletin that is business as usual,
- the public (or local official) does not think that the bulletin addresses their situation directly,
- the bulletin is not well designed (e.g., does not suggest what actions people can take),
  for these and other reasons, people dismiss these bulletins and ignore or forget them,
- the same national and local agencies focus solely on routines (checklists, protocol, rules) that can stifle the free communication of knowledge instead of ensuring it,

There are other reasons that people ignore evacuation advisories and get caught by a flood:

- people think the coming event is just like what they had experienced in the past but, often, extreme events are things the local community has never seen before,
- people naturally associate the home with safety, security, and comfort, even when their home is located in an area of high risk,
- some people are socially or physically isolated (e.g., home-bound elderly) and not well reached by official communication (e.g., evacuation advisories).
- people do not want to leave home because they fear burglary while away,
- people have negative perceptions of the evacuation center and avoid going there.

One root of the problem is that, in many places, government and society draw rigid boundaries: (i) between government and community, (ii) between experts and the public, and (iii) between different agencies. The first issue ensures that the public are treated as simply passive recipients of information and are not expected to participate in risk communication. The second emphasizes information that is technical and difficult for others to understand and pass on. The third creates in-fighting between agencies as to who is to engage in communication (when, in truth, all have to be engaged) and a tendency to focus only on formal routines (hence the predominance of checklists, forms, classification schemes, rules) and not on the fostering of the free flow of communication. Though different national and local contexts have different characteristics, we find the above issues to be true in many contexts. In this report, we draw attention to two kinds of talk, shown below.

Formal Mode	Interpersonal Mode
Standard / Routinized Talk Bureaucratic Speech Technical Terms Public Voice Objective Tone Third Person / Neutral e.g., "The storm surge is classified as high-hazard warning to near-shore residents, who are advised to evacuate."	Particularized / Direct Talk Personal Speech Descriptive Terms Private Voice Confiding Tone Second Person / Concerned e.g., "This flood will be worse than anything you have ever seen, please evacuate before it is too late."

One point to be made is that it is never simply an either-or proposition between these two modes of communicating, and that agencies and publics can use both. Later, we draw a similar contrast between the universal, neutral speech of risk analysis and the embodied, gendered speech of real people.

In this Guidebook and Tutorial, we outline a series of lessons and exercises that is meant to free up and improve communication processes. It is accompanied by a tutorial, which can be a do-it-yourself exercise (on paper or online at https://environmental-communication.space) or part of a larger workshop. Also accompanying this Guidebook are several technical addenda that further discuss particular aspects of the issue.

1. Purpose and Scope of the Report

This is a guide to communicating the risks from storm surges attendant to tropical cyclones or hurricanes. To develop guidelines for communication, a set of focused studies were conducted, including a literature review, a survey testing alternative message texts, and an evaluation of communication around Typhoon Haiyan and other events. These studies are found in the attached Addenda, which provide research in support of the recommendations in this report.

In the latter part of the report are a series of templates for crafting messages (consisting of text and graphics) for use in various venues, including news bulletins at various levels of communication, a media packet for TV and radio, and sms texts. The templates are prepared according to guidelines and best practices identified through the research done for this report. The focus of this report is not on the modeling and prediction of storm surges but on how such knowledge is communicated, shared, and utilized.

The report is designed for the use of agencies and nonprofits engaged in preparing for extreme weather events, news media, and education providers engaged in fostering awareness of these events. To craft guidelines and a toolkit for communicating storm surge risks, the project team reviewed and condensed much emerging research and tried to bring the most recent findings in the literature to the task. The team also conducted a number of empirical investigations in the Philippines, including a survey of public responses to message design and an analysis of institutional issues encountered during Typhoon Haiyan, which struck the Philippines in 2013. The team also reviewed case study literature on other events, such as Hurricanes Katrina and Sandy in the U.S. While much of the empirical work discusses the Philippine situation, which is the main project site, this report is meant to apply to other country situations, especially those where frequent extreme weather events are coupled with deep vulnerabilities, especially among lower-income communities, to these events.

Before entering into the art and science of risk communication, it would be good to note some underlying principles that inform this work. First, the task of risk communication should not be seen only as imparting information. Rather, it is part of a broader agenda in strengthening capacities for analysis, decision-making, and adaptation on the part of relevant agencies and local communities. Towards the end of the report is a discussion of a broader agenda involving interventions aimed at increasing the 'coastal literacy' of communities and strengthening the network of disaster risk reduction professionals. Second, the risk communication process, especially in places with marginalized populations like the urban poor, is a 'messy' process, wherein residents may receive information about a forecast event through different media, many of these informal. For this reason, agency staff and media need to take advantage of the multiplicity of routes of communication and ensure that communication along each route conforms to best practices and contains necessary message components (discussed later in this report). Third, there is a strong contextuality to risk communication --i.e., messages have to be tailored to the audience. In some cases, messages need to be tested across a broad spectrum of publics (agencies as well as members of the public) and, in others, they should be individualized to suit the particular community being addressed. What are the special considerations of the urban poor? What measures and messages are needed to address the needs of the infirm and disabled?

We should be cognizant of who the decision-makers are. In most societies, these are ultimately individual members of the public and heads of households. This is why communicating to promote understanding and involvement is important. One cannot simply assume that an evacuation order automatically produces the desired response on the part of residents. But communication of technical information does not mean that recipients need to be proficient in handling the technical --indeed, much of this

work is premised on the idea that science can be expressed in everyday terms.

This brings up the need to integrate different knowledge systems --technical and everyday community knowledge. This question comes up, most often, when talking about the use of hazard maps prepared by the national government, and their consistency with locally formulated maps. Moreover, unlike some of the literature, which contrasts rational, expert agency approaches with participatory, community-based approaches, what should be clear by now is the need to integrate both into a coherent strategy (Berke and Stevens, 2016).

Lastly, as will be discussed herein and in the Addenda to this report, communication of hazards needs to be an open, interactive process that involves actors (even the public) beyond the weather agency in transmitting knowledge about a storm surge risk. Contrast this to the conventional system where only the expert agency has knowledge, and only it can relay information. This report (and, in particular, Addendum A, Evaluation of Communication During Typhoon Haiyan) works out why the conventional approach can be improved upon.

2. Employing a Risk Communication Framework

Risk communication is a rich field of study that provides valuable insight for practitioners involved in preparing communities for extreme weather events. There is much more to sharing knowledge about incoming storm surges than focusing on its risks to health and property, but lessons from risk communication research can pertain to these other aspects (emergency preparedness, logistics, long-term resilience) as well.

A standard definition of the term, risk communication, is a “process of exchanging information among interested parties about the nature, magnitude, significance, or control of a risk” (Covello, 1992, p. 359). For the purposes of this report, we can take risk communication to pertain to the transmission and sharing of knowledge concerning storm surge hazards (in terms of threats to public safety or property) among affected organizations and individuals.

The simplest, most basic conceptual framework for risk communication is the classic "source–receiver" model of risk communication, as shown in Figure 1 (Shannon and Weaver 1949; Witt 1973; Shoemaker 1987). In this classic model, the goal is simply to transmit, with as great a degree of fidelity as possible, a message from originator to recipient. The focus of this model is on the accuracy and completeness of the message, the success of physical transmission to the receiver, and the degree of understanding on the part of the recipient.

