

NERACOOS

Product Development - Inundation

Summary of user need based products in the focus area of inundation. Product summary link to full product description and functional requirements.

Description of Feasibility Ranking (Scientific Functional Requirements)	Feasibility
* Have data/science available to build product * Minimal collaboration needed	HIGH
* Need more data * Requires moderate collaboration * More scoping required	MEDIUM
* Need more science to understand problem * Need more data * Need more assets (buoys, sampling equipment) * Requires high level of collaboration * More scoping required	LOW

Ref #	Product Summary	Feasibility
4	Visualization tool to depict storm impact based on water level and the size of ocean waves Full description	HIGH
8	Inventory of storm surge activities, products and agency participation. Full description	HIGH
9	Web portal with information and access to currently available inundation tools - include agency responsible for building/maintaining, description and purpose of product. Full description	HIGH
12	Web tool with the ability to preview and compare model output to time series of relevant observations. Incorporate NOAA and non-NOAA models. Full description	HIGH
14	Improve access to training on products and tools. Develop web-based modules where personal training isn't possible. Full description	MEDIUM
6	Develop historical coastal shoreline and nearshore substrate maps to evaluate change (10-year intervals back to the 1930s) and set baseline data including calculating erosion rate/recession rates (1:6000 every ten years); need to be legally defensible. Full description	MEDIUM
7	Develop maps of landscape response to sea level rise/salinity changes (requires detailed topography, bathymetry and habitat baselines) Full description	MEDIUM
9	Accurate estimation of the statistics of coastal inundation in order to enable rational planning regarding sustainable land-use practices in the coastal zone. Full description	MEDIUM
13	Database to access information about big storms (high water marks, extent of flooding, beach erosion, power outages, etc.) Full description	MEDIUM

1	48-72 hour forecast of water-level inundation due to storm (hurricane, tropical, or extratropical (Nor'easter)), with oceanic and bay surge (models) coupled with upstream river discharge. Geographically accurate to street by street level and vertically accurate to 1-2 foot contours with a visual indication of uncertainty. Full description	LOW
2	Map and zone high risk areas (e.g., wave run-up models, storm surge predictions for managers to understand how high water levels will be, how long the areas will be inundated, what direction flood waters will flow, what properties are at risk, etc). Full description	LOW
3	48-72 hour forecast for storm impact on other types of land use settings (beach shoreline, erosion, wetlands). Need to factor in wind (speed and direction) and wave (height and direction) models for erosion consideration. Also be able to extend into future to illustrate potential effect of sea level rise under worst and best case scenarios, and to illustrate wetland loss and beach erosion. Full description	LOW
5	Web-based tool on effects of sea level rise at the property level, for public education and government decision-making Full description	LOW
10	Sediment budgets & load maps/models to understand sources (tributaries, etc.) & impacts of increasing sedimentation, transport & appropriate setbacks at a local scale Full description	LOW
Other user needs, not specifically web products - More information		
14	Add more near-shore buoys in critical areas (inundation prone) for long-term data gathering and better forecasting.	
15	Improve available hydrographic maps. Higher resolution of bathymetry/topography. Provide in format for appropriate user group (GIS, web delivered, etc).	
16	Storm surge forecasts should use a standard vertical datum (NAVD88)	
17	Develop consistent vocabulary for nomenclature, be consistent among agencies.	
18	Improve process for communication before storms/during storms/after storms. Use existing networks where possible.	
19	NOAA/USGS - Improve stream gauge program so data can be integrated into inundation models and tools.	
20	USGS - update river models	
21	NOAA - incorporate river data into SLOSH model.	
22	NOAA - identify plans for improvement to SLOSH and other storm surge models.	
23	NOAA - improve process for updating SLOSH basins.	
24	NOAA - make significant improvements to SLOSH model	
25	USGS - more LIDAR work	
26	Inventory and consolidate sources of bathymetric and topographic data into centrally managed location.	
27	NASA - investigate satellite data and models that might be applicable to inundation.	

