Project Narrative

1. Project title

Behaviorally realistic communications to improve the public's response to and preparedness for high impact storm events

2. Principal and Associate Investigators

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3. Introduction/Background/Justification

Climate forecasts indicate that high-impact coastal storm events may become more frequent and intense in the coming years (Grinsted, Moore, and Jevrejeva, 2013; Holland and Bruyère, 2013). In addition, sea level may rise in the vicinity of 1 meter over the next century (Pfeffer, Harper and O'Neel, 2008; Vermeer, 2009), even given moderate increases in greenhouse gas emissions (Vermeer, 2009). Residents of New York and New Jersey are predicted to be especially vulnerable to coastal flooding and storm surge due to the their unique topographical and demographic characteristics (Strauss et al., 2012; Weiss, Overpeck, and Strauss, 2011). As a result, residents there will be forced to respond to events whose frequency may fall outside their past experience, meaning that their intuitions will no longer provide a trustworthy guide for their decision making. A recent National Oceanic and Atmospheric Administration (NOAA) Service Assessment report "Hurricane/Post-Tropical Cyclone Sandy: October 22-29, 2012" found general confusion among the public about the meaning of 'coastal flooding,' and surprise at the extent to which water inundated normally dry inland areas due to storm surge (NOAA, 2013). Thus, before people can decide whether to take action to prepare for these risks, they must have some sense of them. With jobs, family, friends, and the other demands of daily living, people's lives are filled with more immediate concerns than whether to prepare for the increasing risk of coastal flooding. Thus it is imperative that coastal impact communications are designed in a way that is compelling – capturing and holding people's attention – and is understandable.

Research suggests that personalized or tailored information can be a very effective way of capturing attention (Kalyanaraman and Sundar, 2006), providing decision relevant information, and encouraging people to make decisions reflective of their personal values (Bekker, Hewison, and Thornton, 2004). Kalyanaraman and Sundar (2006) found that tailored information

engenders more positive attitudes, by capturing and holding people's attention, while promoting more effective decision-making. In public health, many studies have found that interventions using tailored information have positively influenced health behaviors (Rimer and Kreuter, 2006; Krebs, Prochaska, and Rossi, 2010). We propose to examine whether these approaches can be equally effective in communicating about climate change-related impacts to promote preparation actions.

Studies of psychological distance have identified four dimensions that tailored communications regarding climate-related impacts should address in order to capture and hold people's attention. In scientific terminology, these are temporal, social, geographical, and uncertainty distance. In everyday terms, the research finds that people are less engaged in topics that they see as further away in time, affecting other people, occurring elsewhere, and more uncertain. These general patterns have also been observed in judgments related to climate change (Spence, Poortinga, and Pidgeon, 2012; Spence and Pidgeon, 2010). Thus reducing psychological distance should increase people's willingness to act. Thus, tailored information may be an effective way to increase willingness to take and support protective actions. We propose to develop and evaluate tailored coastal flooding communications, in terms of their effects on people's *reported* motivation to prepare for future high-impact coastal storm events, their *actual* preparedness behavior, and their *expressed* support for public and private sector preparedness measures.

4. General work plan and milestones

Our research plan follows the four steps of decision science (Edwards, 1961; Einhorn & Hogarth, 1981; Payne, Bettman, & Johnson, 1992; Fischhoff, 2010; Kahneman, Slovic, & Tversky, 1982; Morgan et al., 2002): (1) *normative* research to identify information relevant to decisions about preparing for high-impact coastal storm events suited to individuals' personal circumstances and values; (2) *descriptive* research to characterize the beliefs and values that shape people's current decision making about high-impact storm events; (3) *prescriptive* interventions, such as tailored communications facilitating better informed choices among feasible options for dealing with coastal flooding risks; and (4) *evaluation* research to test how well the intervention works.

Our research plan will be implemented in 4 key phases over a 16-month time period:

Table 1. General work plan and milestones

Research Phase	**Timeline**	**Research tasks**
1: Normative Research: Identification of decision-relevant information for communication	Month 1-2	Month 1: Obtain IRB approval. Interview local stakeholders, including members of the general public, community leaders, emergency managers, and media to discuss the risks of high-impact storm events with a focus on coastal flooding. Month 2: Work with expert collaborators to identify target preparedness strategies for reducing harm from high impact coastal storm events, with a particular focus on coastal flooding. Preliminarily identify information critical for messages targeted at different groups.

2: Descriptive Research: Developing behaviorally realistic communication content	Months 3-10	Month 3-4: Draft communication materials. Recruit and interview 30 participants from diverse settings, asked to evaluate drafts. Months 5-6: Transcribe and analyze qualitative interviews. Revise communications. Conduct pretests. Months 7: Develop structured survey for estimating prevalence of key beliefs revealed in interviews Months 8-9: Distribute survey and analyze results Months 10: Modify communications materials from Phase I in response to participant feedback. Retest.
3: Prescriptive Research: Building the coastal flooding communication intervention	Months 10-12	Month 11: Website development Month 12: User testing and website evolution
4: Evaluation Research: Evidence-based approach	Month 13- Month 16	Month 13: Recruit test sample (n=600) Months 14-15: Experimentally evaluate communication intervention Month 16: Close out, data analysis, intervention evaluation, final reports, and publications, dissemination of results

4.1 Phase 1 – Normative research: Identification of decision-relevant information for communication (Months 1 and 2)

We will hold conduct phone interviews with local stakeholders in coastal locations in New York and New Jersey. Interviews will be conducted with members of the general public, community leaders, emergency managers, and media to discuss the risks of high-impact storm events with a focus on coastal flooding. We will also talk to representatives of local organizations such as NYC's Office of Emergency Management and local chapters of the American Red Cross. These organizations can provide tacit knowledge about the public's communication needs and the best way to reach them. Community members will help to ensure the project's relevance and credibility.

Next we will work with experts such as emergency planners, meteorologists at NWS offices and news stations, and local organizations to determine the technical content (e.g. facts about high impact storm events and response strategies) of the communications about coastal flooding.

4.2 Phase 2 – Descriptive research: Developing behaviorally realistic communication content (Months 3 through 9)

We will use a two-stage approach to identify people's intuitive ways of thinking about decisions relevant to preparing for high impact storm events, with a focus on coastal flooding, in New Jersey and New York. The first stage involves in-depth interviews, allowing people to raise whatever topics are on their minds, in their natural language, with non-directive prompts regarding topics such as past experience, beliefs about the chances of future events, and views on strategies to prepare for events. The second is a structured survey suited to capturing the views

of a larger sample, building on the topics and language identified in the open-ended interviews. The interview and survey will guide the communication's design and evaluation.

