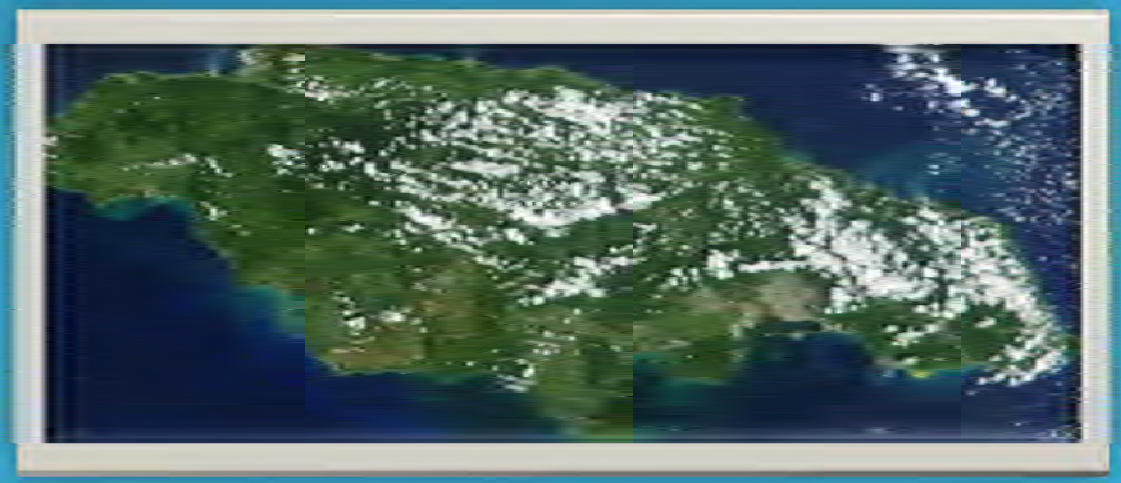
UTILIZING SPACE-BASED TECHNOLOGY TO ENHANCE CLIMATE CHANGE ADAPTATION STRATEGIES IN JAMAICA



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Jakarta, Indonesia
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Presented by Mark Codling, Jamaica

Presentation Outline

- Climate Change Adaptation Strategies
- Use of Space-Based data and technology applications in Jamaica
- Enhancing Climate Change Adaptation Strategies
- Challenges and Opportunities

Negril, Westmoreland, Jamaica

Jamaica Geographic Location and Climate

- Jamaica is an archipelagic state
- Latitude 18°15′ N and longitude 77°20′ W)
- Tropical maritime climate
- The island experiences tropical storms and hurricanes during the period July To November.

Impacts of Climate Change on Coastal Areas

Climate Variables	Impacts
Increasing Temperature	Sea surface temperature increases of at least 1.0 degree Celsius will lead to coral reef bleaching
Storms, Hurricanes, Droughts, Tropical Cyclones, Floods	Improper land use/development in watershed/flood-prone areas increases vulnerabilities to landslides and floods.
Sea Level Rise	Beach erosion as a result of 0.5 m sea level rise in the Caribbean is projected to cause a decrease in sea turtle nesting habitats by up to 35%.

Flooding

Beach Erosion

Impacts of Climate Change on Coastal Areas

Climate Variables	Impacts
Heavy Rainfall	Sea grasses currently face threats from sedimentation.
Storm Surges	Inundation of coastal areas, settlements, loss of life and property are also features of continual coastal development which exacerbate risks from these events.

Storm Surges

Climate Change Adaptation Strategies

Sectors	Adaptation Measures
Ecosystems and Near-shore areas	- Implementation of identified land use guidelines - Protect threatened ecosystems such as the Black Morass - Strict regulation of hazard zones - Conditional phased out development in high risk areas
Coral Reefs	- More structured coral reef management - Monitoring of construction that may contribute to coral reef destruction - Support for coral reef mapping and monitoring programme

Climate Change Adaptation Strategies

Sectors	Adaptation Measures
	- Exercise greater control over fishing activity
Reef Resources (fisheries)	- Pelagic and Reef Species assessment - Biological and Data collection research programs enhanced - Policies and guidelines related to the collection and export of materials
Protected Areas	- Continued support for ecosystem protection - Support for research and environmental monitoring

Climate Change Adaptation Strategies

Sectors	Adaptation Measures
Improved integrated watershed management	- Public education and awareness - Implement integrated watershed management - Promote improved soil management practices - Improve crop selection and planting/harvesting practices
Coastal Water Quality	- Regular monitoring of water quality - Develop and implement non-point source (pollution) - Improve wastewater discharge regulation and enforcement

Use of Space-Based Data in Jamaica

In Jamaica application of space-based technology has been limited to the use of satellite imagery in the areas of :

- environmental monitoring
- land use management
- disaster management.