Inundation - Full Product Description and Functional Requirements

User Need Source:

M06 - MACOORA 06 Inundation Workshop

N05 - NOAA 2005 User Needs Survey

K06 - Keeley Report 2006

WP07 - White Papers 2007

Category: Forecast		Project #: 1
Product Description	48-72 hour forecast of water-level inundation due to storm (hurricane, tropical, or extratropical (Nor'easter)), with oceanic and bay surge (models) coupled with upstream river discharge. Include wave forecasts. Geographically accurate to street by street level and vertically accurate to 1-2 foot contours with a visual indication of uncertainty.	
User Need Source	Evacuation tool - neighborhood prediction model (street level) - inland flooding with storm surge (street by street, 100 m resolutions, 36 hour warnings of likely impact of storm)	M06, WP07
	Need accurate surge elevation (S.C. pilot project)	M06
	Users need access to storm surge information in advance of 24 hours.	N05
	Waves - once water reaches certain height/direction, waves cause most damage. Need more buoys, denser array.	M06
	Northeast users need extratropical storm surge forecasts to be extended beyond two days to four days.	N05
	Coastal flood warning when tide above 2' -EMS, not just "category" storms. Translate into real warnings and damage projection	M06
	Hurr-evac (RI) - integrated data from NWS, surge models	M06
	Technical specialists and decision makers require that updated surge and inundation information, as well as forecasts and products, be readily available and in real time.	N05
Technical Requirements (have)	GoMOOS storm surge forecast - gives water level (assumes coast is a wall and doesn't include water running up on land)	
	UMass Dartmouth - Storm surge, working on better resolution, includes waves (in development)	
	BIO - storm surge model in production (no waves)	
	Texas A&M - wave forecast model	
	MA CZM has street level to 3ft accuracy	
	NOAA NWS SLOSH - (has improved resolution, issues: requires special model for intense storms that will have landfall)	
	Coast Guard SAR, has built interface to take model output in NET CDF and run on web site.	
Technical Requirements (need)	For street level flooding model, would need land info - pilot in a few areas to demonstrate proof of concept	
	UMass Dartmouth model using Boston as experimental area - planning letters into MA Sea Grant for 2-year project	

	Map certain zones (land component) for storm surge; first identify stakeholders to indicate where they want information, then target sites along coast (local knowledge is key)	
	Need to determine how much detail is needed from users - accuracy of bathymetry.	
Feasibility	This product requires improvement to existing models (adding wave component), developing land-based flooding component for key points of coastline.	DIFFICULT
Notes	Chen's group at U Mass Dartmouth is investigating Boston area as experimental location for alternative to SLOSH model. Would be 2 year study if funded.	

Category: Forecast		Project #: 2
Product Description	Map and zone high risk areas (e.g., wave run-up models, storm surge predictions for managers to understand how high water levels will be, how long the areas will be inundated, what direction flood waters will flow, what properties are at risk, etc.	
User Need Source	Identify low lying areas that will be inundated by coastal storms. Determine emergency response measures.	K06
	Where is water now, where it's going to go in storm event (long term trend for change - erosion, sea level)	M06
	Real-time surface waves, surface winds, bathymetry/bottom type in the nearshore	N05
	Waves - once water reaches certain height/direction, waves cause most damage. Need more buoys, denser array.	M06
Technical Requirements (have)	Statistical climatology of storms (Canadian research paper on Scotian Shelf)	
	NWS Taunton - analysis of past 10 years of Nor'easters	
	Chen's Real Time model - inundation in specified areas (using land grid), treat rest as wall (storm surge)	
	Taunton - has model for predicted storm surge	
Technical Requirements (need)	For flooding and drying, need land bathymetry - added grid	
Feasibility		DIFFICULT
Notes	Ranked as high priority by coastal managers in 2006 Keeley survey.	

Category: Forecast		Project #: 3
Product Description	48-72 hour forecast for storm impact on other types of land use settings (beach shoreline, erosion, wetlands). Need to factor in wind (speed and direction) and wave (height and direction) models for erosion consideration. Also be able to extend into future to illustrate potential effect of sea level rise under worst and best case scenarios, and to illustrate wetland loss and beach erosion.	
User Need Source	Models linking erosion and sea level during storm events (hourly predictions in embayments and river mouths, wave observations, isostatic rebound, resonance, accretion, down-cutting, steep slopes).	K06

Technical Requirements (have)	Existing models do not have sediment transport (area of active research with USGS)	
	Extract from current operational model. Forecast of wind/current/wave height are included in model. Would need to calculate for every place on coast.	
	Chen's model (in development) has sediment transport, but can't be run on regional basis.	
	Modeling group needs input from users on where resolution needs to be higher. The greater resolution, the slower the model runs.	
	Local model can be run for specific erosion dangers (EMS/conservation officers/geologists)	
	Incorporate information on building topography important for metro areas.	
Technical Requirements (need)	Many local areas have own models, and could accept data feed incorporating wind/wave.	
	Hindcast using local information and existing models (Chen doing this for Globec project to '95)	
Feasibility		DIFFICULT
Notes	Ranked as high priority by coastal managers in 2006 Keeley survey.	