(a) In-depth interviews with New Jersey and New York residents. With the help of local community organizations, we will recruit approximately 30 residents from New Jersey and New York. These residents will be individuals living in coastal areas of New Jersey and New York. We will work with these organizations to ensure that we capture views across a range of socio-demographic groups, as well as past experience with high impact coastal storm events. During the interviews, we will ask residents about their views on high impact storm events and strategies to prepare for and adapt for future events. The interviews will conclude with asking residents to evaluate draft versions of potential messages that could be used in the communication that we identified during Phase 1 of the research. Initially residents will be approached through our community contacts. Once a first set of residents has been recruited, subsequent resident participants will be recruited via respondent-driven sampling, whereby initial participants – 'seeds' – recruit additional participants from their social/friendship network, using their personal endorsement to encourage enrollment. Following methods developed by Heckathorn (1997), this process continues until a large enough sample of participants are collected. This approach has also been found useful in understanding relationships within communities and at rapidly spreading health interventions (Broadhead et al., 1998).

One-on-one interviews are labor-intensive and as such their sample sizes tend to be small (Fowler, 1995; Presser & Blair, 1994). Therefore, they are conducted until they reveal no more new beliefs. Thirty interviews are usually sufficient to capture a full range of views. These interviews will inform us about the range of people's beliefs, both accurate and not, regarding high impact storm events and their consequences, as well as appropriate strategies for reducing or preventing harm that may come from coastal flooding, preferences for decision-relevant information, and the barriers they see to accessing and acting on risk or preparedness information. All interviews will be transcribed for formal qualitative analysis. The residents we interview will be compensated for their time with $50 (or a gift card of equivalent value), which is standard compensation for a 1-hour in-depth interview.

(b) Surveys with New Jersey and New York residents. Because the sample size from the interviews is too small to provide the statistical power needed to estimate the prevalence or association between beliefs and behaviors, we follow the interviews with a larger-scale, more cost-effective survey. Based on the interviews, we will create a structured survey of topics relevant to high impact coastal storm events, with a focus on coastal flooding. We will then administer survey to a sample of approximately 1,000 coastal residents in New Jersey (500 residents) and New York (500 residents). Assuming a conservative response rate of 30% approximately 3,500 surveys will be mailed to participants with an incentive of a $2 bill to complete it. A recent study was conducted using $2 bills has shown it to be an effective and inexpensive way to achieve such a decent response rate (Schwartz et al., 2013).

This survey will draw on the concepts and language identified in the interviews, in order to assess the prevalence of critical beliefs related to high impact coastal storm events, with a specific emphasis on strategies for reducing harm due to coastal flooding. In both the interviews and the survey, we will additionally ask about our participants' experiences with websites and

digital communications to guide the development of the web-based communication as well as to lay the pathway for the development of a smart phone app. This survey will also elicit beliefs regarding aspects of preparedness and adaptation that they feel are priorities or challenges.

4.3 Phase 3 – Prescriptive research – Building the coastal flooding communication intervention (Months 10 through 12)

In this phase we will develop the online coastal flooding communication targeted to members of coastal communities in New Jersey and New York. As its platform, the communication will use Climate Central Surging Sea's Risk Finder (Figure 1), a stable, searchable, user-tested interactive data toolkit that shows populations, infrastructure, and assets exposed to coastal flooding aggravated by sea level rise. The Risk Finder incorporates the latest, high resolution, high-accuracy lidar elevation data from NOAA and assesses exposure of over 100 infrastructure and other elements – from airports to road miles, from schools to hospitals to wastewater treatment plants – in order to allow users to explore their vulnerability from zip code through city, county, and state levels. It allows easily comparing risk across areas, analyzing the likelihood of coastal flooding, and anticipating future threats with authoritative scientific information. Wong-Parodi and Strauss (2013) describe the collaborative development process, making the site's information accessible to a wide range of users.

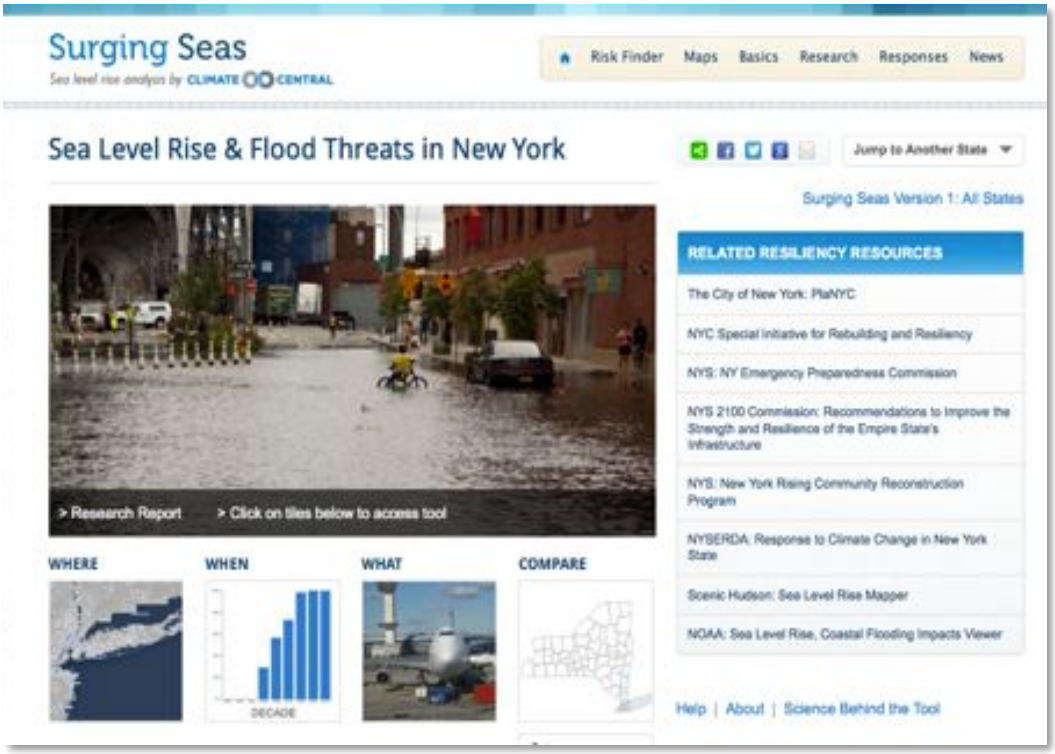

Figure 1. The Risk Finder tool homepage for New York City

All of the messages that we design will be written at the 6th-8th grade reading level, as measured by the Flesch-Kincaid readability statistic. Research has found that such communications are essential for those who have low literacy levels while still serving those with greater literacy (Wong-Parodi, Bruine de Bruin and Canfield, 2013). The communication intervention will be

developed and tested with people drawn from the populations that it is intended to serve, with an initial focus on people living in New Jersey and New York with a later capabilities extended to Connecticut as Climate Central completes its analyses of that coastal region, which is expected in the first quarter of 2014.