Use of Space-Based Data in Jamaica

Organization	Sector	Use of the Space Based Data
National Work Agency	Transportation	Identify/map transportation planning to assure safety for the school population and to inform mitigation plans to alleviate congestion in school zones
National Water Commission	Water Management	Checking and verification of data (pipeline valves etc) digitized from hard copy before field visits.
Ministry of Health	Health	Assist in conducting disease surveys
Water Resources Authority	Water Management	Identifying groundwater supplies throughout Jamaica.

Use of Space-Based Data in Jamaica

Organization	Sector	Use of the Space Based Data
Meteorological Office of Jamaica	Meteorology	Weather monitoring and forecasting purposes
Office of the Disaster Preparedness Emergency and Management	Disaster Management	ODPEM as a member of the Caribbean Flood Pilot Project uses space-based data for a variety of applications in areas of flood early warning disaster reduction in agriculture and in wetlands.
Mines Geology Division	Mining	The Mines Geology Division have made use of satellite imagery and ground-based data to create hazard maps targeting landslides.

Use of Space-Based Data in Jamaica

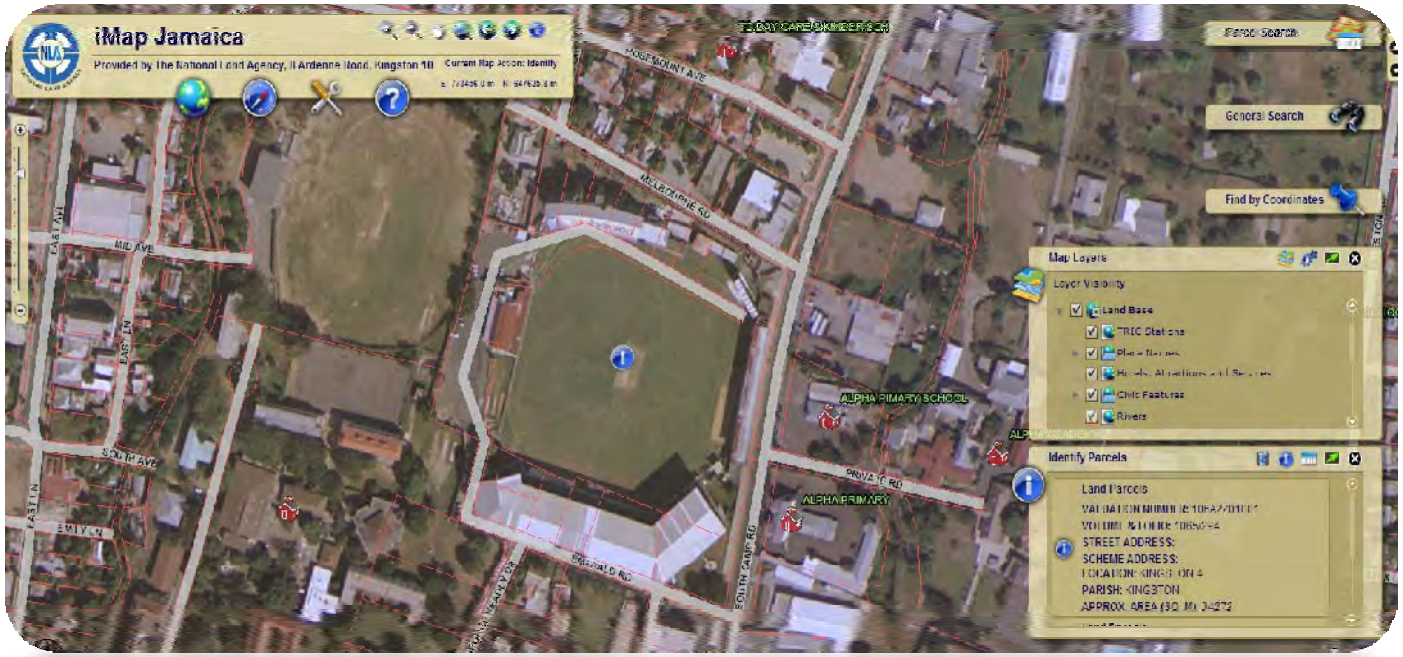
The Forestry Department has taken steps to :

Develop a national classification system of LANDSAT TM interpretation and aerial photographs.

