Increasing satellite oceanography literacy and research in West Africa- the role of data availability

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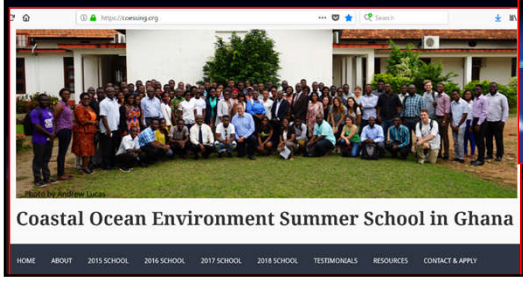
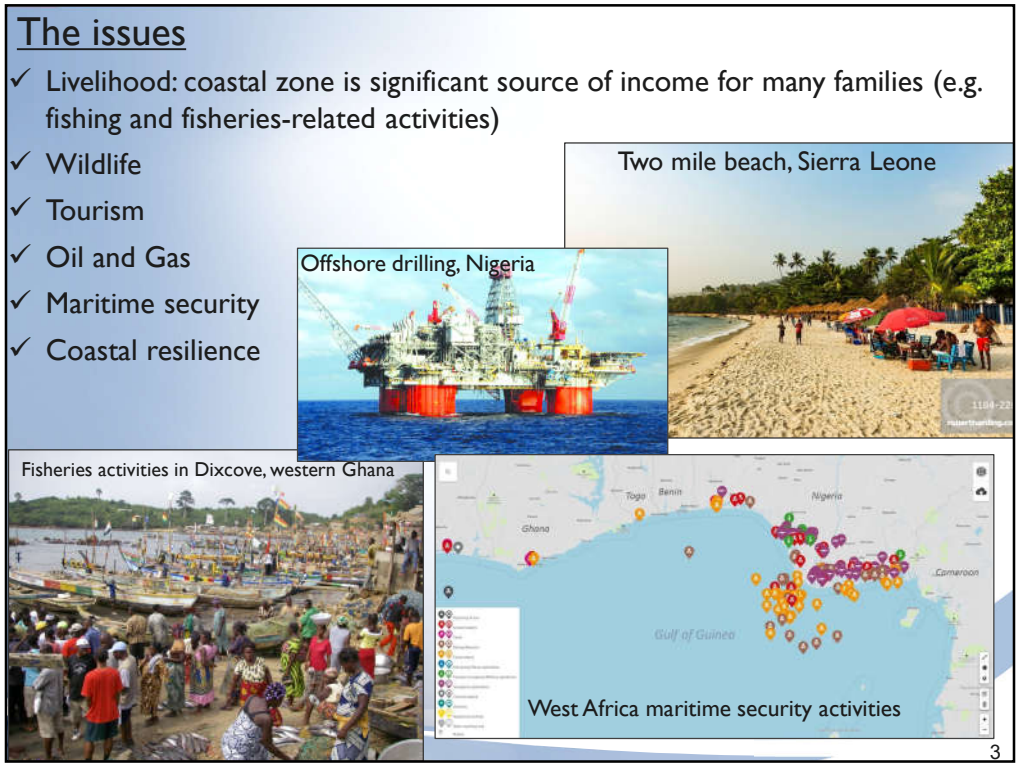


Session : Outreach, Education and Altimetric Data Services

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 are to rise, putting pressure on coastal resources



The West African coastal region is of significant economic importance to the sub-region. The multiple gains from the coast and adjoining seas pose several issues to the environment including littering and oil pollution. There is also pressures on the fisheries resources and other biota. Recently, the West African seas has overtaken the western Indian Ocean as the region with the most pirate activities. These call for research and monitoring to safeguard resources and security.

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

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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 collaboration among West African scientists and with overseas collaborators
- ✓ Increase research outputs (e.g. peer-reviewed papers in high impact journals)
- ✓ Encourage and aid the participation in international meetings

