

Africa Partnership Station: Coastal Geomorphology and Hazards Planning

Andrew Ashton
Woods Hole Oceanographic Institution
MS #22, 360 Woods Hole Rd.
Woods Hole, MA 02543
Phone: (508) 289-3751 Fax: (508) 457-2187 Email: aashton@whoi.edu

Award Number: N00014-08-1-0997

Cheryl Hapke
U.S. Geological Survey
384 Woods Hole Rd.
Woods Hole, MA 02543
Phone: (508) 457-2297 Fax: (508) 457-2310 Email: chapke@usgs.gov

Document Number: N00014-09IP20077

LONG-TERM GOALS

The goal of this research is to develop the coastal management and research capabilities of Gulf of Guinea nations and to increase the ability of these nations to predict and mitigate coastal hazards. This is being accomplished through sponsoring and developing the coastal processes research capabilities of these nations and their university systems. Initial activities are focusing on the research group within the Department of Oceanography and Fisheries of the University of Ghana (UG), with a goal of not only increasing the capabilities of Ghana to monitor and manage their coast, but to develop UG as a center of research excellence for the Gulf of Guinea region.

OBJECTIVES

The objectives of these research activities are to provide guidance to the nascent coastal processes research program at the Department of Oceanography and Fisheries, University of Ghana, Accra, Ghana. Development of this program is anticipated to aid maritime governance capabilities and social stability within Ghana. Over the short term, the goal is to develop the capabilities UG needs to assess local coastal processes and hazards and to provide technical assistance for ongoing monitoring of coastal change. Development of these technological capabilities (coastal processes expertise, terrestrial surveying, bathymetric surveying, wave computation, coastal change modeling, GIS skills) is intended to lead to a self-sustaining research group at the University of Ghana that can then independently pursue other research questions and seek other party funding, both locally or internationally. In 2009, the PIs are serving in an advisory role; however, an objective for future activities is the development of independently funded international-quality collaborative research between the PI and the coastal researchers at UG.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 2009		2. REPORT TYPE		3. DATES COVERED 00-00-2009 to 00-00-2009	
4. TITLE AND SUBTITLE Africa Partnership Station: Coastal Geomorphology And Hazards Planning				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Woods Hole Oceanographic Institution,MS #22, 360 Woods Hole Rd.,Woods Hole,MA,02543				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The goal of this research is to develop the coastal management and research capabilities of Gulf of Guinea nations and to increase the ability of these nations to predict and mitigate coastal hazards. This is being accomplished through sponsoring and developing the coastal processes research capabilities of these nations and their university systems. Initial activities are focusing on the research group within the Department of Oceanography and Fisheries of the University of Ghana (UG), with a goal of not only increasing the capabilities of Ghana to monitor and manage their coast, but to develop UG as a center of research excellence for the Gulf of Guinea region.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 4	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

APPROACH

This project consists of technical advising and the development of collaborations between the PI's and UG scientists. The primary means of interaction was a week-long workshop at the University of Ghana in February 2009 which included scientific presentations, field visits, collection of preliminary field data, hands-on computer analysis exercises, and small-group discussions. Interactions between UG and WHOI continued into the summer when a UG faculty member visited WHOI for a month.

WORK COMPLETED

A workshop on Coastal Processes was held from February 23-27 at the Department of Oceanography and Fisheries, University of Ghana (UG), Accra, Ghana, conducted by ONR-funded researchers experts Cheryl Hapke of the U.S. Geological Survey (USGS) and Andrew Ashton of the Woods Hole Oceanographic Institution (WHOI), in conjunction with hosts George Wiafe and Selorm Ababio of UG. This meeting included representatives of several UG departments, government agencies/regulators, and faculty from other Ghanaian universities/institutions. The workshop followed a previous meeting held in April of 2008 at UG that included Tom Lippman, currently at the University of New Hampshire (UNH), and Dano Roelvink, of the United Nations Educational, Scientific, and Cultural Organization Institute for Water Education (UNESCO-IHE).