Undertake vegetation interpretation of satellite images using the classification system developed. Conduct analysis of pre-1990 land use data together with a detailed study of 1989 and 1998 LANDSAT TM imagery of the island

Use of Space-Based Data in Jamaica

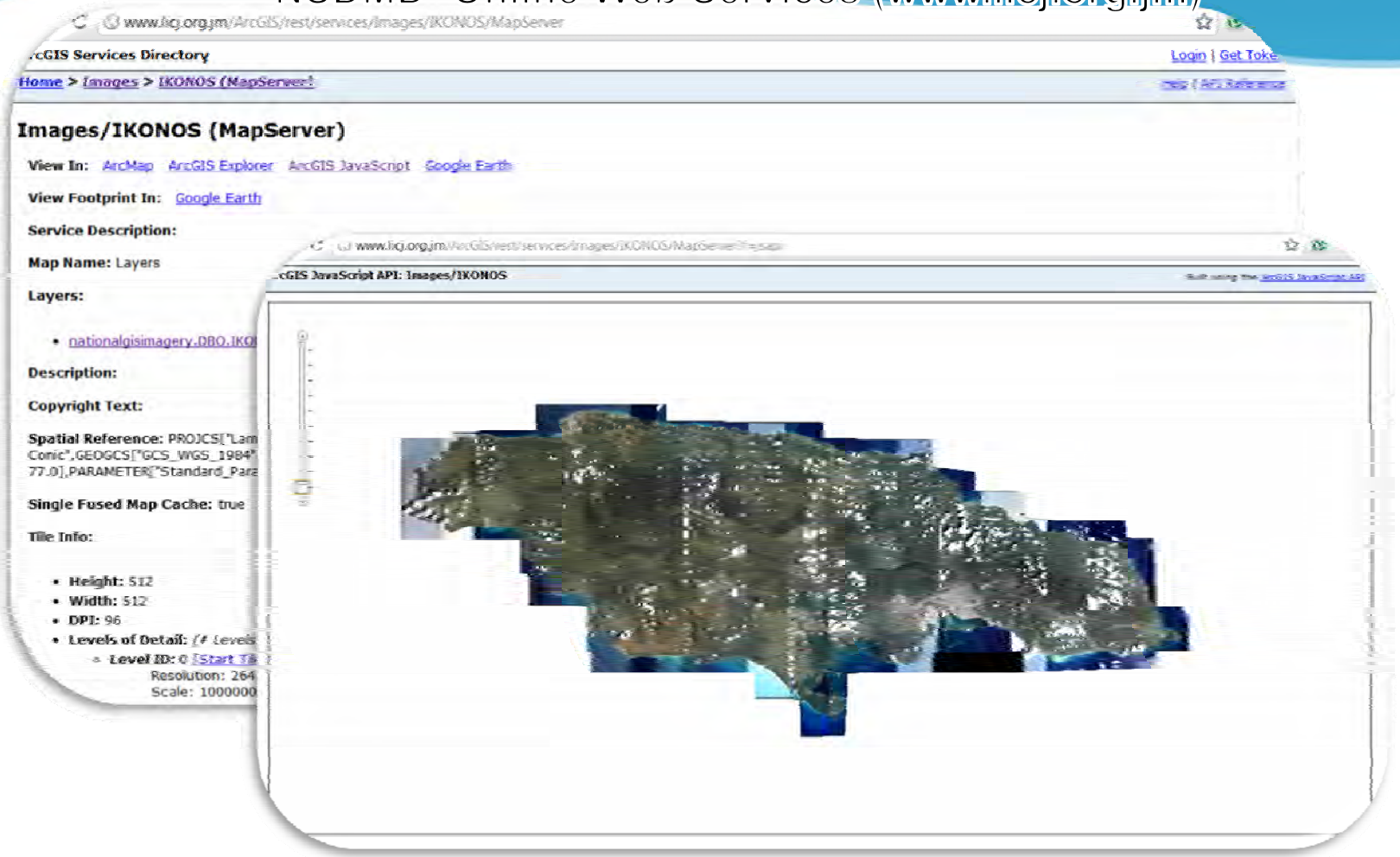
National Land Agency - iMap (www.nla.gov.jm)



To undertake custom analysis to aid in decision making, while disseminating land information to the wider public via web maps. Utilizing satellite imagery as base information layer with the integration of vector based data.