As useful as the source-receiver model is, it needs to be complemented by other depictions of the communication process that better describes aspects of the social and political environment. Figure 2 depicts the model known as the social amplification theory of risk (Kasperson et al. 1988; Renn et al. 1992). In this literature, risk communication is mediated by a host of social, cultural, and other processes, which affect how such communication is received (Pidgeon et al. 2003). The figure also reflects Everett Rogers' insight that communication is not simply a one-way, linear process (Rogers, 2010) and, instead, interactive feedback and conversation between the parties (Hadden, 1989).

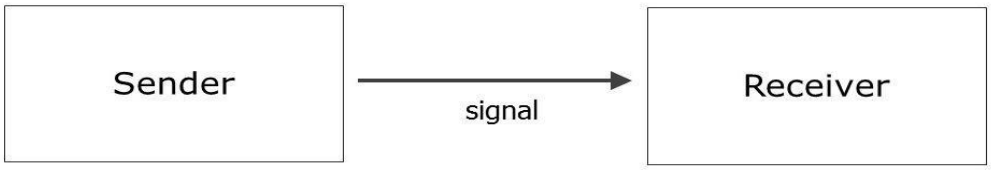


Figure 1. Classic Risk Communication Model

Figure 2. Social Amplification Model of Risk Communication

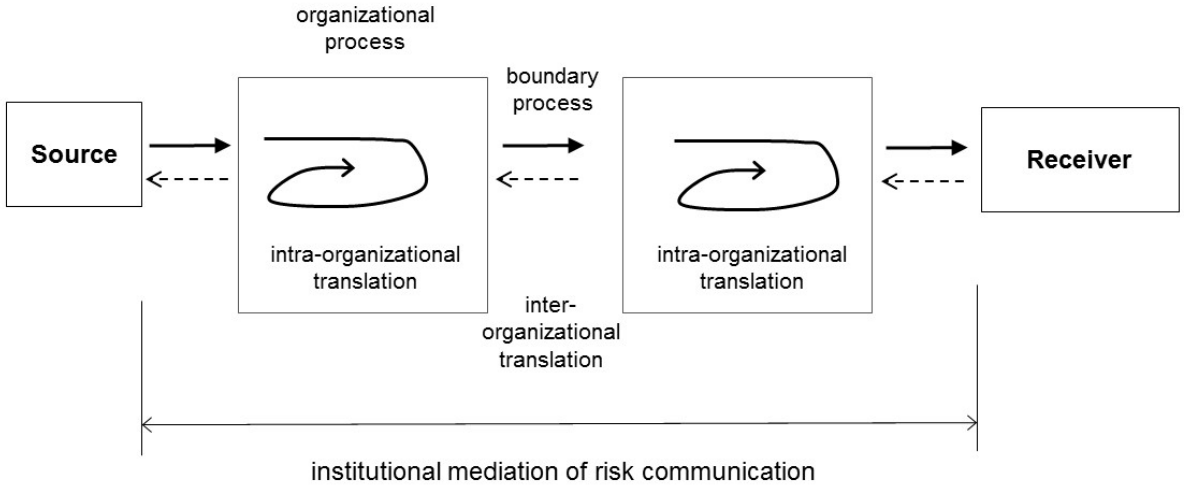


Figure 3. Institutional Processing of Risk Communication

And Figure 3 describes the complex institutional environment within which risk communication takes place. Instead of an exchange between two parties, knowledge courses through a network of organizations and individuals.

With these conceptual models in mind, it is good to acknowledge a number of essential features of the risk communication process.

Reception: Messages must be received, understood, considered relevant by recipients to their situation, and acted upon. This is as suggested by the classic model of risk communication, as in Figure 1. The focus is on the design of the message and transmission process. As discussed below, there are key essential elements that should appear in messages whenever possible.

Redundancy: An organization or individual, in reality, receives multiple messages from multiple sources, as suggested by the network model of Figure 3 (see, also, Sorensen, 2000). This brings up issues about redundancies in information, diversity of modes of communication, and possible issues with conflicting messages. The focus is on taking advantage of multiple communication pathways and consistency /richness of communication all throughout.

Competencies: Communicating risks of an anticipated event builds on a store of common knowledge and shared skills (at interpreting messages and hazard classifications, reading maps, using technical information, etc.) and previous experiences of individuals, organizations, and communities of related events.

Unprecedentedness: The previous point raises a particular feature of extreme weather events, which is that, too often, the event is something that the impacted population has never experienced before. This is particularly true of storm surges, as most people's experiences of floods are those of inland flooding due to rainfall and overflowing watercourses. Most importantly, for many (or most) communities that will be hit with a severe storm surge, this event will be the first of such magnitude that they will have ever experienced. Communication needs to help them visualize the oncoming event and motivate precautionary action.

Informality: Lastly, communication can occur informally. A community resident often hears about an event such as a local evacuation from friends and relatives, either face-to-face or through other means (social media, text messages, phone calls, email). Agencies tasked with initiating risk communication should take advantage of these informal routes, for reasons discussed below.

3. Key Ideas

The following are key ideas that underlie the approaches to risk communication of storm surge recommended in this report. A full discussion of each idea follows this section.

Message Elements: There are a list of message elements that should appear in each message, to the extent possible. This includes even very short messages, as in sms texts.

Duplication: The tendency is for organizations and agencies to simply pass on, routinely, messages from the national weather agency. This can have the effect of making messages appear to be simply routine and pro-forma communications, not necessitating special consideration from the recipient.

Interpretation/Translation: In contrast to pure duplication, research supports the idea that messages need to be contextualized and personalized. In many cases, this entails elaborating or translating messages from the national weather agency to reflect local conditions and to speak directly to recipients, as the messages become distributed in more and more local contexts. Translation also means putting the message in language that recipients easily understand and can pass on.

Self-Relevance: A message can be ignored or treated perfunctorily by a recipient when it is not seen as directly relevant to the recipient's situation. Including key message elements, and increasing contextualization and personalization (with degree of locality), can foster this.

Trust: A message can be treated with less importance by recipients when they have no trust in the sender or the message. Trust is a factor of the authority of the messenger but, also, the degree to which the recipient is familiar with or

recognizes the sender as someone that is trustworthy.

Relationality: The idealized communication situation is that of face-to-face exchange between sender and recipient. In this ideal situation, self-relevance and trust can result. Another feature of direct exchange is the possibility of interaction, where the recipient does not simply receive a message but is able to dialogue, query, and confirm with the sender. The implication of this is that messages and modes of transmission can emulate the qualities of direct face-to-face communications. This has further implications for message design, since recipients should be able to pass on the message to others in their own ways of speaking.

Distinctiveness: There is a need to communicate coming events as distinct --i.e., they have to stand out and catch the reader's or listener's attention. This requires a number of practices on the part of the agencies, including ways of highlighting or foregrounding extreme weather forecasts. This is especially needed since, in the case of severe storm surges, such an event will be something never before experienced by the affected community

Uncertainty: Lack of accuracy or precision of weather and storm surge forecasts can lead to hesitation, on the part of the sender, to communicate richer information. One way to address this is to incorporate expression of uncertainty into the message.