Category: Index		Project #: 4
Product Description	Visualization tool to depict storm impact based on water level and the size of ocean waves	
User Need Source	Incorporate wave height into water level forecasts to determine likelihood of spill-over events that may cause erosion during coastal storm.	
Technical Requirements (have)	Wave forecast model (GoMOOS) Water level (tide stage) NWS Have NWS Storm Type nomogram (BUFKIT) as example	
Technical Requirements (need)		
Feasibility	Will be very straightforward to integrate existing data sets	HIGH
Notes	Working prototype has been built and used in recent Nor'easter	

Category: Sea Level Rise		Project #: 5
Product Description	Web-based tool on effects of sea level rise at the property level, for public education and government decision-making	
User Need Source	More accurate sea level rise visualization (impact on infrastructure, habitat)	M06, K06
Technical Requirements (have)	Assuming no change in weather, could adjust current models to determine potential impacts.	
	NOAA Bathymetry maps - some areas better than others (from sea level down)	
Technical Requirements (need)	Scenario estimate from community (get historic sea levels from a few ports - give to modelers to re-run model).	
	Need to incorporate potential weather change as a result of climate change (if sea temp increases, it will impact sea level rise. Can be incorporated into model)	

	Human impact on tidal regime in GOM (in 70s, Canadians investigated tidal power in BOF, concluded would affect tides in Boston)
	Sediment transport model
	Gridded data set for coastline and potential flood area - above the high water mark. Habitat could be added in areas where a lot of detail exists. Could integrate with NOAA bathymetry maps to be seamless from sea to land across states.
Feasibility	DIFFICULT
Notes	Ranked as high priority by coastal managers in 2006 Keeley survey.

Category: Sea Level Rise		Project #: 6
Product Description	Develop historical coastal shoreline and nearshore substrate maps to evaluate change (10-year intervals back to the 1930s) and set baseline data including calculating erosion rate/recession rates (1:6000 every ten years); need to be legally defensible.	
User Need Source	Shoreline erosion/recession and accretion rates (seasonal, 10-year to 100-year)	K06
	Improve management responses to coastal shoreline erosion	K06
Technical Requirements (have)	Real-time surface waves, surface winds, bathymetry/bottom type in th enearshore	
Technical Requirements (need)	Need to collect historical maps for understanding of sea level	
Feasibility		MEDIUM
Notes	Need to scope this project out with end users and USGS scientists. Ranked as high priority by coastal managers in 2006 Keeley survey.	

Category: Sea Level Rise		Project #: 7
Product Description	Develop maps of landscape response to sea level rise/salinity changes (requires detailed topography, bathymetry and habitat baselines)	
User Need Source	Historic sea level	K06
	Storm surge community-level risk and vulnerability information for emergency planning, coastal management, and land-use planning.	
	Historical/Trend data	
Technical Requirements (have)		
Technical Requirements (need)		

Feasibility		MEDIUM
Notes	Need to fully scope this project out with end users and see if needs can be met with similar product. Ranked as high priority by coastal managers in 2006 Keelev survey.	

Category: Inventory		Project #: 8
Product Description	Inventory of storm surge activities, products and agency participation.	
User Need Source	Users had confusion about which agency was working on what type of storm surge activity, and the purpose of the products.	N05
Technical Requirements (have)		
Technical Requirements (need)	Identify tools used and training opportunities.	
Feasibility		HIGH
Notes		

Category: Inventory		Project #: 9
Product Description	Web portal with information and access to currently available inundation tools - include agency responsible for building/maintaining, description and purpose of product.	
User Need Source	Users rely on NOAA for data and need more access to these data. Users are also confused by the multiple, conflicting sources of storm surge information.	N05
	Inventory assets (limit to operational data - agency/contact info for each asset for more info/clarification when needed)	M06, N05
Technical Requirements (have)		
Technical Requirements (need)		
Feasibility		HIGH
Notes		