Use of Space-Based Data in Jamaica

NSDMD- Online Web Services (www.licj.org.jm)

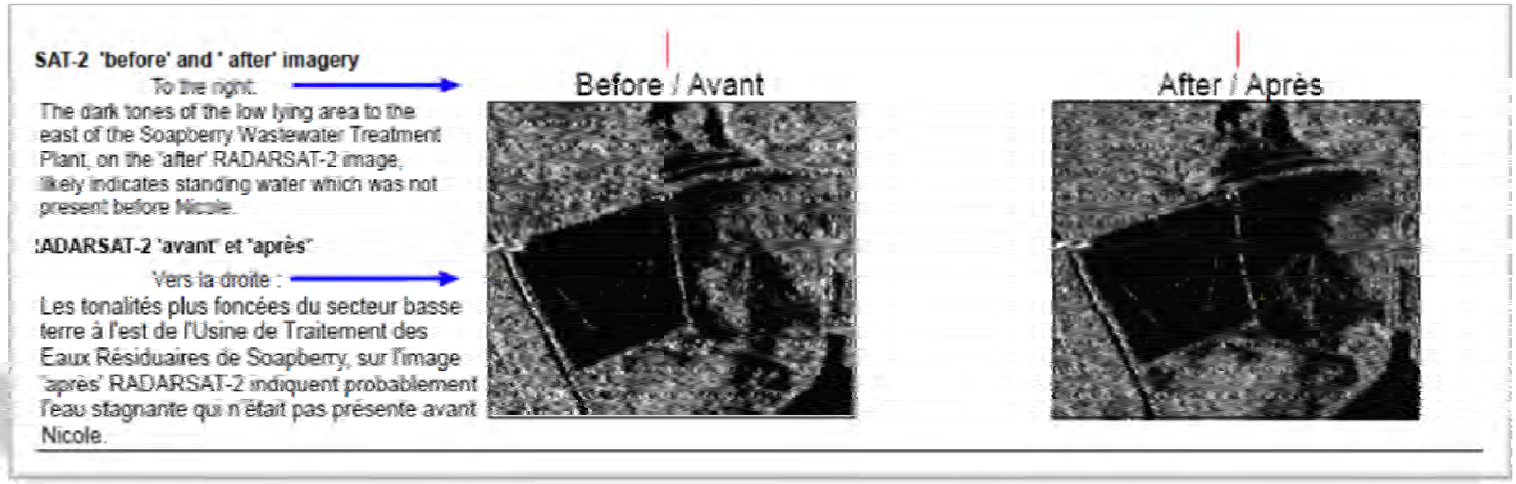


Climate Change Adaptation

Case Study 1: Flood Detection

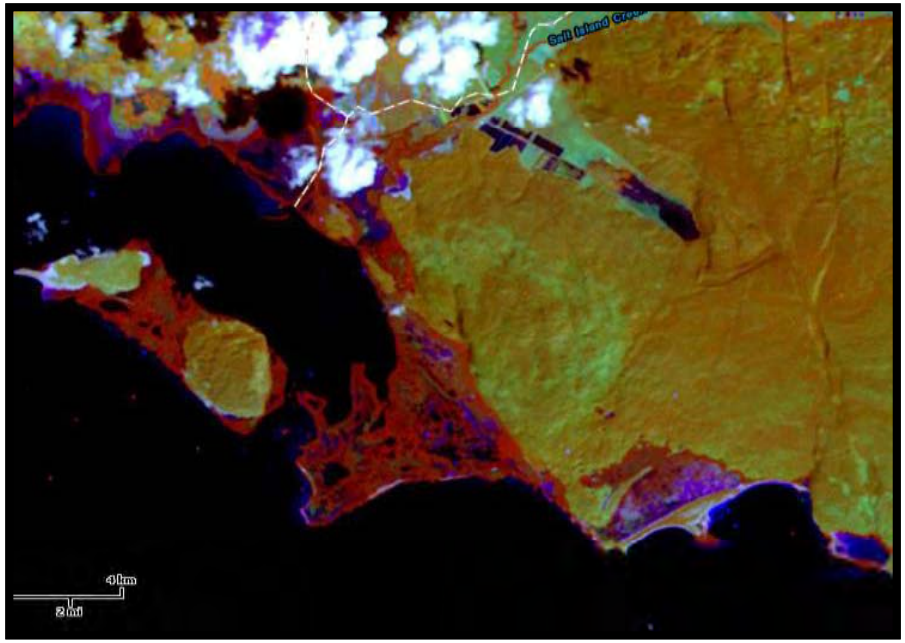
Tropical Storm Nicole in 2010

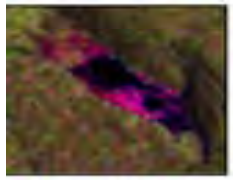
The sections of the island had incidents of flooding and landslide due to the passage of tropical storm Nicole in 2009. The ODPEM being a part of the Caribbean Flood Project through an initiative coordinated by the Canadian Space Agency (CSA), and the National Air and Space Administration of the United States (NASA) used space based information to identify areas of flooding.



Climate Change Adaptation

Case Study 1: Flood Detection





Flooded area

To assist OPDEM with the assessment of flood impacts, the Canadian Space Agency acquired high-resolution RADARSAT-2 data over selected parts of Jamaica, on Oct. 2, 2010. A change detection procedure was performed on the fine mode image from Oct. 2 (the 'after' image) and the fine mode image from July 22 (the 'before' image), in and around the Kingston area. The viewing angles of both images were sufficiently close for a meaningful comparison. The spatial resolution of the imagery is 10 meters. (Source: CSA, 2010)