The online coastal flooding communication will be customizable by the user, and thus provide tailored information about coastal flooding risk and user-appropriate strategies for reducing harm. It will be divided into two sections:

Section 1: Tailored coastal flooding risk information. After selecting the 'where' option on the homepage (Figure 1), users will be able to enter in their zip code and see *where* coastal flooding is likely to occur in their community (Figure 2). Returning to the homepage, users will be able to select the 'when' option. As shown in Figure 3 they will see when coastal flooding at different heights is likely to occur by decade, from 2020 to 2100. As seen in this Figure, users can hover on a decade and see the cumulative risk of coastal flooding. For example, when users hover on 2050 they will see that there is a 51% cumulative likelihood of a flood 6 feet or more about the high tide between 2012 and 2050. Returning to the homepage, users can also select the 'what' option. As shown in Figure 4, it will show the consequences of flooding at different heights for socially vulnerable populations, possible contamination sites, infrastructure such as roads or power plants, and buildings such as hospitals and schools – issues that some may not even have considered previously. Finally, from the homepage, users can select the 'compare' option, allowing them to contrast impacts happening in their community others in their state (Figure 5).

Section 2: Appropriate strategies to prepare for and adapt to high impact storm events. After participants create and interact with their tailored coastal flooding risk information, they will then be taken to a page with strategies for preparing for and adapting to storm events appropriate for long-term planning, a few days before an event, and in the time immediately preceding an event. The strategies presented will be those that are sound, as identified through interviews in Part 1 with experts, as will be behaviorally realistic, informed by the understanding and constraints identified through the interviews and surveys with residents. The set of strategies will include both strategies that they can take themselves and ones that they can support when undertaken by public and private sector organizations. Information about each strategy will be presented, as well as resources such as programs designed to provide informational, community, or financial support. In addition to these strategies, people will be able to access NWS products and other forecast information from this page.