Category: Inventory		Project #: 10
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Product Description	Accurate estimation of the statistics of coastal inundation in order to enable rational planning regarding sustainable land-use practices in the coastal zone.	
User Need Source	Accurate estimates of the statistics of water level (one year, ten year, hundred year, etc) as a function of position in the coastal zone, including estimates of uncertainty.	WP07
Technical Requirements (have)	Long term tide height (statistics) Taunton may be doing this	
Technical Requirements (need)		
Feasibility		HIGH
Notes	Need to discuss with NWS scientists to see what already exists.	

Category: Models		Project #: 11
Product Description	Sediment budgets & load maps/models to understand sources (tributaries, etc.) & impacts of increasing sedimentation, transport & appropriate setbacks at a local scale	
User Need Source	Sediment load maps (Supply, fate and effect/transport) & influence of dredging, Quality of the sand/sediment in the system	K06
Technical Requirements (have)	Area of active research with USGS - sediment transport (ROMS model)	
Technical Requirements (need)		
Feasibility	Need to more accurately describe need from end users to determine scope of this project.	DIFFICULT
Notes		

Category: Models		Project #: 12
Product Description	Web tool with the ability to preview and compare model output to time series of relevant observations. Incorporate NOAA and non-NOAA models.	
User Need Source	NOAA and non-NOAA modelers do not have a forum to allow model improvements to be shared effectively. NOAA does not have a method for inter-comparisons of models.	N05
	Data management (integrate with FEMA/CORE/NWS/NOAA - identify gaps/overlays, standards)	M06
Technical Requirements (have)	NOAA has model to model comparison experiments - finishing up one in Delaware Bay	

	Available models: GoMOOS (Canadian storm surge), Taunton hindcast (storms), U Mass Dartmouth (Chen's model), SLOSH
Technical Requirements (need)	Would need NOAA and others to provide actual sea level from storms
Feasibility	HIGH
Notes	

Category: Hindcast		Project #: 13
Product Description	Database to access information about big storms (high water marks, extent of flooding, beach erosion, power outages, etc.)	
User Need Source	Both NOAA and users need immediate collection of high water marks before the marks are destroyed; users suggested NOAA participate in collecting high water marks from surge for model calibration.	N05
	Post mortem storm surveys (high water, extent of flooding, beach erosion, die back, digital map, power outages, how to integrated data, better ways to collect data stream/tide in advance of storm)	M06
Technical Requirements (have)		
Technical Requirements (need)	Develop process and procedure for post mortem for big storms. Includes: gathering high water marks, extent of flooding, beach erosion, impact on power).	
	Time series of water height in inundation area (hurricane modelers use to evaluate models)	
	Tide gauge	
	Anecdotal	
	FEMA - for big storms	
Feasibility		MEDIUM
Notes		

Category: Training		Project #: 14
Product Description	Improve access to training on products and tools. Develop web-based modules where personal training isn't possible.	
User Need Source	Users need training in their localities, because resource constraints limit their ability to attend training out of state. Personal or Web-based training works best. Training should include uncertainties and risk associated with derived products, use consistent definitions, and showcase how products are to be used in real-life scenarios.	N05
	Inventory of training opportunities and the availability of training.	N05
Technical Requirements (have)		
Technical Requirements (need)	Understanding of what tools are used, what training is available.	
Feasibility		MEDIUM
Notes		