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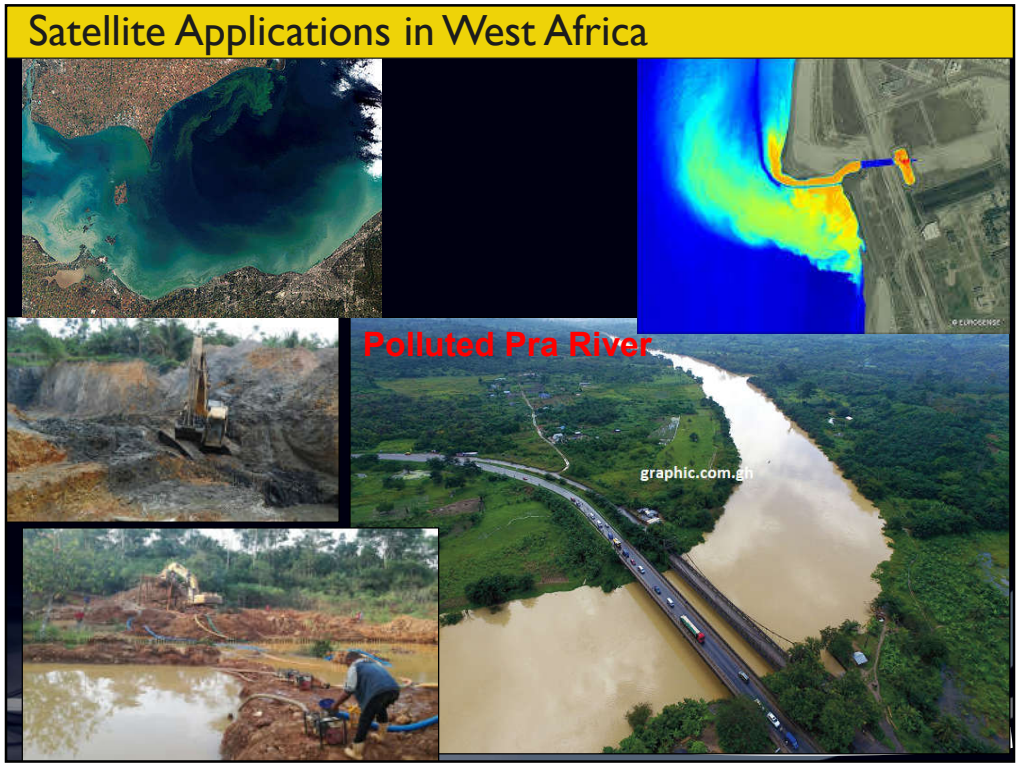
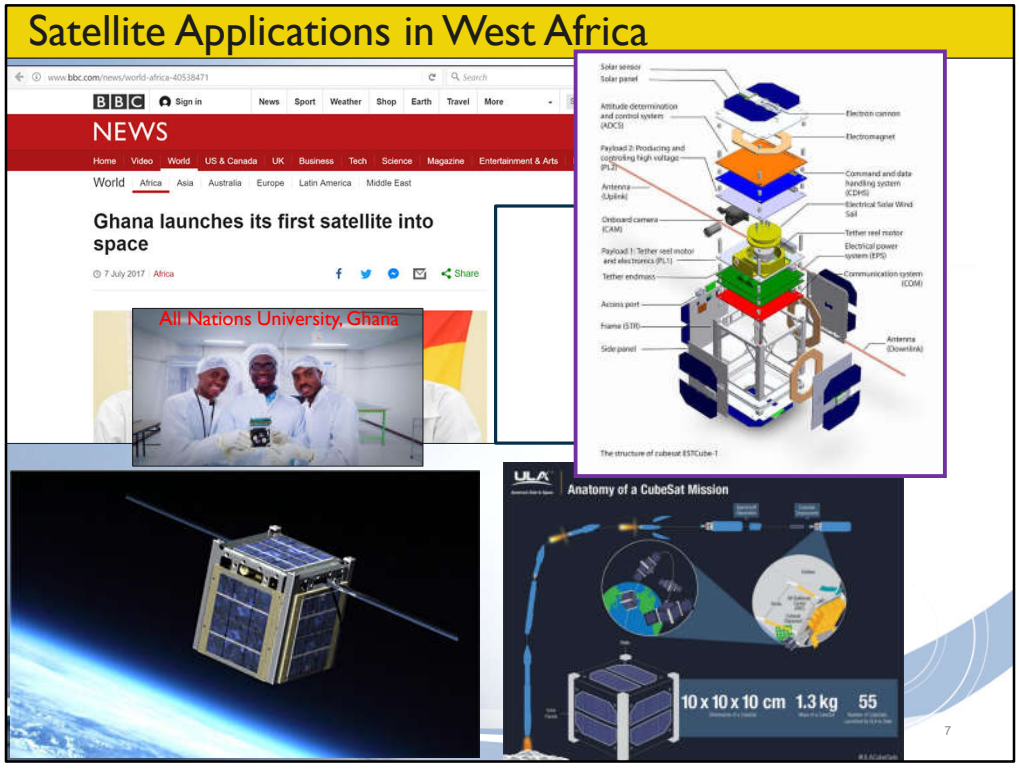


Satellite data provide a cost-efficient means to study and understand the issues. These images show some applications of satellite data in the West African sub-region. Top left shows algal blooms. Top right shows thermal pollution from an energy plant. Bottom images show river pollutions from mining activities. Rivers are a source of drinking water for most indigens. Polluted rivers cause several diseases such as cholera, metal poisoning, among others.