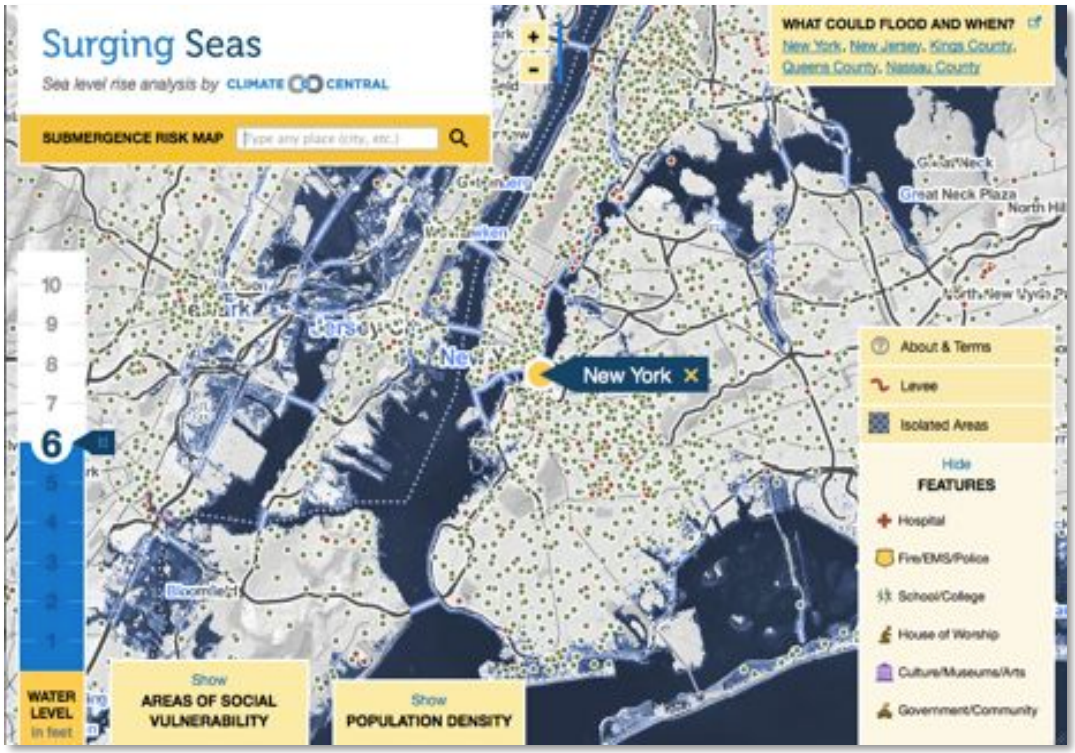

Figure 2. The Risk Finder tool 'where' page for New York City

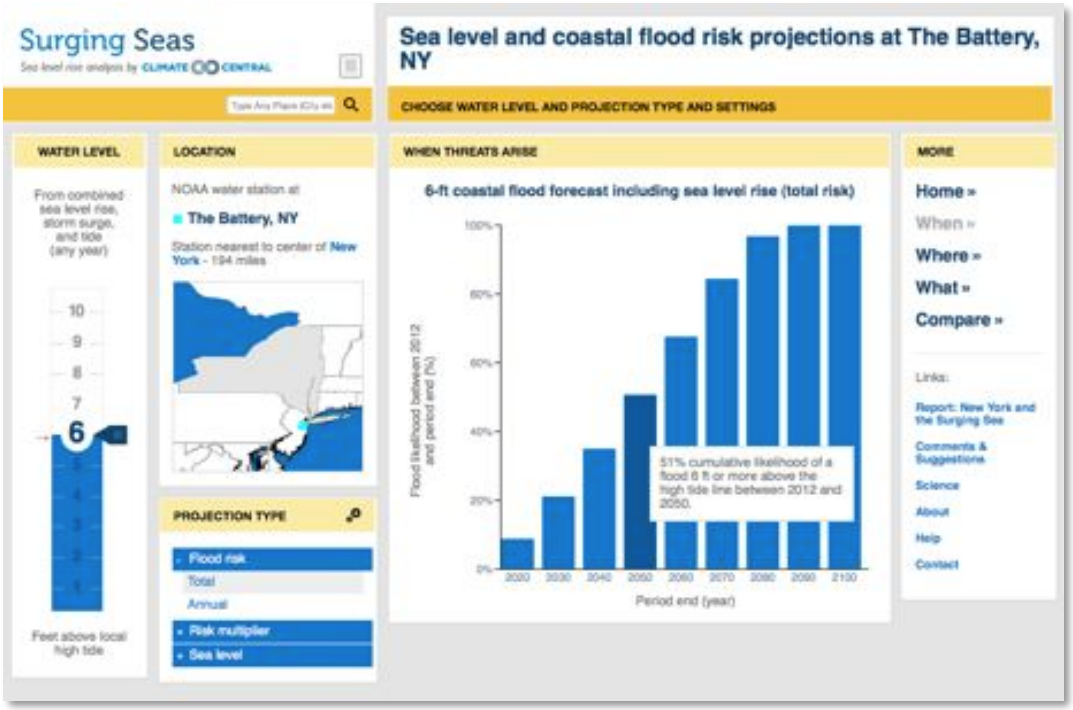

Figure 3. The Risk Finder tool 'when' page for New York City

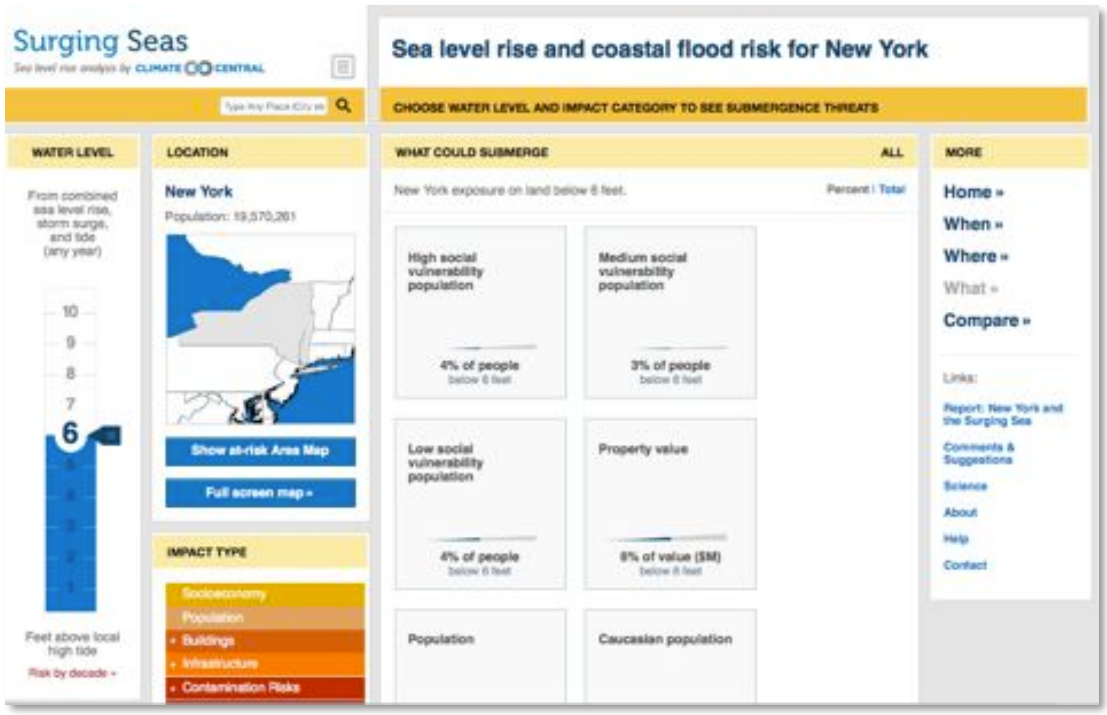

Figure 4. The Risk Finder tool 'what' page for New York

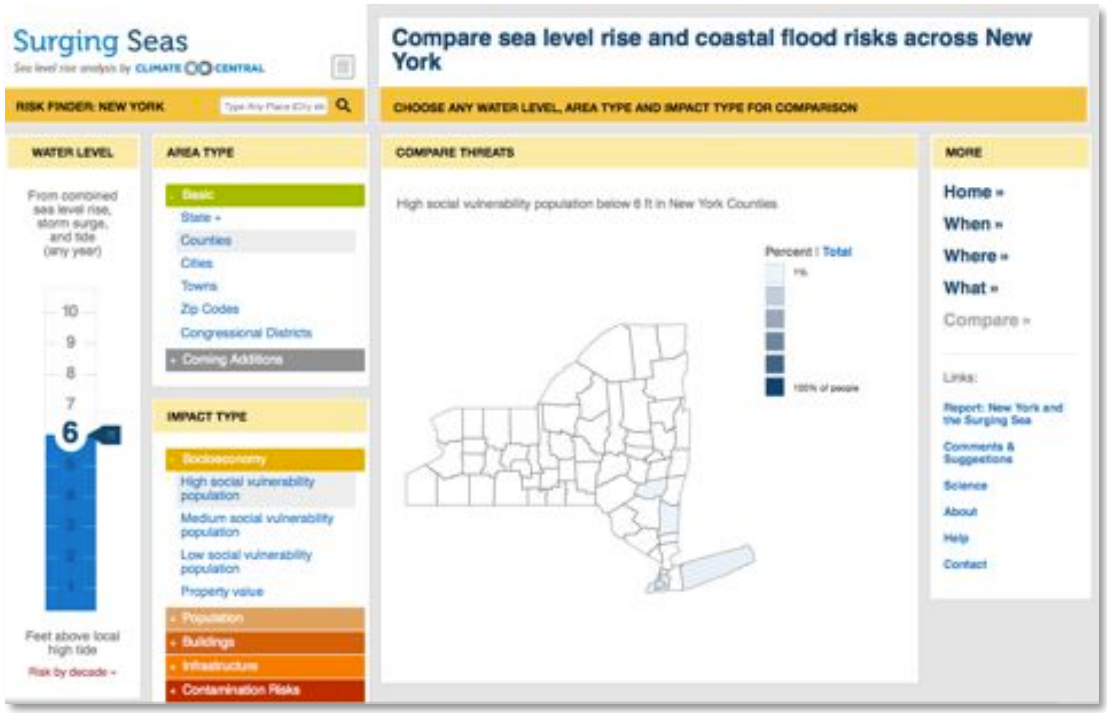

Figure 5. The Risk Finder tool 'compare' for New York

4.4 Phase 4 – Evaluation of communication and framing: Evidence-based approach (Months 13 through 16)

In this final phase, we will evaluate our communication impacts on *reported* motivation to prepare for high impact storm events, *actual* preparedness behavior, and *expressed* support for public and private sector preparedness programs. In these tests, we will vary the way the coastal flooding communication is presented, allowing us to identify the best ways to help our intended audience identify informed, feasible choices related to high impact coastal storm events.

During a 1-month recruitment period, we will work with our community contacts in New Jersey and New York to recruit a sample of 600 residents, representing a wide range of socio-demographic groups. Potential recruits will be screened for having lived in their coastal community continuously for at least 5 years and being age 18 years or older. Participants will be compensated $20 for their participation, which is within the standard range of compensation for a 30-minute survey.

In our design work, we will be drawing broadly on the research literature, in order to identify the best ways to resolve the many issues that arise in such a complex design process. We will also extend the science by comparing several conditions that might affect preparedness behavior, but which have not been studied in this context. Participants will then be randomly assigned to one of three presentation conditions: (1) ownership, (2) self-empowerment, and (3) no frame.

Condition 1: Ownership frame. Psychological ownership has been found to predict prosocial behavior (Vandewalle, Van Dyne & Kostova, 1995). Public health research has found that a sense of ownership can be experimentally enhanced, leading to greater acceptance and adherence to the use of clinical information systems among physicians (Paré, Sicotte & Jacques, 2006). Instead of being given a list of appropriate strategies (see Phase 3, Section 2 above), participants assigned to the 'ownership' condition will be asked to develop their own toolkit of strategies from a preselected list. We will examine the extent to which increasing their sense of ownership of the strategies enhances their motivation to act.

Condition 2: Self-empowerment frame. Empowerment has been found to encourage positive change in education and public health (Perkins & Zimmerman, 1995). We will examine such effects here by asking participants in the 'self-empowerment' condition to identify steps they are already taking to prepare for future high impact storm events. . They will then be told that these steps will help them prepare for storm events and be shown some additional appropriate steps they could take. We will examine how increasing their sense of empowerment affects their willingness to prepare.

