



Committee on Earth Observation Satellites

Recovery Observatory (RO)

Haiti Hurricane Matthew RO Status and Next Steps

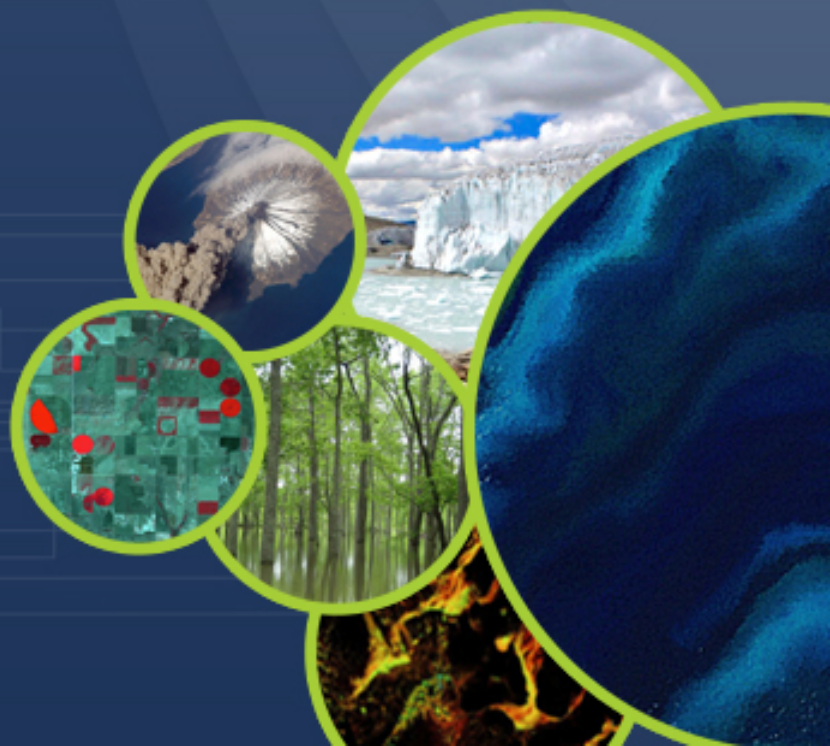
Presentation to WGD #8

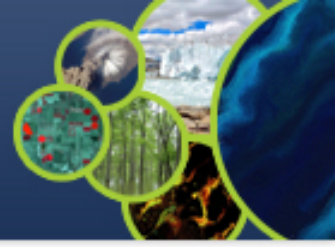
Buenos Aires September 5th, 2017

Helene de Boissezon, CNES

Agwilh Collet, CNES

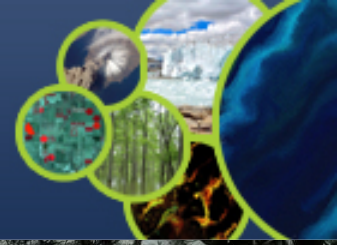
Andrew Eddy, AG - ROOT Secretary





□ Haiti Recovery Observatory

- Status Overview
- Workshop in Port-au-Prince
- ROOP
- Steering Committee
- Next Steps