Mixed-Motivation: People have multiple motivational reasons for evacuating or staying in place. These can include dismissal of the warnings, fear of theft while away from home, negative impressions of the evacuation sites, and others. The warnings should attempt to address these multiple factors

Vulnerabilities: Extreme weather events do not affect everyone equally, and some are more vulnerable to death and injury immediately due to the event and prolongued hardship afterward. However, the mechanisms by which some become more vulnerable are highly dependent on context. The poor and disabled can experience the event in more difficult ways. Often, women can be affected differently --e.g., in some communities, many women spend much of their day doing work at home and possibly isolated from communication networks. Communication processes need to be designed to address these context-specific vulnerabilities.

Each of these key ideas are supported by the research done for this project. In the following pages, these ideas are developed, referencing the technical reports in the Addenda where relevant.

At the end of the report are the communication templates, each designed with these key ideas in mind. Following the templates is a language design aid, providing possible phrases that the user might choose from in crafting a message.

4. Discussion

4.1 Message Elements

The key idea is that the recipient, whether an agency or member of the public, understand what the event is, what the recommended action is, and why the message is directly relevant to the particular agency, individual, or community. The goal of any message is to have the recipient use the knowledge to decide on a pertinent course of action.

Risk communication research has identified five necessary message elements: Source (Lindell and Perry, 1987; Stephens et al., 2013), Hazard (Drabek, 1999; Neuwirth et al., 2000), Location (Drabek 1999; King and Cook, 2008), Guidance (Drabek, 1999; Mayhorn and McLaughlin, 2012), and Time (Sorensen et al., 2004). Recent work has confirmed the importance of having all these elements present in the message, though it is less clear if their order of placement makes a difference (USDHS, 2014).

As discussed in the following pages, messages are more effective when they are contextualized and personalized --i.e., when it is clear to the recipients that the message addresses their

situation and location directly. For this reason, the project has identified a sixth element to add to the list, which we can refer to as the Recipient, or some phrase in the message that tells the recipients that the message is addressing them directly. This can take the form of identifying the affected population specifically. At a minimum, even simply writing the message in second-person format can achieve some degree of personalization (e.g., instead of "Those in the affected areas should evacuate immediately", say "If you are in the affected area, evacuate immediately".)

The final list of message elements is shown below:

Source: Who is sending the message (whether agency or individual)?
Recipient: Who does the message concern, and is it directly addressed to them?
Event/Description: What is the forecast hazard?
Location: Where will the event occur, and what local areas are to be most affected?
Guidance: What is the suggested course of action?
Timing: When will the event occur, and by when does the action need to be taken?

It is important to note that each of these elements can be present as very long strings of text or very brief ones. The idea is that they would, ideally, be present in each communication, whether an extended technical memorandum (where these elements can be discussed at length) or short SMS texts (where these elements can be very brief). For example, Figure 4, shows how a brief text message ("RED ALERT: San Pablo coastal residents, storm surge 4 m danger high, evacuation begins Tues 2 pm, call 119:)") contains all of the elements in a short bit of text, as in the U.S. Federal Wireless Emergency Assistance (WEA) system, which has a 90 character limit.

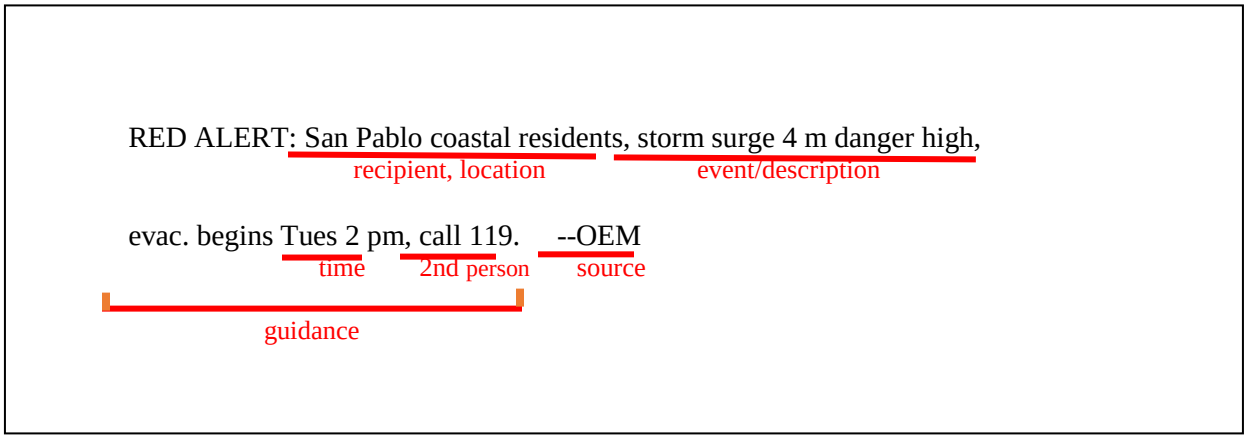


Figure 4. Message Elements in a Sample WEA Text

We have described the above messages as strings of text. Though it is not always possible, the inclusion of a map can increase message effectiveness. In some cases, the map is the message though, in general, a message should consist of both text and graphic. The USDHS study (2016) cautions, however, that message effectiveness seems to increase only with the inclusion of high-resolution maps, where readers can identify their positions on, and that low-resolution maps can reduce the recipient's interest in the message. Another issue is the need, on the part of the reader, for some degree of facility with reading and interpreting maps.

Lastly, many routes of communication cannot use maps (e.g., radio broadcasts, word of mouth, text-only SMS messages) and, so, we emphasize the need for messages to consist of text, not just graphics. Though both are important, the absolute

need is greater for message texts rather than maps, which goes against the tendency of most technical agencies to concentrate on map production (e.g., storm surge hazard maps). This is not mutually exclusive, however, since maps can be translated, usually informally, into words by radio announcers, local government officials, and members of the public.

Optional Message Elements
The above constitute the necessary message elements, but other elements can be added as well. Among the extra, optional message elements are:

Time Stamp: the date and time of the message, so that readers can judge if it is current or not;

Link: some link to another source or webpage or other reference that contains more information than can be found in the message (e.g., storm surge inundation map on an agency website).

Uncertainty: acknowledgement, and maybe even estimates, of the inherent uncertainty behind storm surge predictions;

Regarding uncertainty, discussions with agency staff suggest a desire on their part to be able to impart, to the public and other agencies, the idea that all the weather and storm surge forecasts come with a considerable degree of uncertainty. The inherent goal of the scientist is to report the science as accurately as possible, and this means reporting the uncertainty associated with predictions. A secondary consideration is trepidation over false negatives (when the event turns out to be worse than predicted) and, to a lesser degree, false positives (when the event is not as severe as predicted). Related to this is a desire to avoid undue post-event criticism of the agency's forecasts.

The conventional way of expressing uncertainty, however, is a statistical approach (e.g., indicating 'error bars' or standard errors), which some experts fear would be overly complex and a type of information overload that many publics would not be able to handle. A thorough way of incorporating uncertainty is to incorporate it into a hazard map --e.g., the U.S. National Hurricane Center's Probabilistic Storm Surge Exceedance graphic maps probabilities that areas will experience a certain storm surge flood height (see http://www.nhc.noaa.gov/surge/psurge.php).

