Enhancing oceanographic education and research in West Africa - the role of data availability

Ebenezer S. Nyadjro¹ and <u>Brian K. Arbic²</u>

I. University of New Orleans 2. University of Michigan Ann Arbor







Background

- ✓ West African coastline length: ~5,600 km (3,480 miles)
- Coastal zone (i.e. ~ 25 km inwards) concentrates 31 % of the total population and 51 % of the urban population of the coastal countries
- These numbers expected to rise, putting pressure on coastal resources



The issues

 Livelihood: coastal zone is significant source of income for many families (e.g. fishing and fisheries-related activities)



The challenges

- Need to better understand ocean dynamics and impact on the coastal zone and activities
- Understand these dynamics on different time scales: intraseasonal, seasonal, interannual, decadal
- Lack of local expertise (e.g. Ghana has just about two physical oceanographers)
- ✓ Lack of data
- ✓ Poor governmental commitment
- ✓ Poor representation at international conferences and workshops

4

The way forward??

- Build capacity of indigenes:
 - irrelevant if resources needed for research are not available
- Empower them with tools to use acquired knowledge
 - access to computing resources (computers, software e.g. Matlab, Python)
 - > access to data repositories
- Encourage more collaboration between scientists from West African countries and elsewhere
- Increase research outputs (e.g. peer-reviewed papers in high impact journals)

Encourage and aid the participation in international meetings

✓ coessing.org

- Funded by Arbic's NSF CAREER grant, various sources at University of Michigan and within Ghana, and (more recently) the International Centre for Theoretical Physics (ICTP) in Italy
- ✓ We've run a one-week school every summer since 2015
- Alternates between University of Ghana (UG) and Regional Maritime University (RMU)



- Resource persons mainly from USA, also Ghana and Italy
- ✓ NASA JPL scientist Dimitris Menemenlis is one of the instructors
- Joseph Ansong, who helped Arbic start the school, is now a lecturer (equivalent of assistant professor in US) at University of Ghana



Arbic's history with Joseph Ansong



With my Form 5 science class, Damongo Secondary School, Ghana, 1992

Peace Corps service



Group photo, June 2, 2016 Top, left to right: Paige Martin, Joseph Ansong Bottom, left to right: Eliana Crawford, Anna Savage, Amanda O'Rourke, Brian Arbic, Conrad Luecke, Molly Range

My research group in 2016

University of Michigan

Impact of damping on low-mode internal tides (Ansong et al. 2015)



10

- School averages ~ 100 participants from universities, government agencies & private sector organizations, mainly from Ghana as well Nigeria, Liberia, Benin, Ivory Coast and Mali
- ✓ Emphasis on:
- physical oceanography
- coastal & estuarine dynamics
- satellite oceanography
- ocean modelling
- data analysis

- biogeochemistry
- > fisheries
- piracy, pollution
- shipping and port management
- offshore oil drilling



• School format: morning lectures and afternoon labs and field trips



• School format: morning lectures and afternoon labs and field trips



• School format: morning lectures and afternoon labs and field trips



- Participants are introduced to extensive satellite data sources, and trained to access, process and analyze these datasets.
- Emphasis on satellite data since it's often **free**, has extensive coverage, repeated view and can be used to run models to obtain more data.



- Computer programing software:
 Matlab, Python, Ocean Data View
- ✓ Specialized data software:
 - -- NASA's SeaDAS: ocean color
 - -- ESA's BEAM ocean color, SAR, etc
 - -- UNESCO's Bilko ocean color, SMOS
 - -- ENVI, ERDAS, IDRIS

Participants are guided to use these datasets to understand relevant regional oceanographic phenomena such as *upwelling*, sea level rise and coastal erosion.



i apdrc.soest.hawaii.edu/data/data.php

 In a sample lab exercise, students were guided to download SST and SSHA data for the West African region.



••• 💟 🚖 🔍 Search



0.5

-0.5

-1

1993 1994 1995

SST (°C)

- In a sample lab exercise, students were guided to download SST and SSHA data for the West African region.
- Plots of seasonal variability and trend analysis were done and discussed



1 2012 2013 2014 2015

- In a sample lab exercise, students were guided to download SST and SSHA data for the West African region.
- Plots of seasonal variability and trend analysis were done and discussed





- In 2018, there were specialized mini-projects, allowing personal interactions with instructors
- Participants were also allowed to present results from their own work





Testimonials

e sammer senser nare an

https://coessing.org/testimonials/

nal Council T...



needed to propel me in my research and use what I have learnt to make an impact and a difference in my environment. I thank the organizers of the school summer for this wonderful package brought to Africa and I look forward to the next summer school. - Patrick Dwomfuor, PhD Student, University of Ghana

COESSING, 2018 was my first international workshop experience outside my home country. It was a week of super-loaded, excellent and exciting experience. I followed the Project Track- Data Science. My dedication met commitment from the instructors and within few days I started learning the PYTHON language. At the end of the workshop I was able to plot SID data using Python. COESSSING exposed us to a multi – disciplinary experience in Oceanography, and I must confess that a part of me now loves the sea... Thus, with the introductory lectures I may consider research in the field in the nearest future. Part of



my take-away from the workshop was that my network and connections has been enhanced, hence I have more access to academics, scientific data and tools. Therefore, as I look forward to a brighter future and more exciting experience in life, I hope I can someday give back to this great initiative, because every student deserves access to such a great experience. COESSING, 2018 is a success... and to the sponsor(s) and facilitators- keep illuminating the path, for it leads to greatness! -- Mumin Olatunji Oladipo, PhD Student, University of Ilorin-Nigeria.



Being a part of COESSING has been a wonderful experience. This program provides the opportunity for young scientists and established scientists to acquire

Testimonials

https://coessing.org/testimonials/

ouncil T...

consider research in the field in the nearest future. Part of

my take-away from the workshop was that my network and connections has been enhanced, hence I have more access to academics, scientific data and tools. Therefore, as I look forward to a brighter future and more exciting experience in life, I hope I can someday give back to this great initiative, because every student deserves access to such a great experience. COESSING, 2018 is a success... and to the sponsor(s) and facilitators- keep illuminating the path, for it leads to greatness! --Mumin Olatunji Oladipo, PhD Student, University of Ilorin-Nigeria.



Being a part of COESSING has been a wonderful experience. This program provides the opportunity for young scientists and established scientists to acquire tools to be engaged in the scientific community. COESSING has reinforced what it means to be a global scientist. Regardless of discipline, it is our job to teach and share our scientific findings in addition to investigating and exploring the natural world. As a young scientist I am looking forward to continuing to help build capacity and opportunity in places that have been neglected. People of color need to be represented

in the scientific community and global issues require people all around the world to work together. The most important takeaway I learned from this program is that it is possible. — Nefertiti Smith, Undergraduate in Marine and Environmental Science, Hampton University

I am very happy that I was able to participate in COESSING 2018. As a graduate student researcher, I am always happy



Going forward

- Beyond the school, some instructors keep in touch with the participants, helping them acquire and analyze data for their research
- Going forward, there is the dire need to obtain continuous funding to support summer school and capacity building
- Plan to incorporate more research into the school
 - Tide gauges?
 - Set up coastal monitoring and forecasting systems?
 - Collaborate with many European and West African countries to obtain a large grant?