Encouraging and launching low-cost, low-energy satellites could provide needed solutions. In 2017, All Nations University in Ghana showed this initiative by launching a cube sat.

Coastal Ocean Environment Summer School in Ghana

- ✓ The Coastal Ocean Environment Summer School in Ghana (coessing.org) was formed to help increase interests in coastal research.
- ✓ An idea of Prof. Brian Arbic, University of Michigan, Ann Arbor
- ✓ Goal is to help address the aforementioned gap in oceanographic research in the West African sub-region
- ✓ COESSING has been held every summer since 2015
- ✓ The summer school alternates between University of Ghana (UG) and Regional Maritime University (RMU)

To encourage and improve expertise in satellite-data driven research, among others, in West Africa, the Coastal Ocean Environment Summer School in Ghana (coessing.org) was launched.

Coastal Ocean Environment Summer School in Ghana

- ✓ School averages ~ 100 participants from universities, government agencies & private sector organizations, mainly from Ghana as well Nigeria, Liberia, Benin, Ivory Coast and Mali

- ✓ There is emphasis on:
  - ➢ physical oceanography
  - ➢ coastal & estuarine dynamics
  - ➢ satellite oceanography
  - ➢ ocean modelling
  - ➢ data analysis
  - ➢ biogeochemistry
  - ➢ fisheries
  - ➢ piracy, pollution
  - ➢ shipping and port management
  - ➢ offshore oil drilling

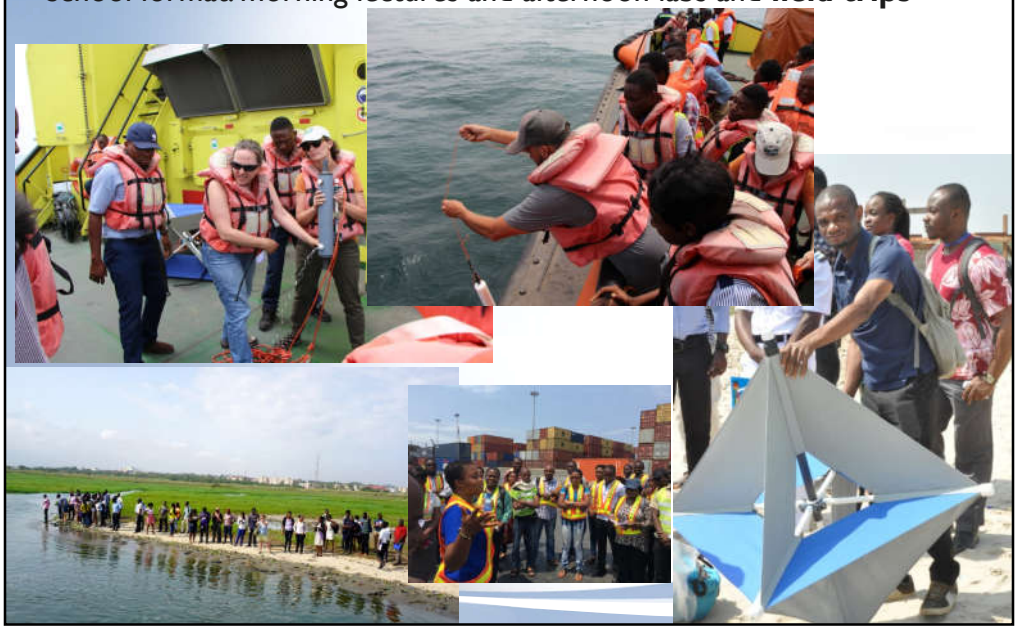
Coastal Ocean Environment Summer School in Ghana

- School format: **morning lectures** and afternoon labs and field trips

The format of the school includes morning lectures to introduce participants to the various subject matters of the school. There is also one-on-one interactions (bottom right image) especially with graduate students and early career participants.

Coastal Ocean Environment Summer School in Ghana

- School format: morning lectures and afternoon labs and **field trips**



Participants are taken on field trips including going out to sea to launch instruments. There is also sampling from nearby lagoons and estuaries to collect samples for lab analysis.

Coastal Ocean Environment Summer School in Ghana

- School format: morning lectures and **afternoon labs** and field trips

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We organize several lab exercises to provide hands-on training. This improves experiential learning.