Condition 3: No frame. In this condition, participants will simply receive a list of strategies they can employ to help them prepare for high impact storm events.

All participants will first interact with Section 1 (see Phase 3) of the tailored coastal flooding communication. We will then assess their beliefs and motivations regarding preparations for coastal flooding. They will then interact with Section 2 of the communication, in one of the three conditions just described. Next, all participants will be asked if they would like to use some of their compensation to purchase a small emergency preparedness toolkit for their home, work or office at the end of the survey. Finally, participants will answer questions about self-efficacy, perceptions of the efficacy and cost of preparedness strategies, and demographics.

We will perform appropriate statistical analyses to compare the impacts of presentation type and the factors that predict our dependent variables (self-reported beliefs, motivation, and intentions).

5. Outcomes: Tailored coastal flooding communication

At the conclusion of the research project, we will develop a final version of the coastal flooding communication to be posted on Climate Central's website among other public websites. It will include the tailored flooding risk information (Section 1) and a set of appropriate set of strategies to help people prepare for and adapt to high impact storm events (Section 2), presented in the powerful way possible, as identified through our experiments. We will seek additional funds to create and test a way to present a customizable set of strategies to help people prepare for future high impact storm events.

We will reach out to and work with the New Jersey chapter of the American Planning Association. It is likely that we'll leverage their contacts as well as our own through Climate Central to link the communication to websites frequented by local residents. We will work with Climate Central to solicit their network of local on-air meteorologists to publicize the communication.

In order to access the communication during this test phase, users will be required to register by entering their names and a valid email address. They will then have full access to the tool. After interacting with it, they will be asked a few simple questions regarding their risk perceptions and action intentions. After 1-month, they will be sent a follow-up email asking about the actions that they may have taken, focused on the strategies suggested to them in Section 2 of the communication. In this way, we will be able to assess the impact of the communication on real users' self-reported motivation to take action and self-reported actions.

6. Coordination

Our interdisciplinary team includes three main investigators at two institutions (Carnegie Mellon University [CMU] and Climate Central). Dr. Gabrielle Wong-Parodi (PI: CMU), whose area of expertise is behavioral decision research as related to natural hazards and risk communication. In addition to directing the overall project, she will lead the interviews, surveys and experimental effort. Dr. Baruch Fischhoff (Co-PI: CMU), whose area of expertise is judgment and choice, focused on risk decisions, will provide overall support, work on the design and execution of the experiments, and contribute to data analysis and synthesis. Dr. Ben Strauss (Co-PI: CMU), whose area of expertise is climate science focused on sea level rise and coastal flooding, will provide overall support, guidance on appropriate flood settings and use of the tool and add a page to the website platform on preparedness strategies informed by the interviews with experts. We will also hire two student assistants at local universities or colleges. These students will help with conducting and transcribing the interviews, administering the survey, and conducting the experiments. To coordinate among the project components, the team will interact regularly through conference calls, combined with in-person meetings among the CMU personnel and at least two in-person meetings with the entire team during the required Sea Grant meetings.

A number of excellent high impact storm event communications for the general public have been developed over the past few years, by bodies such as New York City's Office of Emergency Management (www.nyc.gov/html/oem/html/hazards/storms.shtml) and the National Flood Insurance Program (www.floodsmart.gov/floodsmart/pages/partner/tools_resources.jsp). Our proposed coastal flooding communication complements these efforts by providing *tailored* information about coastal flooding risk. It will provide actions that are effective and behaviorally realistic for better preparing for high impact storm events. Finally, it will enhance the general understanding needed for residents to support public and private sector measures to reduce these risks. Thus, we will not duplicate the efforts of other programs, but work with them project to develop communications complementing their important work.

Data management and sharing plan

1 Types of Data, Samples, Physical Collections, Software, Curriculum Materials, and Other Materials to be Produced in the Course of the Project

The types of data that will be generated through this study are:

- Information about the perceptions and conceptions (mental models) of interpersonal (and other) high-impact coastal storm events, with an emphasis on coastal flooding;
- Information about the prevalence of these perceptions and conceptions among a representative sample of New Jersey and New York residents;
- Information about behaviorally realistic, useful, and practical strategies to prepare for high-impact storm events, with an emphasis on coastal flooding;
- Information about the most powerful way to present the communication to enhance motivation to prepare for coastal flooding risks;
- Information about the impact of the communication on motivating intention to take preparatory action, and actual behavior.

No environmental data will be gathered and recorded.

2 The Standards to be Used for Data and Metadata Format and Content

There are several file formats that will be used for this study. First, all of the quantitative data will be put into a Microsoft®(Redmond, WA) Excel spreadsheet. Excel is a standard way to organize and hold the type of data collected for this study. Furthermore, data analysis will be performed using IBM's® SPSS® Statistics Base (Armonk, New York). Data in an Excel spreadsheet can be easily and quickly uploaded to SPSS. Second, the interviews will be audio-recorded using a handheld recording device as MP3 files. These files will then be uploaded to a secure computer located in Gabrielle Wong-Parodi's office in 129 Baker Hall at Carnegie Mellon University. The files will be transcribed to a Microsoft® Word using MacSpeech Scribe® (Cupertino, CA) for Mac OS X. The transcripts will then be transferred to Atlas TI® (Berlin, Germany) to perform qualitative analyses such as a content analysis.

3 Policies for Access and Sharing Including Provisions for Appropriate Protection of Privacy, Confidentiality, Security, Intellectual Property, or Other Rights or Requirements

All interview and experimental data will be stripped of any information that could be used to identify individual respondents, coded, and stored on servers at the Department of Engineering and Public Policy at Carnegie Mellon University, Pittsburgh, PA. Initially, the data will be accessible to only the project PIs. After quality assurance checks and analysis, the data will be made available to the research community via the web, with a link to the webpage of the PI. If needed to facilitate use, the data will be organized into multiple manageable files. Explanatory files with an overview of the research project, a description of the sample populations, and a data dictionary will also be provided. The data thus will easily be available and free to practitioners (forecasters, media, public officials, insurance companies, emergency managers) and others interested in understanding how to improve communication about high-impact coastal storm risks in ways that promote timely, appropriate protective action, reducing the human toll from natural hazards. In making these data available, we will take extra measures to ensure that all information that could identify individual respondents is removed and referenced only by sample number.

The collection and handling of the data will follow completely the standard IRB protocol. Researchers are free to use the data for their own personal use, however they may have to obtain my consent if they plan on publishing their results. The PIs will maintain the rights to any publications that result from the data collected for this study.