Climate Change Adaptation

Case Study 2 : Shoreline Protection

Coastal Rehabilitation of the Palisadoes Peninsula

The National Works Agency and the National Environment & Planning Agency were able to utilize space-based data to analyze coastal erosion along the Palisadoes Peninsula.

The figure above illustrates the shoreline degradation between 2002 and 2006, which was approximated utilizing satellite imagery to as much as 27 meters over the 4 year period.

Climate Change Adaptation

Case Study 2 : Shoreline Protection

Coastal Rehabilitation of the Palisadoes Peninsula

Rehabilitative and protective works along the Peninsula have been designed for a 100-Year Return Period (i.e. the shoreline will be expected to withstand storm surges only anticipated to re-occur every 100 years).

Damage to the Palisadoes Peninsula after Hurricane Ivan in 2004 (Source: wunderground)

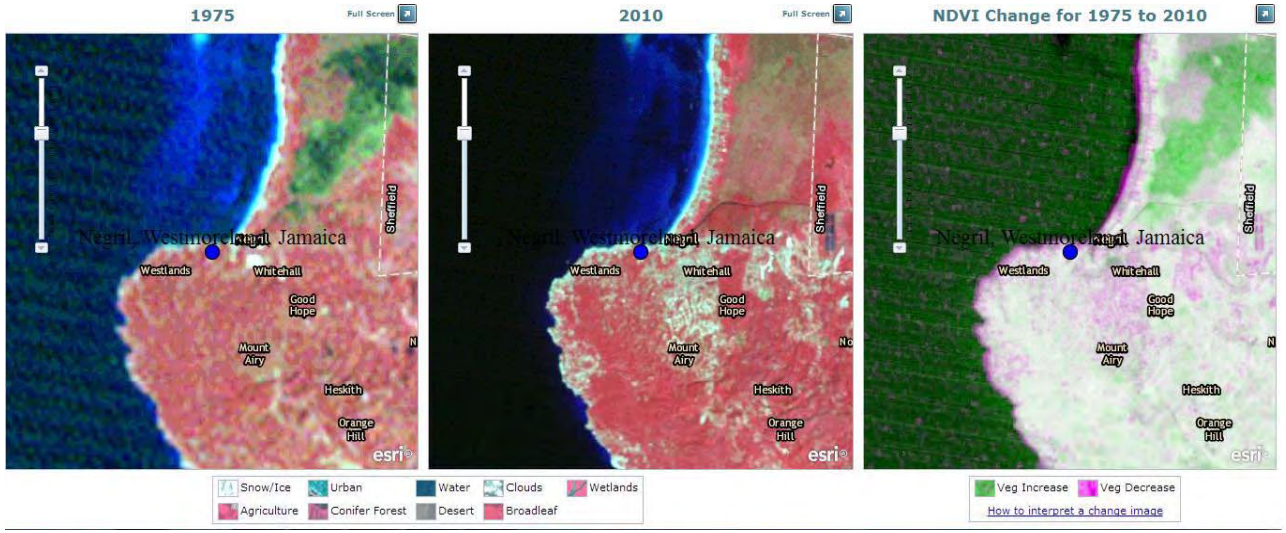
Construction of rock rivetment walls after road improvement and shoreline protection work on the Kingston Harbour side of the Palisadoes Peninsula.