A Reminder of Haiti's diversity

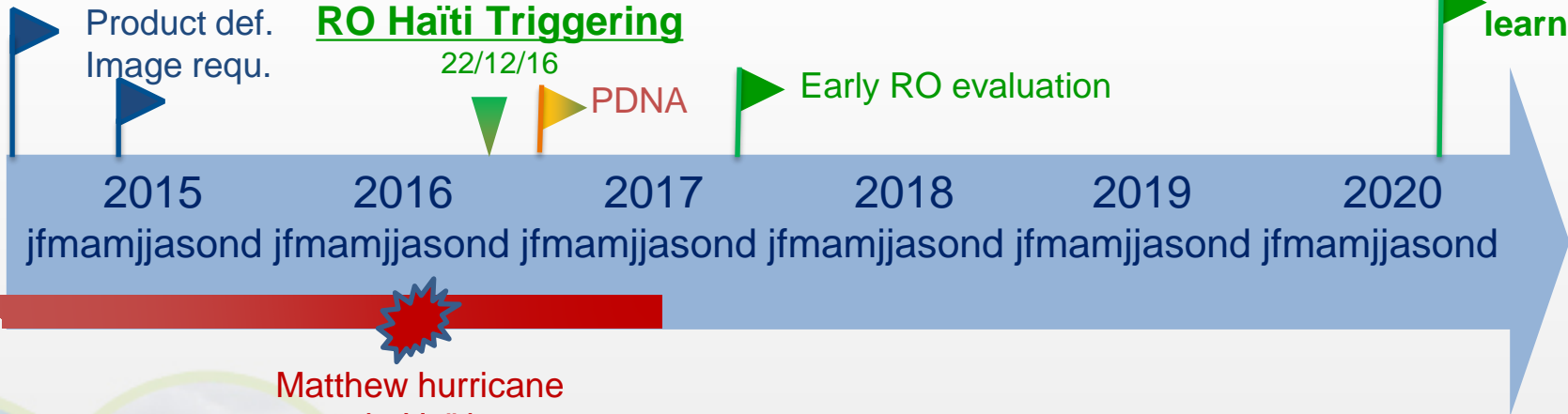
- **Triggering of the RO** decided by CEOS Chair in consultation with CEOS Principals, **December 22, 2016**, after **Hurricane Matthew - October 2016**
- **Mission to Haiti 31 Jan - 3 Feb 2017** to establish partnership with Haiti RO users and stakeholders
- **Mission to Haiti 29 May – 2 June 2017** to establish RO users connection and feedback from first products

Haiti RO to cover three departments: Grand'Anse, Sud, and Nippes





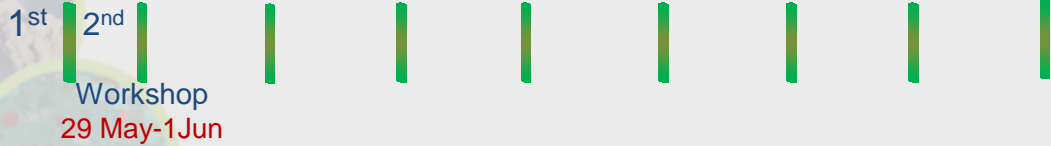
Infra dvt



Matthew hurricane in Haiti
04/10/16

Malawi, Nepal demos

Missions (Haiti, WB/UN)
(2 to 3 per year)





Workshop users : 29 May to 2 June, 2017

Validation of needs and state of the art with Haitian users, organized by CNIGS/CNES.

Introduced by the Head of the Ministry of Planning cabinet, CNIGS director, UNDP deputy country director, ONEV director.

CNES :

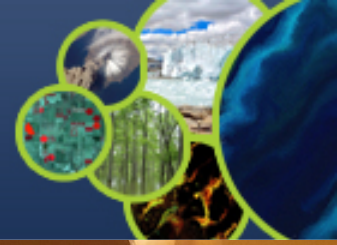
Helene de Boissezon
Frederic Moll
Agwilh Collet

CIMA :