Uncertainty can be expressed in different ways, however. The simplest is a qualitative approach, where language is used that acknowledges uncertainty and the possibility that the forecasts are wrong. Perhaps a middle ground is to use a simple measure of uncertainty, without employing a suite of statistical measures. An example of this is to posit that the probability that the forecast event (e.g., storm surges along a specific coastal area) might not actually occur. Note the difference of such an estimate from that that pins the probability that the actual storm surge inundation heights would not match those which were predicted --the probability of such would be essentially 100 percent. But the probability of no occurrence at all, of storm surge, in a general area where some storm surge has been predicted, is a smaller probability and something that provides people with a reasonable sense of uncertainty.

4.2 Duplication

The research team conducted an evaluation of communication issues observed during Typhoon Haiyan (and, to a lesser degree, similar issues during other events like Hurricane Sandy). This report is found in Addendum A -- Evaluation of Communication During Typhoon Haiyan (see also Lejano et al., 2016).

The usual communication situation begins with a national weather agency generating a storm surge forecast or model output. This, or related, agency then transmits the information as hazard warning bulletins to other agencies and to the public.

There is a tendency for a recipient organization to take the bulletin and simply retransmit the same unchanged (though, sometimes the organization will remove parts of the message and transmit an even shorter form of it). The evaluation exercise (Addendum A) suggested, however, that mere

duplication of a message increases the likelihood that it will be seen by the recipients as a routine exercise requiring no responses out of the ordinary. For members of the public, the response can often be to disregard the message. This was seen to be the case during Typhoon Haiyan in the Philippines in 2013 and, to some extent, in the case of Hurricane Sandy in New York and New Jersey states in 2012. In short, the routine copying and retransmission of messages (which often are sent to a national audience) can reduce the degree to which recipients find them as self-relevant and actionable.

As discussed below, the remedy requires interpretation and modification of the message by the recipient. The idea is to produce messages that are tailored for more specific recipients and that increase the degree of contextualization and personalization. This brings up the question of how the recipient can increase message specificity or richness when the original message contained none of it. This issue will be discussed below.

4.3 Interpretation

Consider a bulletin from a national weather agency that is received by a local mayor's office or community organization, which then passes on a message to field agents or the local population. Ideally, the local agency would modify the message to call out locally relevant details and address the local community directly --otherwise, recipients may regard the communication as the same as standard bulletin information from the national weather agency, leading to a business-as-usual response. This even pertains to transmission of local emergency response orders --when they appear identical to previous, then there is no indication as to what different responses are required in the present situation. But responses have to be tailored to the specific situation --whether on the part of the local government or members of the public. For example, which areas to evacuate depend on the specifics of the oncoming event.

The literature has reinforced the idea that different message recipients need to be active in interpreting warning messages. That is, one cannot assume that members of the public would evacuate en masse if told they should without explanation. In the end, individual households decide to evacuate or not, regardless of what the national or local agencies tell them (even under a mandatory evacuation order). Local agencies and organizations have to assess the degree of urgency or severity of the situation to calibrate their actions, as well. There is a natural tendency of bureaucracies to assume that pre-established routines are sufficient to organize the right response, but routines do not determine the extent of actions on the ground. There is always a degree of discretion on the part of the local agency official or member of the public. Moreover, routines can fail to respond adequately to extreme weather events that have never been experienced by the local population.

The basic idea is that, as messages are routed through more and more local networks, the messages themselves need to become more contextualized and personalized. That is, the messages have to speak to the recipients specifically and directly. This is discussed at length in Addendum C (Overview of Communication Practices Around Storm Surge) and is depicted in Figure 5, below.

The need for interpretation on the part of recipients before retransmitting the message is echoed in the discussion below, on self-relevance and trust. We emphasize that these same principles pertain whether the recipient is a government agency, an organization, or members of the public.

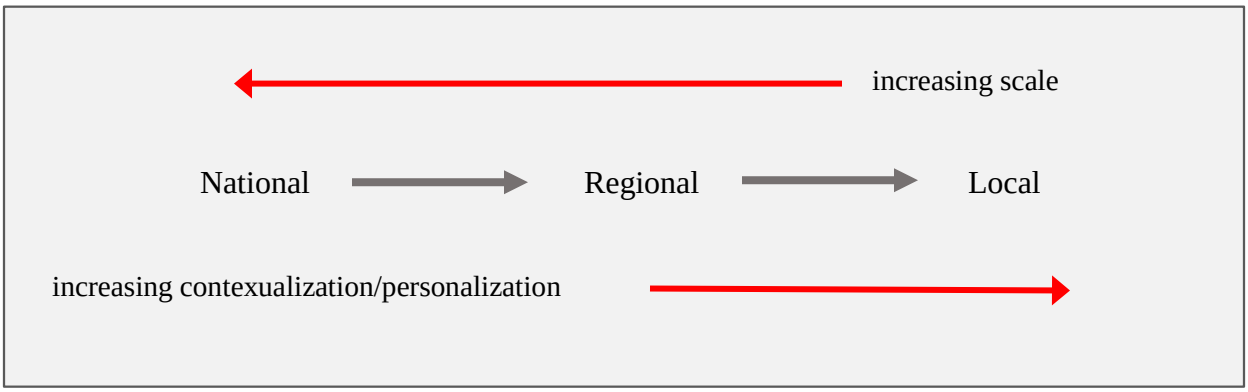


Figure 5. Tailoring Messages to Scale

4.4 Self-Relevance and Trust

Ultimately, the success of a disaster prevention or evacuation effort depends on the decisions of thousands of individuals and households. Evacuation orders can be ignored, or they can be treated with urgency. For this reason, messages need to be understood by these people as immediately and directly relevant to them, and the sources have to be those that they regard with trust.

Now, this pertains even when the message recipient is a local government agency. The field agent needs to personally assess a great the severity of the threat is, as well as the urgency of action. An evacuation order can be treated as a routine event or an extraordinary one necessitating unprecedented action.

The literature on message self-relevance and trust is discussed in Addendum C. Self-relevance increases when the message speaks to the situation of the recipient in specific terms. Another aspect of self-relevance is when the message is somehow addressed directly to the recipient.

Similarly, trust involves multiple dimensions, one of them being the credibility and authoritativeness of the message source. There is more to trust, however, than simply knowing the sender is an authoritative one. Another aspect of trust is referred to as affective or identification-based trust, which refers to the aspect of the recipient's knowing, being familiar with, or identifying with the sender. One sign of this is when messages are personalized and contextualized.This brings us to the next idea.

4.5 Relationality

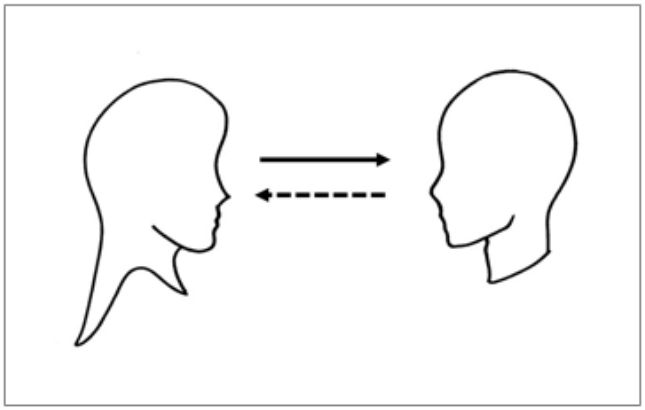
As discussed in Appendices B and C, the idealized communication situation, which maximizes self-relevance and trust is the direct face-to-face exchange between two persons (the sender being a person considered by the recipient as trustworthy), as depicted in Figure 6.