Other user needs not identified as web products

Product Description	Add more near-shore buoys in critical areas (inundation prone) for long-term data gathering and better forecasting.	15
User Need Source	Increased marine observations are needed for both model validation and real-time decision making.	N05
Product Description	Improve available hydrographic maps. Higher resolution of bathymetry/topography. Provide in format for appropriate user group (GIS, web delivered, etc).	16
User Need Source	Better hydrographic maps (digital, updated wetlands maps)	M06
	High resolution 1-2' contours of bathymetry/topography	M06
	Users need inundation information and historical maps in displays and outputs to be as user friendly as possible without compromising the data.	N05
	Users desire improved display capabilities such as geographic information system (GIS) outputs to facilitate their decision-making processes.	N05
	Chiefly GIS compatible visual tools of inundation, with maps where GIS tools are unavailable to local managers (a particular problem at many predominantly rural county levels).	M06
Product Description	Storm surge forecasts should use a standard vertical datum (NAVD88)	17
User Need Source	Use of multiple vertical reference systems is difficult for users to understand and apply	N05, M06
Product Description	Develop consistent vocabulary for nomenclature, be consistent among agencies.	18
User Need Source	Users are confused by nomenclature.	N05
Product Description	Improve process for communication before storms/during storms/after storms. Use existing networks where possible.	19
User Need Source	Communication: use networks (SeaGrant, NERR), inundation integral to lives, products for people (public, TV/weather - ocean "man"), National Academy of Science Studies	M06
	Users indicated a majority of the public get their information from the local weather broadcasters. Users said that educating the public about the risks of storm surge could be enhanced if more local broadcasters received training on how to convey risk to the community.	N05
	Coastal and emergency managers also want historical analysis and visual examples to help educate public as to phenomenon and risks: for example, for single-events as well as long-term accumulative effects of such events.	M06
Product Description	NOAA/USGS - Improve stream gauge program so data can be integrated into inundation models and tools.	20
User Need Source	NOAA/NERR - NWLON short term gauge equipment	M06
Product Description	USGS - update river models	21
User Need Source	USGS model river in response to 25 year rain/snow shift (salt wedge/wetland redist, salinity gauging, freshet)	M06

Product Description	NOAA - incorporate river data into SLOSH model.		22
User Need Source	SLOSH for riverine flooding (NWS river forecast model)	M06	
Product Description	NOAA - identify plans for improvement to SLOSH and other storm surge models.		23
User Need Source	There is insufficient funding of the SLOSH program from NOAA and external sources such as FEMA and USACE. NOAA needs to identify how it is going to continue investment in storm surge modeling. NOAA needs to define what approach it is to take for storm surge modeling in the near-term and in the future, specifically SLOSH and next-generation models.	N05	
Product Description	NOAA - improve process for updating SLOSH basins.		24
User Need Source	SLOSH basin updates occur at a rate of three basins per year. This rate falls short of user needs, since they need basins updated to reflect changes in topography and bathymetry so the model can accurately display surge impacts. In addition, in years where storms make landfall, resources are sometimes redirected towards rapidly updating those basins.	N05	
Product Description	NOAA - make significant improvements to SLOSH model		25
User Need Source	SLOSH improvements should include: wave setup, rainfall/river outflows, increase vertical precision to +/- 1 foot, model on uniform national grid, expand model to inland bays, expand extratropical forecasts.	N05	
Product Description	USGS - more LIDAR work		26
User Need Source	More LIDAR work - convince FEMA/govt to fund	M06	
	Topography and bathymetry (LIDAR) mapping on 10-year cycle for shorelines and more intensive mapping for wetlands. Ranked as high priority by coastal managers in 2006 Keeley survey.	K06	
Product Description	Inventory and consolidate sources of bathymetric and topographic data into centrally managed location.		27
User Need Source	There are numerous, scattered sources of bathymetric and topographic data, including modern high-resolution Light Detection and Ranging (LIDAR) data that are not managed centrally and that require coordination.	N05	
Product Description	NASA - investigate satellite data and models that might be applicable to inundation.		28
User Need Source	Explore NASA dataset	M06	

= not a potential web product

Sources of user needs used to develop potential products

Mo7 - Workshop on Coastal Managers Needs for Coastal and Ocean Observations for Inundation – MACOORA, Baltimore, MD November 2006

- 2-day user needs workshop focused on identifying the needs of coastal managers in the MACOORA region for estuarine and coastal observations products and tools for planning and managing coastal inundation, including the effects of both storm surge and sea level rise.
 - 70+ representatives from federal, state and local governments, research community, and private sector representing Mid-Atlantic region (including CT, MA and RI).

Ko6 - Synthesis of Coastal Managers Needs for Ocean Observing Products and Services – The Keeley Group – September 2006.