Giorgio Boni

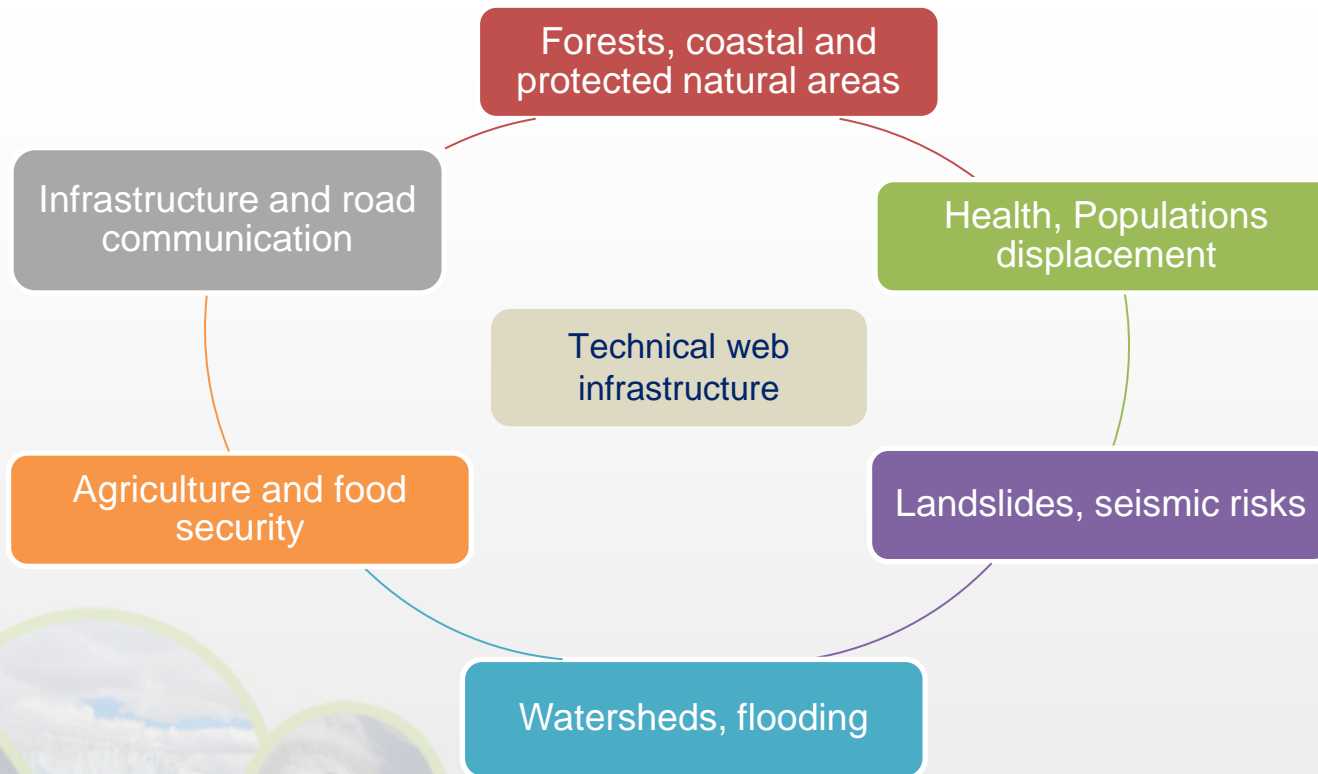
RO Secretary :
Andrew Eddy





46 participants from

Ministry of Planning, CNIGS, CIAT, ONEV, Mining and Energy department, Ministry of Environment, Ministry of Agriculture, Nature Resources and Rural development, Delegation of European Union, Echo Field, French embassy, CNSA (National Coordination of Food Security) , UNDP, UNEP, SERTIT, CIMA



6 Value-added product themes, 1 technical

- Haitian + CEOS speaker
- Haitian concrete examples / showcases
- Discussion to define priorities for value added products