Climate Change Adaptation

Case Study 3 : Monitoring Coastal Ecosystem

Risk and Vulnerability Assessment Methodology Development Project (RiVAMP)

This evidence based approach involved satellite imagery analysis to determine the distribution of coastal ecosystems specifically mangrove, coral reefs, sea grasses to estimate beach erosion in Negril over the last 40 years as shown below.

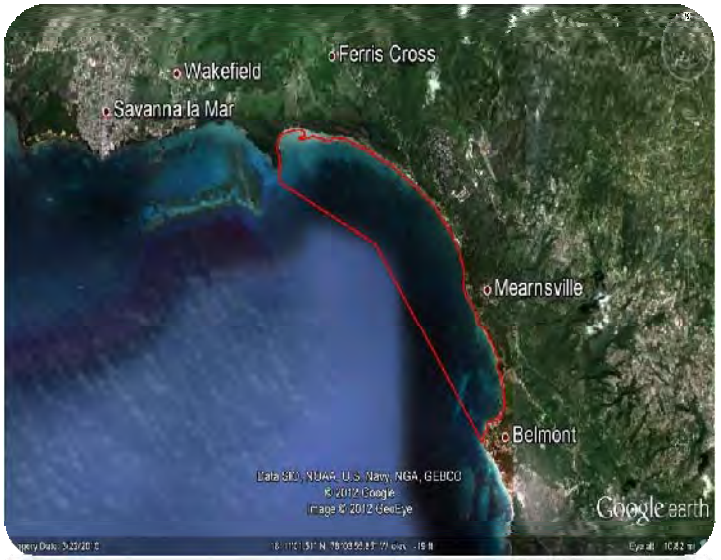


Use of Space-Based Applications to enhance Climate Change Adaptation Strategies

Effective Fisheries Management

Satellite imagery would be useful in providing timely analysis to support sustainable fisheries development including:

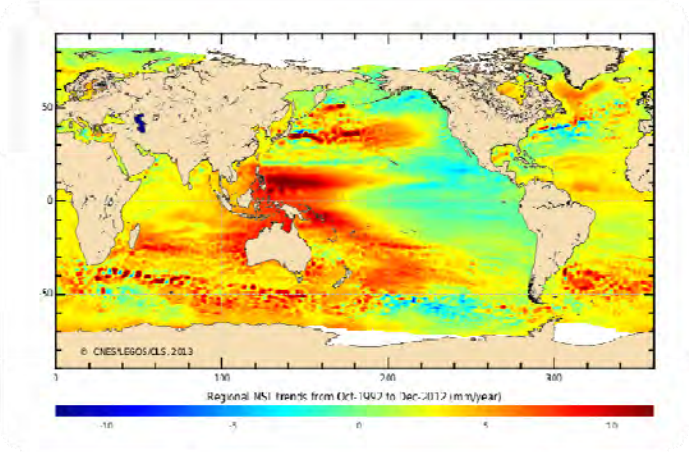
- the detection of algal bloom,
- demarcating fish nurseries and sanctuaries
- coral reef protection and management
- development of fisheries improvement projects, by catch reduction programs, etc.
- vessel monitoring, and illegal fishing analysis



Use of Space-Based Applications to Enhance Climate Change Adaptation Strategies

Sea Level Rise (SLR) and Sea Surface Temperature determination

Sea surface temperature can be determined from satellite imagery (which gives a global average) and **combined with data from in situ reference sites** can help to determine local rise in sea surface temperature. Space based data enables determination of SLR using satellite altimetry measurements on a global scale.