Weather and disaster risk reduction agencies and local governments are not able to communicate directly with individuals, of course (of course, there are exceptions to this, such as when the agency maintains a hotline). But messages can be contextualized and personalized to closely approach the ideal of direct communication. As described in Addendum B (Research on Message Design), the research team tested the effect of two alternative messages, shown below: Message A, an enhanced message that features a greater degree of contextualization and personalization, and Message B, a default storm surge warning bulletin.

Survey responses indicate a statistically higher positive response (in terms of willingness to evacuate) from Group A compared to Group B. Moreover, Message A registered higher in vividness and self-relevance, but no statistically significant differences in trust or authority.

Figure 6.

Idealized Face-to-Face Communication Situation



Message A

To residents of Barangay Pablo,

According to PAGASA, our barangay may experience a storm surge of 1 ft (up to your knees) tomorrow. You and your family may be in danger. Even if low, you may be swept by the water and carried away. You or your family can be hurt or even drown as the fast-moving water carries you. Please evacuate immediately. Call me should you need assistance.

Your tanod and PAGASA liaison,
Mariano Loreto.

Message B

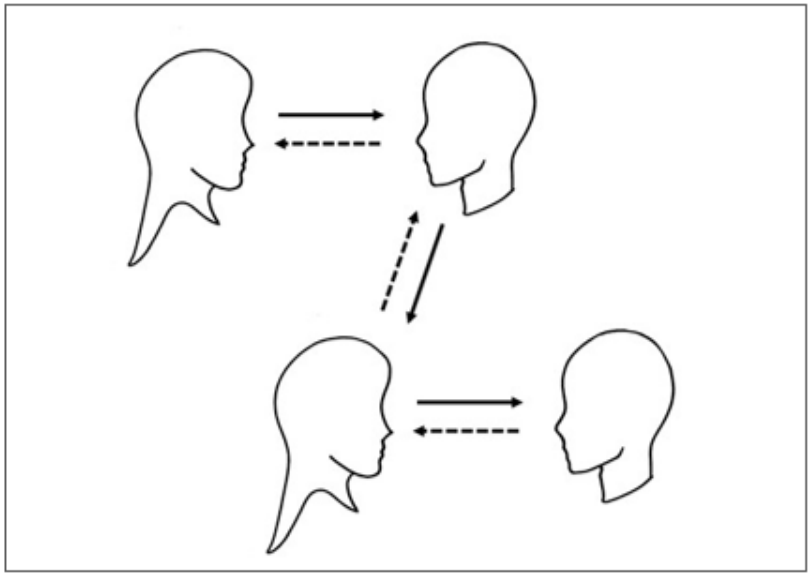
PAGASA forecast: 1 ft storm surge by tomorrow.
Risk: Possible danger as this level of surge can sweep people away.
Hazard: Possible injuries from trauma or drowning from flood.
Recommendation: evacuation of residents in affected area.

So, the message can emulate characteristics of direct face-to-face communication, where the sender is a person known to the receiver, and the message directly addresses the receiver's situation. This effect is enhanced by the wording of the message, which is written in second-person (i.e., addressed to "you") --this is what we mean by personalizing the message. It can also be enhanced by having the message refer directly to the local community --this is what we mean by contextualizing the message. This effect can also be enhanced by using everyday language.

An obvious strategy is to take advantage of direct communication. At the local level, this is achieved formally through door-to-door campaigns or, less directly, a roving announcer speaking through a loudspeaker, using a siren, or other similar method. One step removed from this is broadcasting messages through television and radio, especially through local stations.

One survey inquired into which routes of communication were most effective in spurring action. The highest ranked item was communication through family and friends, followed by tv, door-to-door visits, sirens, radio,

Figure 7. Interpersonal Communication Process



internet posts, and SMS/text bulletins, in that order (USDHS, 2016). Social media and posters were not found to be least effective in inducing action. These findings are consistent with the relational model, where trust and self-relevance are seen to be maximized through direct face-to-face communication. For example, one reason tv may be more effective than radio is that seeing the sender approximates receiving the message face-to-face.

Messages consist not just of the text, but also the delivery of the message. How it is delivered, and by whom, can affect message effectiveness, as we will discuss below.

There are yet more implications of the relational model. Extending the communication process to others, what we have is as depicted in Figure 7, which shows the message as being passed on from person to person. What is required for this to happen, however, is that the message be something that people can translate into their own ways of speaking, which requires understanding the meaning of the forecast event and recommended actions. And this has implications for agency staff, the media, and others, that messages need to be put into language that is not too technical, so that recipients cannot pass it on and retell the story in their own terms. This is further discussed in Addendum A, which evaluates how organizational routines can constrain message reception and response.

Aside from personalizing and contextualizing the message, another signal of directly relevant (as opposed to merely routine) communication is tacit, 'confiding' language --e.g., "You may assume this a routine warning message but do not. You and your family are in danger."

One more thing to note, and that is the time needed for information to course through the network depicted in Figure 7. This means that organizational routines, which can delay alerting the public to a storm surge until either model results are more exact or until a cyclone enters a country's or agency's jurisdication, can leave too little time for communities to learn about, communicate, and prepare for the event.

4.6 Distinctiveness

In many countries, cyclones are a fairly periodic occurrence. This means that populations are used to these storms and even expect them to occur each year. This can actually pose a problem, as far as coping with the risk of storm surge. Most of people's experience will be of strong winds and inland flooding. Extreme storm surges are not a common experience and, so, people's prior experiences will not guide them as far as dealing with storm surge risks, and this goes for both the public as well as local agencies.

This means that messages might contain some indication that the forecast storm surge is something beyond the range of experience of the local population (both residents and officials).

We can predict, with a fair amount of certainty, that catastrophic storm surges will occur in some part of the world. The issue is that, for that community that is hit by the surge, it will invariably be the first time the local population would have experienced such an event. This was the case during Hurricane Katrina, as well as Typhoon Haiyan. This poses a dilemma, since people's risk avoidance behavior is strongly influenced by memory of extreme weather events in the past (Hall and Endfield, 2016). Complicating this further is the possibility, as some recent scientific investigations suggest, that climate change may lead to increasing frequencies of these severe weather events (Emanuel, 2013).

4.7 Mixed-Motivations

The survey, described in Addendum B, recruited Tacloban City residents who chose not to evacuate during Typhoon Haiyan. They were asked to rate possible reasons for not evacuating on a scale of 1 to 4 (least applicable to most applicable). The responses are summarized in the table below.

The responses reveal a wide range of reasons behind not evacuating, may of which had a mean rating of around 3 on a scale of 1 to 4. This suggests that many motivating factors were behind people's decision not to evacuate. The highest ranked responses include: perception of safety of the home, underestimating the strength of the event, negative impressions of the evacuation center, fear of theft, and lack of clarity regarding what a storm surge was.