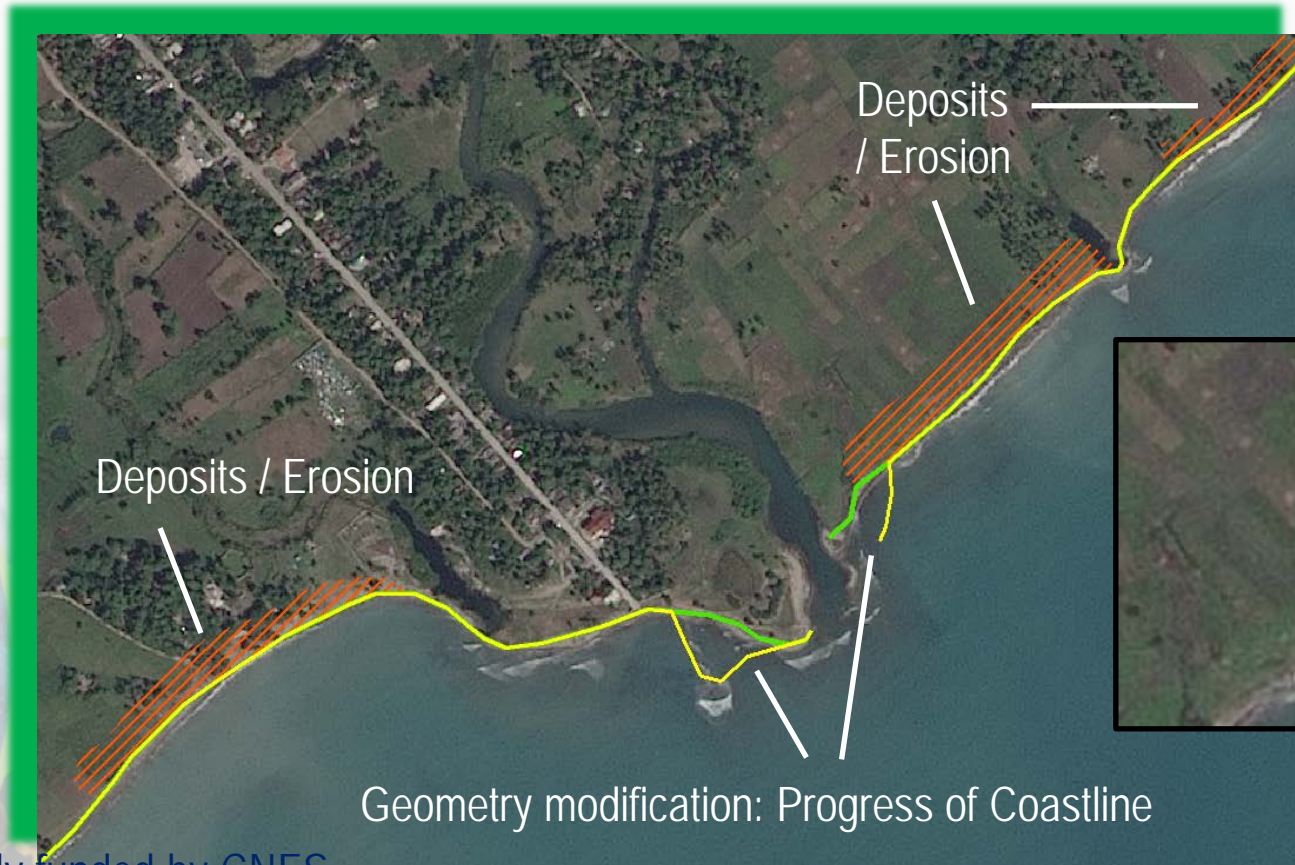
- **Strong Haitian presence and support** for RO concept
- Plan to link existing tools & platforms for increased synergy: **Common portal RO, HaitiData.org, RASOR, KAL-Haiti**, future ONEV environmental information service.
- **In each theme:**
 - Definition of key partners and key users
 - Feedback from first products and improvement
 - Choose zoom area(s) to highlight
 - ⇒ **Map of future works**
- **Plan the Copernicus EMS Risk&Recovery requests**
- **Strong need in Capacity Building** (not directly addressed in CEOS WG Disasters framework)