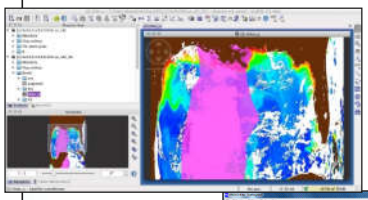
Coastal Ocean Environment Summer School in Ghana

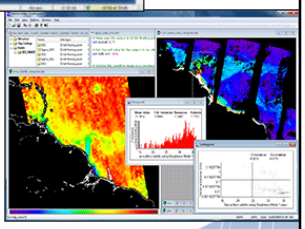
- Participants are introduced to the extensive satellite data sources, and trained to access, process and analyze these datasets.
- Emphasis on satellite data since its often **free**, have extensive coverage, repeated view and can be used to run models to obtain more data.

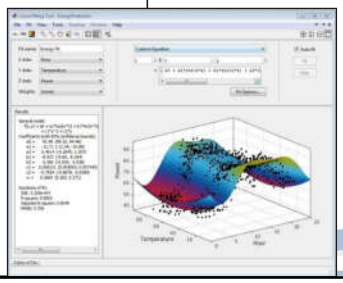
Satellite Data processing

- ✓ 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 oceanographic phenomena to their regions such as *upwelling, sea level rise and coastal erosion.*



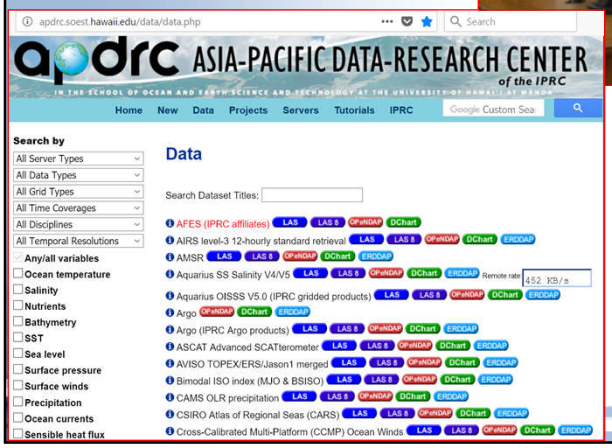


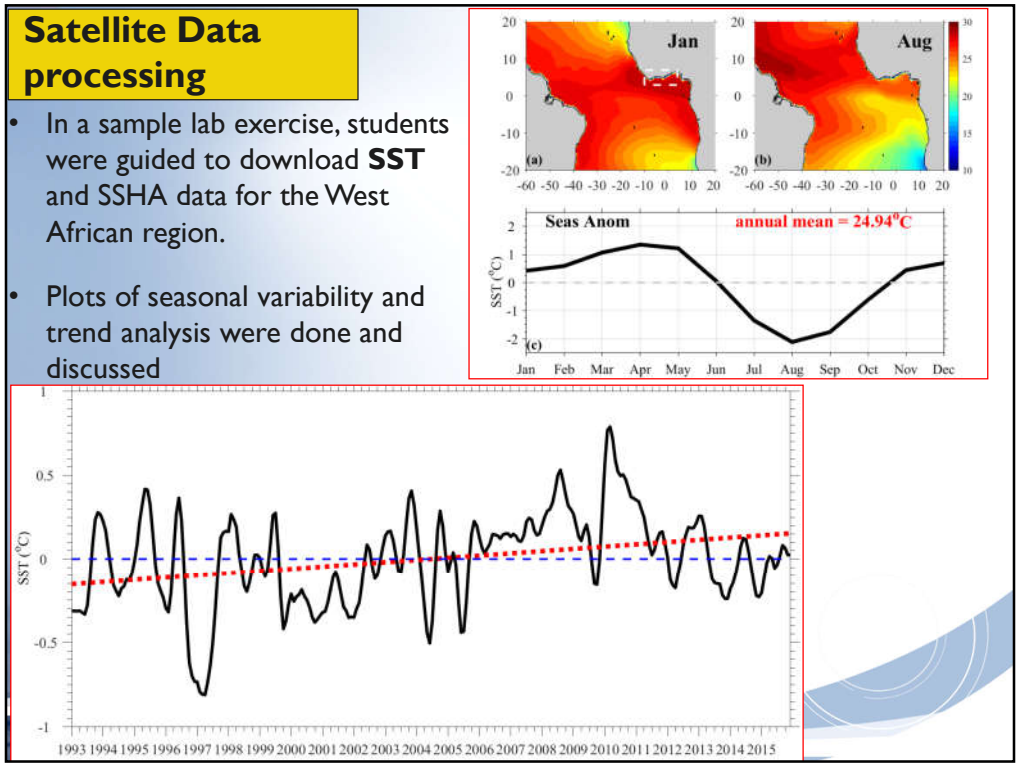


We train participants to use the satellite data for research of importance to their region such as erosion, algal blooms, upwelling and sea level rise. We have dedicated training on Python software as it is free.