4 Policies and Provisions for Re-use, Re-distribution, and the Production of Derivatives

There will be no permission restrictions placed on the data, however if a researcher(s) plan to publish a manuscript using the data collected from this study, they will need to obtain the permission from one of the PIs of the project. There are three groups most likely to be interested in the data. The first are the practitioners (forecasters, media, public officials, emergency managers, insurance companies) interested

in communicating warnings to the public specifically about high-impact coastal storm events, in addition to other natural hazards. The second are decision science scholars interested in the underlying beliefs people have about high-impact storm events, as well as about strategies to prepare for or protect against event risks. The third are psychologists interested in understanding the effect of interactive decision aids displaying sophisticated information and strategies on concern and motivation. The data will be shared freely, as all identifying information will be removed and therefore there are no compelling reasons to restrict its distribution or use.

5 Plans for Archiving Data, Samples, and Other Research Products, and for Preservation of Access to Them

The interview and experimental data will be maintained for at least five years after completion of this project on the Department of Engineering and Public Policy's server, and interested researchers will have access to the data via the web. The data will also be housed (in paper form) in a locked and secured cabinet in the PI's office at 129 Baker Hall at Carnegie Mellon University and will move with the PI at her next place of employment. If and when the data is removed from the Department's server, researchers can contact the PI to obtain paper copies or scanned copies of the data. If needed to facilitate use, the data will be organized into multiple manageable files. Explanatory files with an overview of the research project, a description of the sample populations, and a data dictionary will also be provided. All results published from this data will be made available on the PI's website, and will be included with the data.

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Strauss, B. H., Ziemlinski, R., Weiss, J. L., & Overpeck, J. T. (2012). Tidally adjusted estimates of topographic vulnerability to sea level rise and flooding for the contiguous United States. Environmental Research Letters, 7(1), 014033.
Vandewalle, D., Van Dyne, L., & Kostova, T. (1995). Psychological ownership: An empirical examination of its consequences. Group & Organization Management, 20(2), 210-226.
Vermeer M, Rahmstorf S (2009) Global sea level linked to global temperature. Proc Natl Acad Sci USA 106:21527–21532
Weiss, J. L., Overpeck, J. T., & Strauss, B. (2011). Implications of recent sea level rise science for low-elevation areas in coastal cities of the conterminous USA. Climatic change, 105(3-4), 635-645.

Project Timeline

Tasks / Activities / Milestones	Related Project Objective(s)	Funding Year 1												Funding Year 2											
		Beginning Month and Year: January 2014																							
		Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24
Obtain IRB approval. Interview local stakeholders, including members of the general public, community leaders, emergency managers, and media to discuss the risks of high-impact storm events with a focus on coastal flooding.	1	X																							
Work with expert collaborators to identify target preparedness strategies for reducing harm from high impact coastal storm events, with a particular focus on coastal flooding. Preliminarily identify information critical for messages targeted at different groups.	1		X																						
Draft communication materials. Recruit and interview 30 participants from diverse settings, asked to evaluate drafts.	2			X	X																				
Transcribe and analyze qualitative interviews. Revise communications. Conduct pretests.	2					X	X																		
Develop structured survey for estimating prevalence of key beliefs revealed in interviews	2							X																	

Distribute survey and analyze results	2	X X	
Modify communications materials from Phase I in response to participant feedback. Retest.	2	X	
Website development	3	X	
User testing and website evolution	3	X	
Recruit test sample (n=600)	4		X
Experimentally evaluate communication intervention	4		X X
Close out, data analysis, intervention evaluation, final reports, and publications, dissemination of results			X

Gabrielle Wong-Parodi

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Research Interests

Applying behavioral decision research methods to promote environmental sustainability and community resiliency. Application areas include energy resources, climate change adaptation and mitigation, and public health.

Education

Ph.D. UC Berkeley, Energy and Behavior Group, Risk theory, Risk perceptions and communication (December 2011). Thesis advisor: Isha Ray.
B.A. UC Berkeley, Psychology, High honors (May 2003).

Positions

Research Scientist, Department of Engineering and Public Policy, Carnegie Mellon University (2013-present)
Postdoctoral Fellow, Department of Engineering and Public Policy, Carnegie Mellon University (2011-2013)
Principal Research Associate, Lawrence Berkeley National Laboratory (2004-2011)

Awards

Outstanding Graduate Student Instructor Award, UC Berkeley (2010)
Best presentation, International Energy Administration: Greenhouse Gas Summer School, Lorne Australia (2009)
Outstanding Performance Award, Lawrence Berkeley Laboratory, Berkeley, CA (2005)

Peer-reviewed Publications

15. **Wong-Parodi, G.**, Fischhoff, B. & Strauss, B. Resilience vs. Adaptation: Induced and natural framing, *Nature Climate Change*, In preparation for December 2013 submission.
14. **Wong-Parodi, G.**, Fischhoff, B. & Strauss, B. Designing for usefulness: A coastal flooding decision aid, Nature Climate Change, In preparation for November 2013 submission.
13. Israel, A., **Wong-Parodi, G.**, Webler, T. & Stern, P. Concerns about risks of shale gas development among interested and affected parties, *Environmental Science and Technology*, Under review.
12. **Wong-Parodi, G.** & Strauss, B. A story of collaboration for science communication, *Proceedings of the National Academy of Sciences*, Under review.
11. Bruine de Bruin, W., **Wong-Parodi, G.** & Morgan, G. Public perceptions of flood risk and the role of climate change, *Risk Analysis*, Under review.
10. Canfield, C., Bruine de Bruin, W. & **Wong-Parodi, G.** Redesigning Bills: The Effect of Format on Responses to Electricity Use Information, *Journal of Experimental Psychology: Applied*, Revise and resubmit.
9. Bruine de Bruin, W. & **Wong-Parodi, G.** (In press). The role of initial impressions in responses to educational communications: The case of carbon capture and sequestration, *Journal of Experimental Psychology: Applied*.
8. **Wong-Parodi, G.**, Bruine de Bruin, W. & Canfield, C. (2013). Effects of simplifying outreach materials for energy conservation programs that target low-income consumers, *Energy Policy*, 62, 1157-1164.
7. Krishnamurti, T., Davis, A. L., **Wong-Parodi, G.**, Wang, J., & Canfield, C. (2013). Creating an in-home display: Experimental evidence and guidelines for design. *Applied Energy*, 108, 448-458.

6. **Wong-Parodi, G.**, Dowlatabadi, H., McDaniels, T. & Ray, I. (2011). Influencing attitudes towards carbon capture and sequestration: A social marketing approach. Environmental Science and Technology, 45(16), 6743-51.
5. **Wong-Parodi, G.** & Ray, I. (2009). Community perceptions of carbon sequestration: Insights from California. Environmental Research Letters, 4.
4. Bradbury, J., Ray, I., Peterson, T.R., **Wong-Parodi, G.** & Feldpausch, A. (2009). The role of social factors in shaping public perceptions of CCS: Results of multi-state focus group interviews in the U.S. Energy Procedia, 1, 4665-72.
3. Lekov, A., Franco, V., **Wong-Parodi, G.**, McMahon, J. & Chan, P. (2009). Economics of residential gas furnaces and water heaters in U.S. new construction market. *Energy Efficiency*, 3(3), 203-22.
2. **Wong-Parodi, G.**, Ray, I. & Farrell, A. (2008). Environmental non-governmental organizations' perceptions of geologic sequestration. *Environmental Research Letters*, 3.
1. **Wong-Parodi, G.**, Dale, L. & Lekov, A. (2006). Comparing price forecast accuracy of natural gas models and futures markets. *Energy Policy*, 34(18), 4115-22.