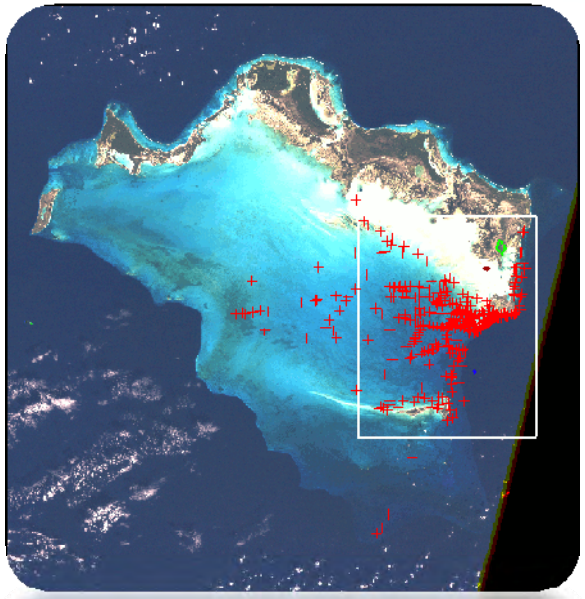


Use of Space-Based Applications to Enhance Climate Change Adaptation Strategies

Restore and protect coastal ecosystems to enhance natural buffers and increase resilience-

Space based data can be used for:

- Effective assessment and monitoring of coastal ecosystems such as mangroves and sea grasses
- Detecting and Monitoring changing position of coastline areas and detecting overall changes using high resolution imagery



Use of Space-Based Applications to Enhance Climate Change Adaptation Strategies

Pre and Post Disaster Assessment and Early Warning Systems

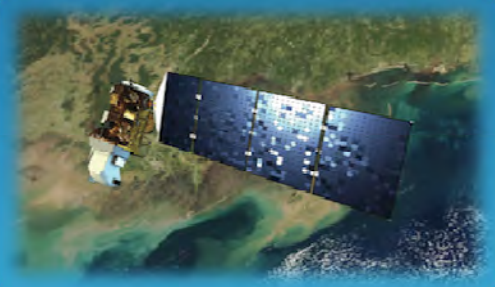
Current satellite imagery can assist with:

- the identification of areas of flooding, assessment of vulnerability to hazards using a combination of in-situ data with archived satellite based data;
- increasing the warning time and defining more specifically who to warn and suggesting potential impacts from historical information and analyses.
- (Satellite communications also help warn persons in remote areas).

Benefits of Space-Based Technology for Jamaica

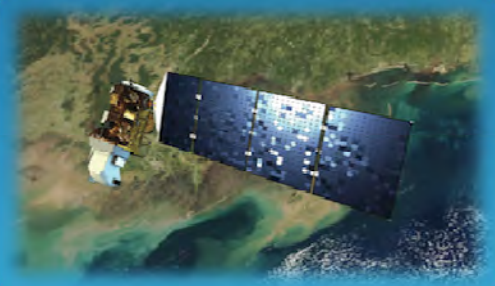
- Improved efficiencies in planning infrastructure projects to adapt to extreme climate change events
- Improved efficiencies in tracking land use changes over a period.
- High potential for saving lives and property during emergency situations.
- Pre planning for disaster risk reduction

Challenges



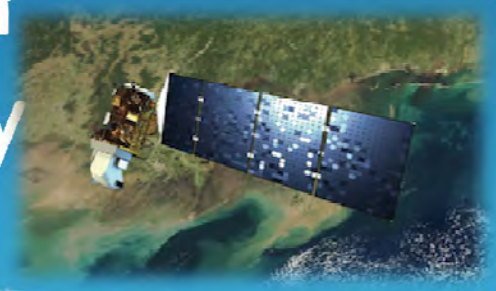
- Significantly **high cost associated** with its acquisition of current imagery.
- **Due to pace of developmental activities and rapid growth in urbanization,** the situation on the ground changes rapidly, requiring imagery acquisition at intervals of at least every 2-3 years.
- Some available satellite-based tools and products **mostly utilize imagery at low resolution for the Caribbean region**, or the spatial resolution is too coarse for most impact studies. High-resolution models would be more useful to local responders, planners or analysts.
- Most satellite data used in the Caribbean is optical imagery and does not provide useful information **during periods of cloud cover,** which are common.