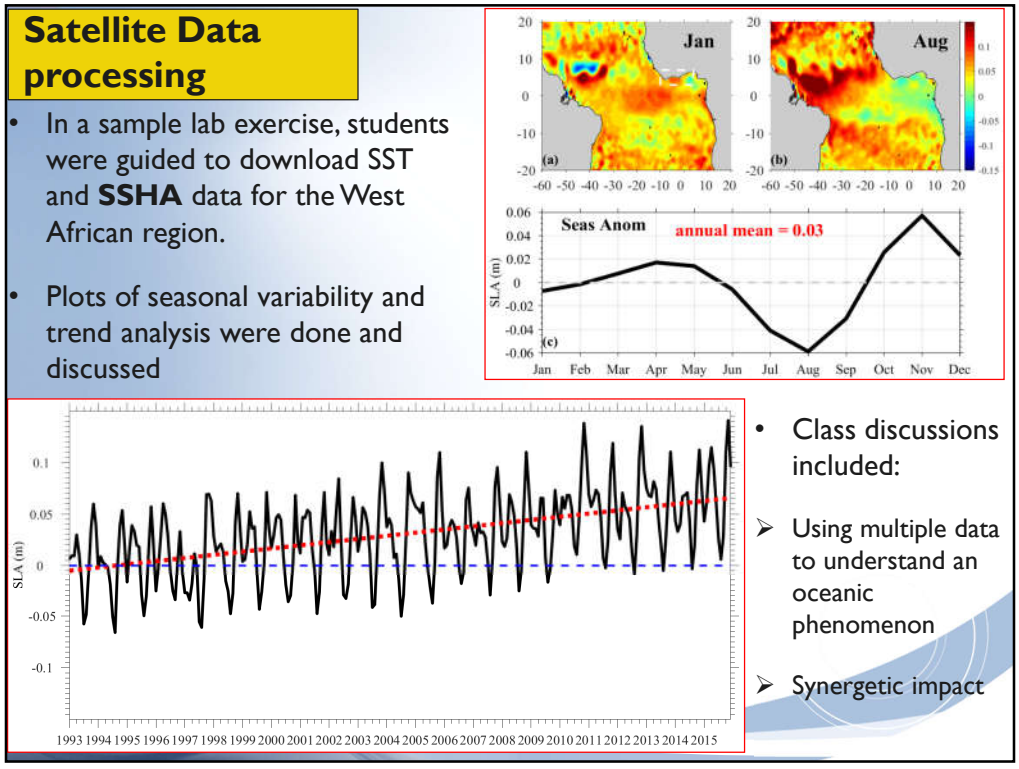
Satellite Data processing

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





In a sample lab exercise we used satellite data to study sea surface temperature (SST) variability in the West African region (top right). We used plots of January and August to represent the winter and summer seasons, respectively. Time series were also taken from the box in Fig (a). The seasonal anomaly plots show cooling (a proxy for upwelling) during the summer months. The bottom plot shows trend analysis (red line) of SST (black line) over 1993-2015 .



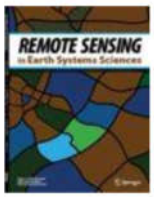
In a sample lab exercise we used satellite data to study sea level anomalies (SLA) variability in the West African region (top right). We used plots of January and August to represent the winter and summer seasons, respectively. Time series were also taken from the box in Fig (a). The seasonal anomaly plots show lowered SLA (a proxy for upwelling) during the summer months. The bottom plot shows trend analysis (red line) of SLA (black line) over 1993-2015 .

Satellite Data processing

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

Going forward

- Beyond the school, instructors stay connected with the participants, helping them acquire and analyze data for their studies, and dissertations, among others
- Going forward, there is the dire need to obtain **continuous funding** to support summer school and capacity building
- Funding for equipment to aid efficient knowledge transfer: build a center of excellence where satellite/data receiving station, computers and other analytical tools will be made available to help with research in the sub-region



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There is currently a special issue being run in the Remote Sensing in Earth System Sciences journal on applications of satellite data in Africa. Please submit your manuscript. Thanks.


Thank you
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