The workshop included presentations, field reconnaissance, preliminary collection of field data, and informal discussions amongst the participants. These included:

- presentation of theoretical aspects of coastal evolution by Andrew Ashton (WHOI), including recent research findings regarding plan-view coastal evolution that is likely applicable to understanding chronic erosion hazards along the Volta Delta and research involving the response of coasts to accelerated sea-level rise, a phenomenon which will exacerbate the existing hazards along the Ghanaian coast over the future decades and centuries.
- presentation of techniques to conduct regional, long-term analyses of coastal evolution and the identification of erosion hazards using historical data sources such as aerial photography and historic maps (led by Cheryl Hapke). The data and analyses produced by such an effort by UG will provide the critical foundation for evaluating future hazards due to sea-level rise and climate change.
- visiting coastal locations of varying geomorphic type to assess coastal hazards and processes, particularly to understand the influence of geologic setting and history on active processes and current change.
- performing initial field deployments of UG's recently acquired Real-Time Kinematic Global Positioning System (RTK-GPS) equipment and reconnaissance mapping using WHOI's geophysical equipment (Ground-Penetrating Radar, GPR).

Future collaborations were planned to apply an existing model of shoreline evolution (Ashton and Murray, 2006) to the Volta Delta coast and to begin the systematic compilation of historical data appropriate for regional change analyses (Hapke et al., 2006). The preliminary data collected during field deployment of the GPR was post-processed, demonstrating that high-quality subsurface data can be collected along the Ghanaian coast. Postprocessing was demonstrated at the workshop (by PI

Ashton). Ashton also hosted Selorm Ababio of UG at WHOI during the summer of 2009; the visit included interactions with a number of scientists throughout the WHOI community, including the USGS, and participation in field activities, including offshore vibracoring and CHIRP deployment.

RESULTS

The successful workshop led to the development of future collaborations and studies of the Ghanaian coast. Ashton and Hapke communicated that the location of many of the reported chronic erosion problems along the Ghanaian coast can generally be understood using geological and anthropogenic perspectives—there seem to be few ‘surprising’ coastal erosion hazards. Accordingly, short-term coastal research goals were delineated, including surveying the current Ghanaian coast, compilation of historical shorelines, computation of regional sediment budgets, and measurement of wave forcing.

The workshop led to an abstract that was presented at International Geoscience and Remote Sensing Symposium held in Cape Town, South Africa in the summer of 2009 (Wiafe et al., 2009), and an abstract for the entire Ghanaian coastal research initiative was submitted by the group (led by George Wiafe). Selorm Ababio of UG visited Woods Hole, MA, to interact with researchers at WHOI, the USGS Woods Hole Field Center, and UNH; this visit was hosted by the Ashton and used funding from WHOI’s Mary Sears Visitor Program. Plans have been developed for future study of the processes affecting coastal evolution of the Volta Delta, including further geophysical surveys and application of a large-scale numerical model of coastal evolution. Additionally, a time series analysis of long-term coastal behavior is planned to help identify how natural processes and anthropogenic changes influence patterns of coastal behavior and impact the regional sediment budget.

IMPACT/APPLICATIONS

This project addresses the overarching goal of improving maritime security in the Gulf of Guinea, and specifically in Ghana. A short-term impact will be assessment of coastal hazards along the Ghana coast and development of a research plan to increase coastal safety through hazard identification and mitigation. This hopefully will lead to the development of scientific relationships between the PI’s and African coastal researchers. Over the long term, the objective is to develop the independent research capabilities of the University of Ghana to improve the national capabilities in coastal hazards management and eventually maritime and fisheries management.

RELATED PROJECTS

None

REFERENCES

- Ashton, A. and Murray, A.B., 2006. High-angle wave instability and emergent shoreline shapes: 1. Modeling of sand waves, flying spits, and capes. *Journal of Geophysical Research-Earth Surface*, 111(F04011): doi:10.1029/2005JF000422.
- Hapke, C.J., Reid, D., Richmond, B.M., Ruggiero P., and List, J., 2006, National Assessment of Shoreline Change part 3; Historical shoreline change and associated coastal land loss along sandy shorelines of the California coast: U.S. Geological Survey Open-File Report 2006-1219, 79 pp. <http://pubs.usgs.gov/of/2006/1219/>.

Wiafe, G., Ababio, S., Appeaning, A., Hapke, C., Agyekum, K., Lipmann, T., Roelvink, D., Ashton, A., Drake, T., and Vogel, A., 2009, Development of an Integrated Coastal Erosion Assessment Program along the Coastline of Ghana, International Geoscience and Remote Sensing Symposium, July 12-17, 2009, Cape Town, South Africa, Paper No. 3579.