What this implies is that warning messages and evacuation orders need to take these multiple factors in mind and attempt to address them, to at least some extent.

Item	Mean Rating
I did not hear about or know about the coming flood/or storm surge.	2.278
I heard about the flood/storm surge but did not think the risk was great.	3.011
I felt my home was the safest place to be.	3.478
I did not like to stay at the evacuation center.	2.966
Storm warnings in the past, before Yolanda, are usually exaggerated, nothing usually happens.	2.889
I heard about the storm surge but the information was unclear about what a storm surge is.	2.922
I did not think that the information about the storm surge applies to me or my local area.	2.822
I was afraid to leave my home because someone may break in and rob us.	3.044
I was waiting for some official or person I know to inform us [about the storm surge?] in person.	2.191

4.8 Vulnerabilities

In every community, there are groups of people who are more vulnerable to harm from extreme weather events. But who, exactly, and how they are more vulnerable, is something highly dependent on each specific context.

In some areas of the world, the most exposed can be the urban poor who might live in makeshift housing along the coastline or riverbank. In other cases, low mobility and access to transportation can leave the infirm and elderly most vulnerable.

There is a growing literature, too, on how women in many communities can experience or be harmed by extreme events in ways differently or more more deeply than men. In some large-scale disasters, it was found that female victims outnumbered male victims significantly (GFDRR, 2016). The research group investigated specific pathways of vulnerability for women during Typhoon Haiyan, which is discussed in Addendum D (Gender Report). Interviews with survivors of Haiyan's storm surge were interviewed, and their comments underscored the fact that the pathways by which some women can experience extreme weather events differently is specific to context. In Tacloban City, socio-economic patterns underlie some of these vulnerabilities.

As one interviewee suggested, some women were more isolated from risk communication about the storm surge and evacuation because of physically spending time at home: "News…? Of course, since they are not exposed in their communities, they are more focused in their houses, in their house, in their household to take care of the kids.. They wash clothes, so more of their chores at home, they have limited access to news.. maybe because we are used to the culture that women are just home. It's like we are contented that they are just there. Like the decision making (power) for the whole community they are already dedicating it to other people… Ok.. yes i mean if they're not busy since we have a notion that women are only at home the whole day.. But actually, it's not because, to take care of the house, it's a fulltime job. You wake up in the morning you take care of

your kids, your husband and when they leave for school or work, you wash the dishes, you clean the house, it's like your rest is to take a nap and watch tv.. Something to relax you.. Not news… So many things are done by mothers or by women who just stay.. Of course, since you are tired the entire day… you just sleep… Very dangerous since she herself who is at home she's very busy…"

The theme of women's multiple, consuming responsibilities was a recurring theme. One interviewee said that, during the first rush of water from the storm surge, many women were caught trying to save their children, as she recounted what happened to her neighbor:
"Because firstly, women are always concerned about the welfare of her family. Secondly, they let their children out first. And women don't know how to swim. They're concerned about their children…That's because the water suddenly rose. Her children started to panic, she struggled to put her family to safety first, which is why more women died compared to men."

And, so, the risk communication instruments and process need to be tailored for the specific vulnerabilities found in a place. This is a challenge, especially since the idealized communication process (Figure 1) envisions a universal message delivered to universal recipient. But, often, who the messages are geared toward and delivered to, versus who are isolated from these communication channels, can be different groups in a community. One lesson from Haiyan is that risk communication should be a more widespread process, including everyone possible (e.g., home-bound, children, etc.) so that knowledge is transferred to places and people normally not accessed by formal processes.

The involvement of all members of the community in risk communication also addresses another issue identified earlier, which is that, often, weather bulletins and warnings seem to simply be standard agency talk, which may seem as simple bureaucratic routine. But if the same messages are heard, especially face-to-face, from a trusted person, then the message is more likely to be recognized as "real" and not just routine agency communication. But this idea goes against what many agencies espouse, which is to designate that only official persons conduct risk communication --this can be a dangerous mistake, especially when there are people in the community who are isolated or, for different reasons, afforded less access to information. Everybody in the community must learn to spread the word.

Literacy can be an important vulnerability factor, also. In preparing for workshops in one lower-income coastal community, it was found that lowered literacy rates in that place meant that printed material might not be as effective. Workshops were then designed around verbal transmission of information. In short, communication needs to be tailored for context --i.e., there is no such thing as a 'universal message'.

Messages are not only the text but also the way the text is delivered, which leads to another important idea: if there are groups that are more vulnerable or more excluded from communication channels, then there can be great benefits to including representatives from these groups in risk communication. Such representatives can speak to special concerns or conditions experienced by these groups, and they can ensure that communication is routed to those often excluded from them. Perhaps messages can be tailored to the needs of these groups. Also, workshops on disaster risk prevention and risk communication should seek out representatives from these same groups. For example, if, in a certain region, small-scale fishers who live on the coast are most vulnerable to storm surge, then risk communication workshops should explicitly seek out members of this group.

Should representatives of excluded or vulnerable groups be the faces of broadcast messages? Can the message text reflect their concerns or, even, be in "their voice"? Perhaps new practices can increase the degree to which message recipients trust or identify with the source.

5. Two Kinds of Talk

The table below contrasts two types of speech.

Formal Mode	Interpersonal Mode
Standard / Routinized Talk Bureaucratic Speech Technical Terms Public Voice Objective Tone Third Person / Neutral e.g., "The storm surge is classified as a high-hazard warning to near-shore residents, who are advised to evacuate."	Particularized / Direct Talk Personal Speech Descriptive Terms Private Voice Confiding Tone Second Person / Concerned e.g., "This flood will be worse than anything you have ever seen, please evacuate before it is too late."

Why is the speech on the left side of the table technical and the one on the right merely descriptive? There is use of scientific or technical measures, such as rating systems. But more than that, the overriding concern with technical, objective talk is pinpoint accuracy and legal formalism, while the main concern of descriptive, confiding talk is to have the message recipient understand as much as possible. For this reason, technical speech will never describe a coming event as "worse than anything you have ever seen" because, technically, there is always a chance that someone may have. The urge, with technical talk, is foolproof speech, even to the point of not communicating the meaning of the message effectively. For this reason, bureaucratic talk will never call a storm surge a tsunami and, in fact, will even avoid using a term like 'tsunami-like'. However, descriptive, confiding, interpersonal talk can use a phrase like "it will be like a terrible tsunami" if that is what it takes to have the message recipient understand.

Routinized, technical messages can pose a problem. As discussed in Appendix A, the routine, boilerplate message regarding a level five cyclone (and attendant storm surge) may have led people to dismiss the message or assume it would be an event just like what people had experienced in the past.

Appendix B provides an extended discussion, with some empirical evidence, of how more interpersonal speech can make risk communication more effective.

The point we are making is that it is never an either-or proposition. Both kinds of speech can and should be used. The national weather agency can employ both. Or, if the organizational culture is too formalistic or if there is a desire to maintain some boundary between both kinds of speech, the weather agency can issue formal speech, and recipient agencies (e.g., local governments) can translate this into more descriptive, confiding talk in the interpersonal mode.