Reports

3. Carr, A., **Wong-Parodi, G.**, Itaoka, K., Saito, A., Dowd, A., Rodriguez, S. & Ray, I. (2010). Investigating carbon capture and storage (CCS) opinions via survey and focus group methods: An experimental comparison in Australia, Japan, and the United States of America. Report No. EP 11942. The Commonwealth Scientific and Industrial Research Organisation, Australia.
2. Lekov, A., Sturges, A. & **Wong-Parodi, G.** (2010). Impacts of imported liquefied natural gas on residential appliance components: Literature review. June, 1, 2010. Report No. LBNL-2906E. Lawrence Berkeley National Laboratory, CA.
1. **Wong-Parodi, G.**, Lekov, A. & Dale, L. (2005). Natural gas price forecasting – AEO versus Henry Hub. February 9, 2005. Report No. LBNL-5780. Lawrence Berkeley National Laboratory, Berkeley, CA.

Invited Talks, Presentations, and Posters (2013)

Science of climate change communication, Bocconi University, Milan, Italy, July 16-17, 2014 (upcoming).

Communicating extreme weather: An evidence-based approach, Penn State University, November 20, 2013 (upcoming).

Designing for understanding, Carnegie Mellon Electricity Industry Center, October 16-17, 2013.

Collaboration | Communication, National Academy of Sciences, Sackler Colloquia: Science of Science Communication II, September 23-25, 2013.

Risk governance concerns among the public, National Academies Shale Gas Workshop, August 17, 2013.

Designing for usability, Center for Climate and Energy Decision-Making NSF Advisory Meeting, Pittsburgh, PA (2013).

Perceptions of flood risk, Center for Climate and Energy Decision-Making, Pittsburgh, PA (2013)

Baruch Fischhoff

Professional Preparation

Wayne State University	Mathematics, Psychology	B.S., 1967
Hebrew University of Jerusalem	Psychology	M.A., 1972
Hebrew University of Jerusalem	Psychology	Ph.D., 1975

Appointments

1987--present Professor, Carnegie Mellon University; currently Howard Heinz University Professor, Department of Social and Decision Sciences, Department of Engineering and Public Policy; http://www.hss.cmu.edu/departments/sds/src/faculty/fischhoff.php
1984-1990 Research Associate, Eugene Research Institute, Eugene, Oregon
1982-1983 Visiting Scientist, University of Stockholm
1981-1982 Visiting Scientist, Medical Research Council/Applied Psychology Unit, Cambridge, England
1976-1987 Research Associate, Decision Research, Eugene, Oregon
1974-1976 Research Associate, Oregon Research Institute, Eugene, Oregon

Publications

(i) Most closely related

Fischhoff, B. (2005). Cognitive processes in stated preference methods. In K-G. Mäler & J. Vincent (eds.), *Handbook of Environmental Economics*. Amsterdam: Elsevier.
Fischhoff, B. (2013). The sciences of science communication. *PNAS, 110*, 14033-14039.
Fischhoff, B., Bruine de Bruin, W., Guvenc, U., Caruso, D., & Brilliant, L. (2006). Analyzing disaster risks and plans. *Journal of Risk and Uncertainty. 33*, 133-151.
Fischhoff, B., & Kadvany, J. (2011). *Risk: A very short introduction*. Oxford: Oxford University Press.
Pidgeon, N., & Fischhoff, B. (2011). The role of social and decision sciences in communicating uncertain climate risks. *Nature Climate Change, 1(1)*, 35-41.

(ii) Other significant publications

Fischhoff, B. (2011). Communicating the risks of terrorism (and anything else). *American Psychologist, 66*, 520-531
Fischhoff, B. (2011). *Judgment and decision making*. Oxford: Routledge/Earthscan.
Fischhoff, B. (2011). *Risk analysis and behavioral research*. Oxford: Routledge/Earthscan
Fischhoff, B., Brewer, N., & Downs, J.S. (eds.). (2011). *Communicating risks and benefits: An evidence-based user's guide*. Washington, DC: USFDA.
Fischhoff, B., Lichtenstein, S., Slovic, P., Derby, S. L. & Keeney, R. L. (1981). *Acceptable risk*. New York: Cambridge University Press.

Synergistic Activities

- Contributed to creating the interdisciplinary fields of risk analysis and behavioral decision research, with applications in many domains; past president of Society for Risk Analysis and Society for Judgment and Decision Making; co-founder and director of Carnegie Mellon University's (unique) Decision Science major.
- Member, Institute of Medicine of the National Academy of Sciences; served on 25-30 NAS-NRC-IOM committees; chair of recently completed National Research

Council Committee on Social and Behavioral Science Research to Improve Intelligence Analysis for National Security, which focused on issues of analytical methods relevant to this proposal and has led to high-level briefings. Co-chair of NAS Sackler Colloquia on the "Science of Communicating Science" (May 2012, September 2013) and co-editor of special issue of *PNAS*.

- Served on federal advisory committees: founding chair, FDA Risk Communication Advisory Committee and Environmental Protection Agency Homeland Security Advisory Committee; former member, Department of Homeland Security Advisory Committee and Environmental Protection Agency Scientific Advisory Board.
- Managed many research grants and contracts, from the National Science Foundation, Nuclear Regulatory Agency, Carnegie Corporation of New York, Army Research Institute, Office of Naval Research, the National Institute of Mental Health, and National Institute of Mental Health, among others. Past director of the NSF-funded Center for Integrated Assessment of Human Dimensions of Global Change. PI of DOE-ARRA project on consumer behavior related to electricity use.
- Collaborated with scientists from many disciplines on diverse topics, including climate change since the late 1970s. Basic research includes hindsight bias, confidence assessment, value elicitation, forecasting, expert judgment, deliberative processes, and individual differences in decision-making competence.

Research collaborators (last 48 months; except for papers with more than five authors; not including mentees)**:** Jay Aronson (CMU), Noel Brewer (UNC), Cherie Chauvin (National Research Council), Julie Downs (CMU), Bonnie Halpern-Felsher (UCSF), Enes Hosgar (CMU), Leslie John (Harvard), Jay Kadane (CMU), John Kadvany (consultant), Lester Lave (deceased), Ragnar Löfstedt (King's College London), Jack Lorenz (Columbia), Susan Millstein (UCSF), Granger Morgan (CMU), Pamela Murray (WVU), Claire Palmgren (CMU), Nicholas Pidgeon (Cardiff), Dietram Scheufele (Wisconsin), Felix Schläpfer (Zurich), Barry Schwartz (Swarthmore), Taylor Seybolt (Pittsburgh), Roxane Cohen Silver (UCIrvine), Fallaw Sowell (CMU), Eric Stone (Wake Forest), Elizabeth Walker (Yeshiva).