Challenges



- **No national level policy on the use of spaced based data,** which would specify its usage, sharing, dissemination and accessibility.
- There is a need for the development of **better use of space-based data to allow for effective analysis** and understanding of the climatic processes.
- There is a **paucity of trained personnel in advanced remote sensing** to take advantage of existing opportunities to make effective use of satellite imagery.
- Jamaica would require additional technical expertise in space based technology and its related fields.. Some organizations will also **require additional equipment including high-speed computers** and other specialized technical apparatus

Way Forward /Opportunities for Use of Space Based Technology



Jamaica can benefit from the effective utilization of integrated space-based data and technology to assist the implementation of climate change adaptation strategies in meaningful ways as such will continue to utilize satellite imagery to the fullest extent.

Need to develop an effective mechanism to ensure currency of imagery at all times (e.g. seed funds with help of international orgs. to kick-start the establishment of a mapping fund)

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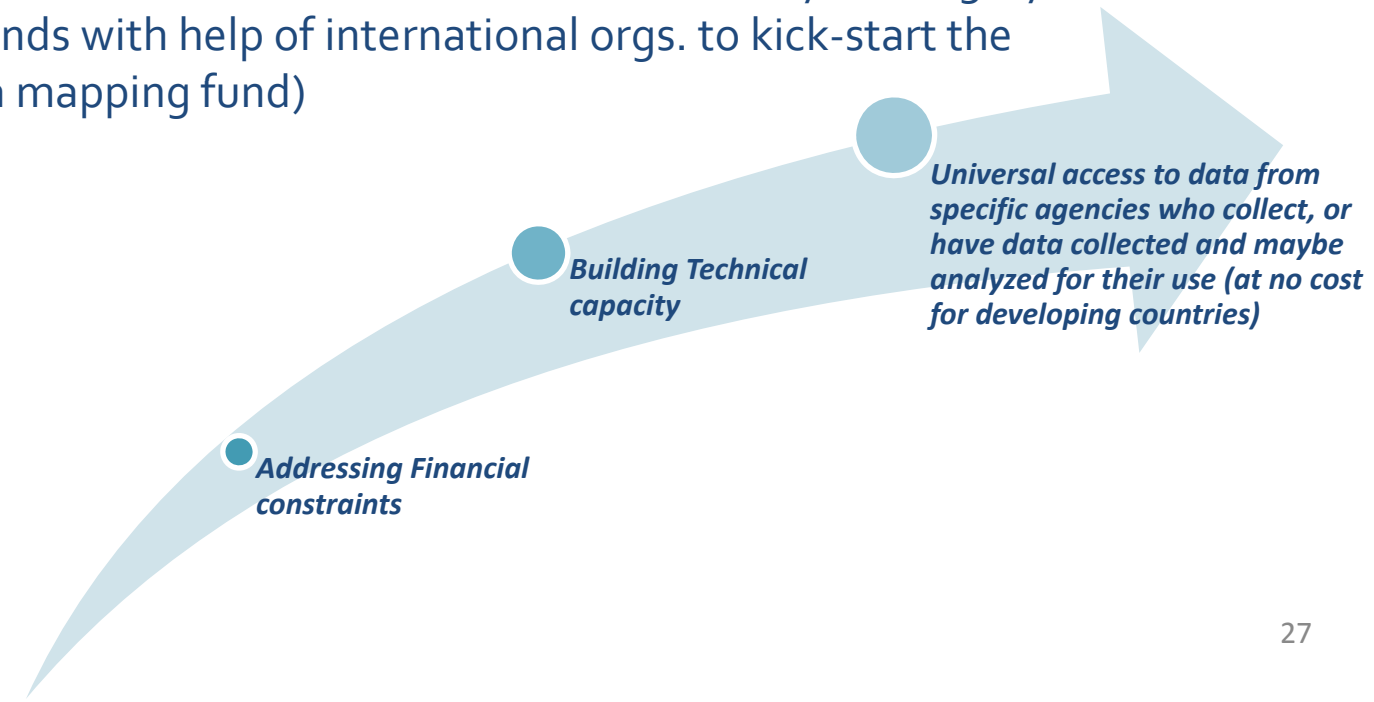

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