The attached Toolkit provides a series of exercises designed to build competencies in combining the two types of speech.

6. Use of Maps

Maps can be a crucial part of the message. Most storm surge modeling will have a mapping component, where the model results will be depicted on a map. A storm surge model, however, might predict surge heights offshore (on the water) and not water heights onshore (on the land). A mapping of offshore surge heights can already be quite useful, as it identifies coastal areas that are most vulnerable.

The most detailed type of map, however, is one that shows inundation levels onshore. This type of map shows, directly, the areas most vulnerable to storm surge and, it follows, most urgently needing to be evacuated. For local government, this is most useful for evacuation planning. For the local resident, this increases the degree that a storm surge and evacuation warning is recognized by the resident as self-relevant and necessitating action. As discussed earlier, vividness of the message is important in spurring action.

If a map is used, the ideal type would be one that shows the underlying street grid in enough detail such that readers can identify their locations, evacuation routes can be planned, and exact locations of evacuation centers determined. One study concluded that such a level of detail is not just ideal, but that maps with low levels of detail can have no or a negative effect in terms of motivating action (USDHS, 2016). If the map lacks street detail, it can still include locations of local landmarks that will help readers orient themselves.

Morrow et al. (2015) conducted research that suggests some possible best practices. One is to express inundation in terms of water "heights" not "depths" and to express inundation levels on land in terms of heights above ground level instead of above sea level. Their research also suggests that different users (both meteorologists as well as members of the public) prefer multi-colored maps that depicted two or more zones of inundation with different colors (e.g., red indicating the most inundated area). A sample of their maps is shown in Figure 8. Color maps are most suited for dissemination by internet or on television but, with regard to print media, situations may require maps that can be shown in grayscale or even black and white. Map developers need to test whether a color map, printed in grayscale on a black-and-white printer is still sufficiently legible such that readers can identify zones of inundation (and evacuation).

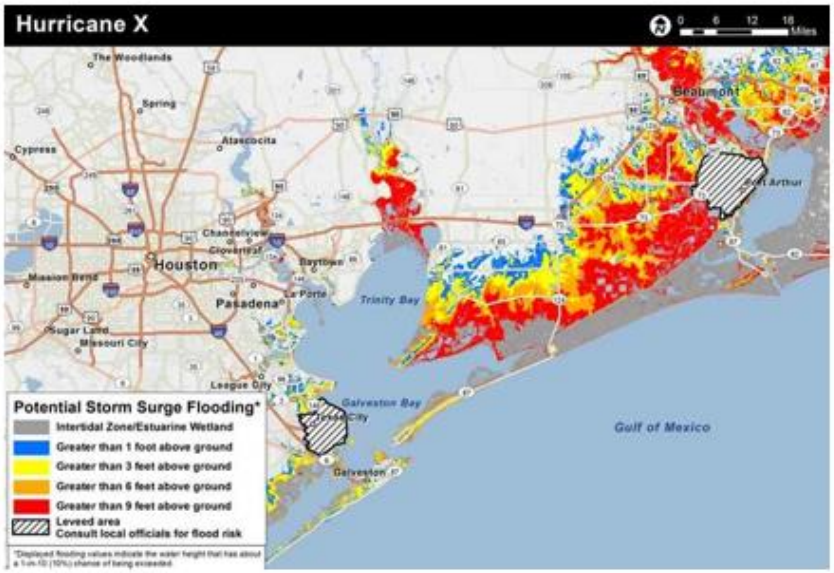


Figure 8. Sample Storm Surge Hazard Map

(Source: http://www.nhc.noaa.gov/surge/inundation/)

6.1 Effectiveness of Maps for Communicating Risks of Hazard

To know whether maps are effective in communicating storm surge risks and hazards, Typhoon Haiyan survivors were asked to identify their houses on a storm surge flood map. Respondents were asked to provide their addresses, mark the location of their houses with Xs and plot the nearest street corners. Researchers compared the marked storm surge maps with Google Maps to examine whether each X was correctly placed on the specified address.

Out of 86 survey respondents, only 72 (some 84 percent) plotted Xs where they thought their houses were located. Of the 72 respondents who did plot Xs, only 29 (or 40 percent) gave clear details about their actual addresses and were successful in identifying the location of their houses in the given map.

Responses were classified based on the level of accuracy: (1) Low - for an X mark that is off by more than 300 meters; (2) Moderate - for an X mark that is off by less than 300 meters; and (3) High - for X mark that coincides with the street name.

6.2 Using Geohazard Maps in Lieu of Surge Maps

Not all governments provide comprehnsive all-in-one hazard maps that show people what they need to know in any given impending natural disaster.

The Philippine Government, for example, uses two different maps maintained by two separate agencies: the Geo-hazard Mapping and Assessment Project (GhMAP) and the Project Nationwide Operational Assessment of Hazards (NOAH). GhMAP provides Flood Susceptibility Maps that identify areas susceptible to landslide, flooding, ground subsidence, and coastal erosion. Project NOAH produces Storm Surge Advisory maps that identify areas prone to floods, storm surges, and landslides.

The Flood Susceptibility Maps (i.e., geohazard maps) are more widely used by local governments in preparing their land use plans and disaster risk reduction and management plans. This is because the agency that handles the project conducts more intensive campaigns, reproduces maps, manuals, and information materials for public dissemination, and provides workshops for public officials on the proper use of these maps (Andoy, Gregorio, & Ugay, 2016). However the geohazard maps do not show storm surge hazards.

How sensible would it be to use the Flood Susceptibility Maps to evacuate ahead of a possible storm surge event? Figure 9 shows the two maps side-by-side. The geohazard maps covers much, but not all, of the storm surge hazard areas and, moreover, draws most attention to inland areas. In other words, if the risk were solely that from an incoming storm surge, then using a geohazard map is not much more informative than a simple text-based warning (e.g., "evacuate coastal areas up to 1 km. from the ocean").