Graduate Advisors and Postdoctoral Sponsor: Daniel Kahneman (Princeton); Amos Tversky (deceased); Paul Slovic (Decision Research).

Students Advised (primary). *Completed*: Cindy Atman (Washington), Laurel Austin (Copenhagen Business School), Ann Bostrom (Washington), Wändi Bruine de Bruin (CMU), Stephanie Byram (deceased), Alex Davis (CMU), Matt Dombroski (Lawrence Livermore National Laboratory), Marek Druzdzel (Pittsburgh), Sara Eggers (FDA), Shane Frederick (Yale), Umit Guvenc (CMU), Hiroshi Hayakawa (McKinsey-Japan), Karen Jenni, (consultant), Sharon Jones (Portland), Dan Kovacs (Decision Partners), Tamar Krishnamurti (CMU), Michael Maharik (Israel Atomic Energy Commission), Jon Merz (Pennsylvania), Andy Parker (RAND), Marilyn Quadrel. (Battelle Pacific Northwest Laboratory), Donna Riley (Smith), Harriet Shaklee (Idaho), Daniel Schwartz (Wharton), Ned Welch (McKinsey); *Current:* Casey Canfield, Alycia Chin, Barry DeWitt, Caitlin Drummond, Nate Peterson, Michael Yu; *Post-doctoral advisees (last five years)*: Coreen Farris (RAND), Marlyse Haward (Columbia Medical), Gulbanu Kaptan (EU Marie Curie Fellow), Deepika Mohan (UPMC), Gabrielle Wong-Parodi (CMU).

Ben Strauss

Employment

- **Climate Central** (Princeton, NJ). VP for Climate Impacts (2013 - present); Director of the Program on Sea Level Rise (2011 - present); COO (2011-13); Interim Executive Director (2010-11); Associate Director, Strategic Initiatives and Research Scientist (2008-10).
- **Princeton University** (Princeton, NJ)**:** Teaching assistant (2004-05)
- **Abt Associates** (Bethesda, MD)**:** Analyst (1996-98)
- **Nathan Cummings Foundation** (New York, NY)**:** Consultant (1995)

Degrees

- Ph.D., Ecology & Evolutionary Biology, **Princeton University**, Princeton, NJ. 2007
- M.S., Zoology, **University of Washington**, Seattle, WA. 2000
- B.A., Biology, **Yale University**, New Haven, CT. 1994

Scientific publications

- Strauss B H 2013. Rapid accumulation of committed sea-level rise from global warming. Proceedings of the National Academy of Sciences, 110(34), 13699-13700.
- Strauss B H, Ziemlinski R, Weiss J L, and Overpeck J T 2012. Tidally adjusted estimates of topographic vulnerability to sea level rise and flooding for the contiguous United States. Environmental Research Letters.
- Tebaldi C, Strauss B H and Zervas C E 2012. Modelling sea level rise impacts on storm surges along US coasts. Environmental Research Letters.
- Weiss, J L, Overpeck J T, and Strauss B. 2011. Implications of recent sea level rise science for low-elevation areas in coastal cities of the conterminous U.S.A. Climatic Change 105: 635-645.
- Strauss B H 2007. Snails at three scales: Interplay of stream hydrology and hydraulics with the morphology, dispersal and distribution of *Elimia proxima* (Princeton University dissertation)

Select Reports

- Strauss B, Tebaldi C, Kulp S, Cutter S, Emrich C, Rizza D, and Yawitz D (2013). "New York and the Surging Sea: A Vulnerability Assessment With Projections for Sea Level Rise and Coastal Flood Risk." Climate Central Research Report.
- Strauss B, Tebaldi C and Ziemlinski R 2012. Surging Seas: Sea level rise, storms, & global warming's threat to the US coast. A Climate Central Report. 12 pp.
- Strauss B, Ziemlinski R 2012. Sea Level Rise Threats to Energy Infrastructure. A Surging Seas Brief Report by Climate Central. 8 pp.
- Strauss B 1996. The Class of 2000 Report: Environmental Education, Practices and Activism on Campus, The Nathan Cummings Foundation, NY. 127 pp.

Testimony

- N.Y. State Assembly Standing Cmte on Environmental Conservation. Hearing: The Environmental Causes and Effects of Extreme Weather Events, Jan 16, 2013. Link
- U.S. Senate Committee on Energy and Natural Resources. Full Committee Hearing: Impacts of Rising Sea Levels on Domestic Infrastructures, Apr 19, 2012

Creative direction: Web, graphics, interactive features, video, photography

- Surging Seas Risk Finder (tool suite), Mar 2012-present. Link
- Surging Seas (interactive map), Mar 2012. Link
- Surging Seas (collected graphics), Mar-Apr 2012. Link
- "Sea level rise in my lifetime" (Conference photography exhibit. Risk and Response: Sea Level Rise Summit, Boca Raton, FL), Jun 2012.
- July Heat: Postcards from the Future (collected graphics), Aug 2010. Link
- Arctic Changes project (collected graphics), Mar 2010. Link
- Arctic Changes project (video), Mar 2010. Link
- The Future of Freezing (animation), Mar 2010. Link
- August Heat (collected animations), Aug 2009. Link
- Climate Central (website original design), 2009. Link

Op Eds

- Strauss B and Kopp R 2012. Rising Seas, Vanishing Coastlines. *The New York Times*, Nov 25. Link
- Kopp R and Strauss B 2012. Rising seas a real threat to New Jersey. *Newark Star-Ledger*, Jul 10. Link
- Strauss B 2012. Rising sea levels imperil our state. *Miami Herald*, Mar 22. Link
- Strauss B 2010. Earth Day smoke signals. Op Ed, *Denver Post*, Apr 22. Link

Highlight reels and media appearances

- Select on-air appearances from Hurricane Sandy coverage, Nov 2012. Link
- 3-minute video excerpt of U.S. Senate testimony, Apr 2012. Link
- 3-minute video summary of Surging Seas launch coverage, Mar 2012. Link
- Short bibliography of Surging Seas media coverage highlights, Mar 2012. Link

National television

- NBC Nightly News, Nov 29, 2012 (graphics only)
- NBC Nightly News, Nov 26, 2012
- PBS NewsHour, Nov 20, 2012
- CBS Morning, Nov 3, 2012
- CNNi, Nov 2, 2012
- CNN Headline News, Nov 2, 2012
- Today Show, NBC, Nov 1, 2012
- The Weather Channel, Nov 1, 2012
- CNN Anderson Cooper, Oct 31, 2012
- NBC Nightly News, Oct 30, 2012
- CBS Evening News, Jun 29, 2012
- NBC Nightly News, Mar 14, 2012
- CBS Evening News, Mar 14, 2012
- PBS NewsHour, Mar 14, 2012

Nationally syndicated radio

- The Diane Rehm Show, NPR, Jul 3, 2012
- Marketplace, NPR, Apr 20, 2012
- On Point, NPR, Mar 19, 2012
- The Daily Wrap with Michael Castner, WSJ radio, Mar 16, 2012