Synthesizing user needs from the following sources:

- Workshops:
 - Managing Nitrogen Impacts in the Gulf of Maine – 2001
 - Gulf of Maine Coastal Monitoring Strategy – 2002
 - Northeast Coastal Indicators Workshop – 2004
 - Gulf of Maine Summit – 2004
- Proceedings:
 - Alaska User Needs Assessment, May, 2004
 - Coastal and Ocean Observing System User Requirements: An Examination of User Surveys. (Boyd 2000)
 - Improving Methods and Indicators for Evaluating Coastal Water Eutrophication: A Pilot Study in the Gulf of Maine. NOAA/CICEET (Bricker, Lipton, Mason, Dionne, Keeley, Latimer, Pennock 2005)
 - Recommendations to the US Commission on Ocean Policy. 2004 (Coastal States Organization.)
 - SECOORA Ocean Observing Market Analysis; Appendix A Compendium of Needs Assessment Documents. (Eslinger 2004)
 - Great Lakes Observing System. Public Survey. August 2005.
 - More Effectively Using Observing, Monitoring, Research and Education Infrastructure. California and the World Ocean Conference Proceedings (Keeley, Gregorio, Bailey 2002)
 - Ocean Observing and Coastal Managers Users Needs. Coastal States Organization/Anchorage Alaska Annual Meeting. (Keeley 2003)
 - Great Lakes Coastal Managers User Needs Focus Group. NOAA & Coastal States Organization – Chicago, Illinois (Keeley 2005)
 - Southeast Coastal Managers User Needs Focus Group NOAA & Coastal States Organization – Jacksonville, Florida (Keeley 2004)
 - Nutrients and Coastal Managers Needs. NOAA Eutrophication Workshop – Patuxent Maryland. (Keeley 2002)
 - Information Needs for Fishery Management in Maine. Gulf of Maine Modeling Workshop – Portland, Maine (Mercer 2002)
 - NOAA National Ocean Service Requirements for the integrated Ocean Observing System: Case Study for Coastal Management. (Mitreteck Systems 2005)
 - A Demonstration of the Alaska Ocean Observing System in Prince William Sound: Alaska Ocean Observing Workshop. (Schoch, McCammon 2005)
 - A User Assessment of Coastal Ocean Observation Systems in the Gulf of Mexico. (Thurlow, Kruse, Bierling 2004) Texas Sea Grant Program/Texas A&M University System

- State Coastal Observations and Monitoring Needs: Results of a Survey to Assess Coastal Management Needs. (Urban Harbors Institute 2004) Coastal States Organization/SEACOOS Outreach and Education Work Group
- Improving Links Between Science and Coastal Management: Results of a Survey to Assess Science and Technology Needs. (Urban Harbors Institute. 2004) Coastal States Organization/NOAA - Cooperative Institute for Coastal and Estuarine Technology
- Summary of Needs from CeNCOOS Stakeholders. (Watson 2004)
- Additional notes from personal communication and informal meetings with stakeholders in NE region

Eo2 - ECOHAB/GLOBEC Gulf of Maine Modeling Workshop – June 2002

- Management and scientific informational needs for harmful algal bloom and fisheries forecasting in the Gulf of Maine - A framework for moving toward an operational capability
 - Workshop sponsored by CSCOR to facilitate the transfer of model-based research products into the hands of managers and stakeholders for environmental decision-making. Over 30 participants from state and local governments, research community representing ME, MA, NH and the Maritimes. (Including WHOI, NOAA, MA DMF, ME DMR, DFO, NMFS, MWRA, UMaine, UMass)

Eo6 - ECOHAB User Needs workshop – December 2006

- Third of three scheduled workshops under ECOHAB project. Focused on gathering User needs workshop with
- 30+ representatives from state and local governments, research community representing ME, MA, NH and the Maritimes. (Including WHOI, NOAA, MA DMF, ME DMR, NMFS, MWRA, UMaine, UMass)

No5 - Storm Surge Tools and Information: A User Needs Assessment - NOAA Coastal Services Center 2005

- Interviews were conducted with key professionals from NOAA, FEMA, professional associations, state and local governments, nongovernmental organizations, and private sector.
- On-line needs assessment sent to 552 professionals and distributed through Association of State Floodplain Managers (ASFPM) and regional NWS Weather Forecast Offices. 254 responses received
- Focus Group Sessions for 61 individuals representing 10 states held in CT, MA and FL.

GoMOOS Annual Survey 2005, 2007

- 2005 Survey – 455 participants
- 2007 Survey – 300 participants (1 week remaining in survey)