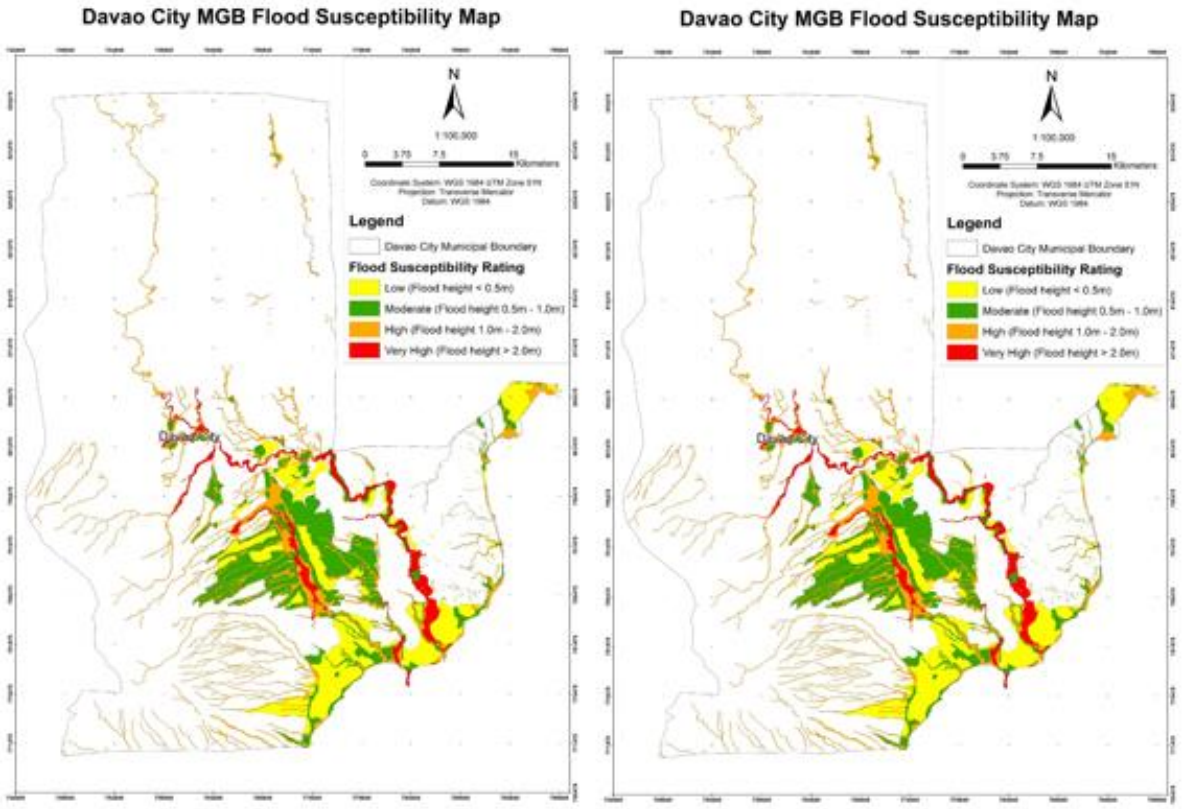


Figure 9. Comparison of Davao City DENR-MGB Flood Susceptibility Map and DOST-Project

7. Diagnostics

The above guidelines can translate into an easy diagnostic that can be employed to evaluate messages and identify any improvements that can be made. The diagnostic amounts to asking a short list of questions, shown on the following table.

1. Are all the necessary message elements found? If not, can the missing elements be added?

2. Do the messages gain in contextualization and personalization as they get more local?

3. Does the message tell the reader about the unprecedented, unusual nature of the coming event?

4. Does the text or the map include some expression of uncertainty over the predicted event?

5. Does the message address some of the factors behind non-evacuation?

6. Does the message use simple, non-technical language or a combination of technical and everyday terms?

7. How can message delivery be conducted to reach the most vulnerable or isolated members of the community? Should messages be delivered by spokespersons for these communities?

8. Communities of Practice

The literature often uses the term, Community of Practice, to characterize a participatory form of knowledge sharing (Lave and Wenger, 1991). The term simply represents a group of people in the process of learning together. The important thing, for the purpose of this report, is to conceive of such a community as a network of different persons: agency staff, local government officials, schoolteachers and principals, residents, NGOs, and others.

These kinds of communities can now be formed, which include people from remote parts of a country, using a combination of strategies ranging from traveling workshops, online workshops, email and social media, and other means.

The idea is that of a continuous risk communication network. Information about storm surge risks and forecasts should not simply be seen as a parcel of information passed from the central agency down to recipients, but a story that is retold by recipients to others. Addendum A makes the case that communication needs to be more open and inclusive. For knowledge to be passed on, this requires that, first, the message must be translated (or translatable) into everyday language that nonscientists can pass on and tell others about. Secondly, it requires some competencies in understanding and interpreting weather forecast information, especially that concerning storm surge. It is for this second reason that a community of practice approach can be valuable.

The community of practice is a network that includes experts from the weather and disaster risk reduction agencies, local officials, residents, and all the other players that are involved in decision-making during an extreme weather event. With regard to storm surge, it is possible to identify municipalities (and areas within those municipalities) most vulnerable to storm surges, and to tailor a learning process for these areas. The idea is to develop and share a kind of "coastal literacy" where agency officials and representatives of the local community understand the risks and opportunities of living along the coastline. This requires understanding occurrences such as storm surge, but also being able to read technical bulletins, maps, and other sources of information regarding these events. Requisite skills involve using such information in planning for emergency response (planning evacuation strategies and mobilizing red alert teams) and in pre-event planning and adaptation. For example, locals should learn skills in mapping out areas vulnerable to storm surge and discerning differences from areas vulnerable to inland flooding. They should gain skills in siting

evacuation centers and planning evacuation routes. This may require being able to modify government-supplied hazard maps and tailoring them to suite local needs and to add local knowledge.

Coastal literacy means not just reading maps and bulletins but, more generally, "reading" the coastal environment. This means recognizing what features of the coast make an area more vulnerable or resilient (why, for example, coastal marsh and mangrove can reduce the severity of a storm surge). It also means being able to convey messages about coastal risks to others. Such competencies mean being able to receive a bulletin from a national weather agency and, then, conveying the message to another verbally. If risk communication is understood as a story to be told, then coastal literacy means everyone should be able to participate as a storyteller.

There is a need to go beyond officials in fostering a community of practice. The main reason is because multiple actors are involved in decisions to evacuate and other actions to protect community members. For example, it is important to involve both women and men from the affected communities. This is especially true in highly stratified and male-dominated communities. There is some research that suggests that positive responses to evacuation advisories are maximized when female heads of households make the decision (Bateman and Edwards, 2002). In general, the community of practice needs active involvement of female and male residents --as discussed in Addendum B, the survey of survivors of Typhoon Haiyan suggests both female and male heads of households decide whether or not to evacuate.

The community of practice needs to seek out residents from the most vulnerable communities, which means the urban poor living along the coast. In many areas of the world, this means informal settlements built on vacant or marginal areas along waterways. For these kinds of precarious settlements, shelter-in-place may not be an option, and evacuation measures need to be completely effective. And, yet, the decision to evacuate or not still remains to the heads of households of even the lowest-income communities, which means building the same capacities for 'coastal literacy' among the urban poor.

There is one additional element of a community of practice that needs serious reflection, and this is the dimension of interaction. Messages do not just travel in a one-way direction. For this reason, there should be ways that community members, NGOs, and local governments dialogue with, query, or reason with technical experts (even if they are found in national agencies far removed from these vulnerable communities). This holds true during emergency situations, as well as during ongoing disaster risk prevention activities. But this requires, in many cases, departing from the idea of a chain of command with rigid organizational boundaries and formalized communication.

This report, along with the attached addenda, should be used as a guidebook for those involved in risk communication, even indirectly. It is hoped that, by providing a reasonable set of guidelines for designing communication, the report may play a role in the broader mission of keeping communities safe.

These reports can all be downloaded from:
https://environmental-communication.space.

ACCOMPANYING DOCUMENTS *

Attachment: Toolkit for Storm Surge Risk Communication

Attachment: Template

Addenda:	A	Evaluation of Communication During Typhoon Haiyan
	B	Survey Research on Storm Surge Message Design
	C	Brief Overview of Communication Practices Around Storm Surge Risk
	D	Gender Analysis Report
	E	Map Effectiveness Report

* Source: environmental-communication.space

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