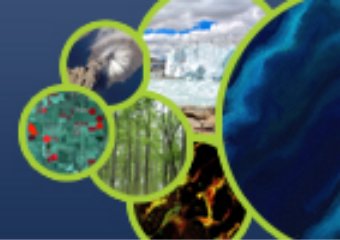


Forests, coastal and protected natural areas

- Secteur 1 : Plaine des Cayes

Torbech
Spot 7 1,5m
Image before
Matthew
08/01/2016

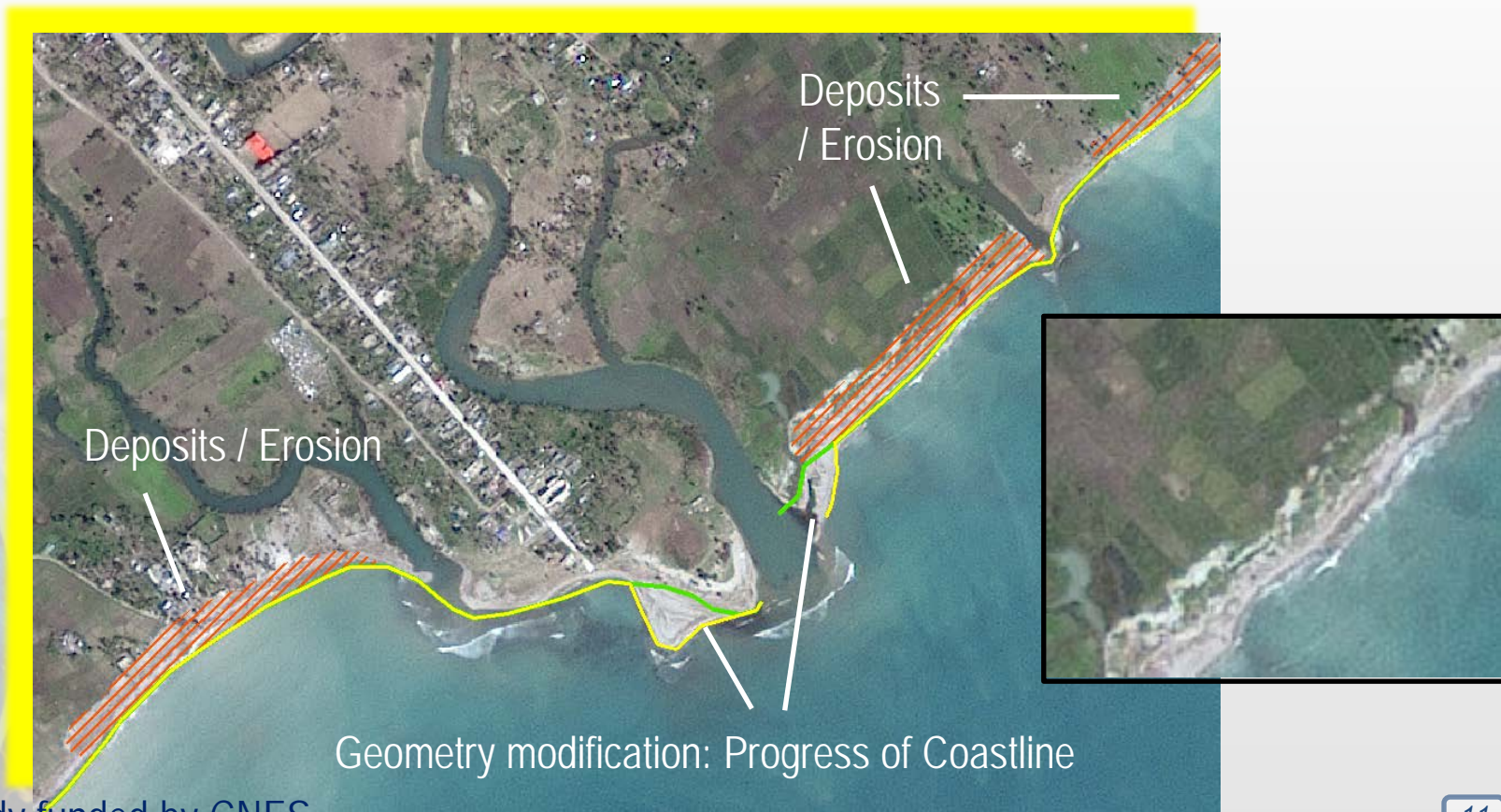




Forests, coastal and protected natural areas

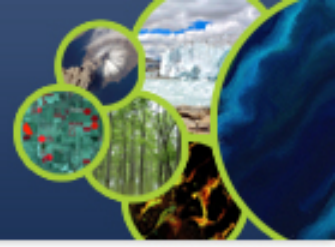
- Secteur 1 : Plaine des Cayes

Torbech
Spot 7 1,5m
Image post
Matthew
14/02/2017

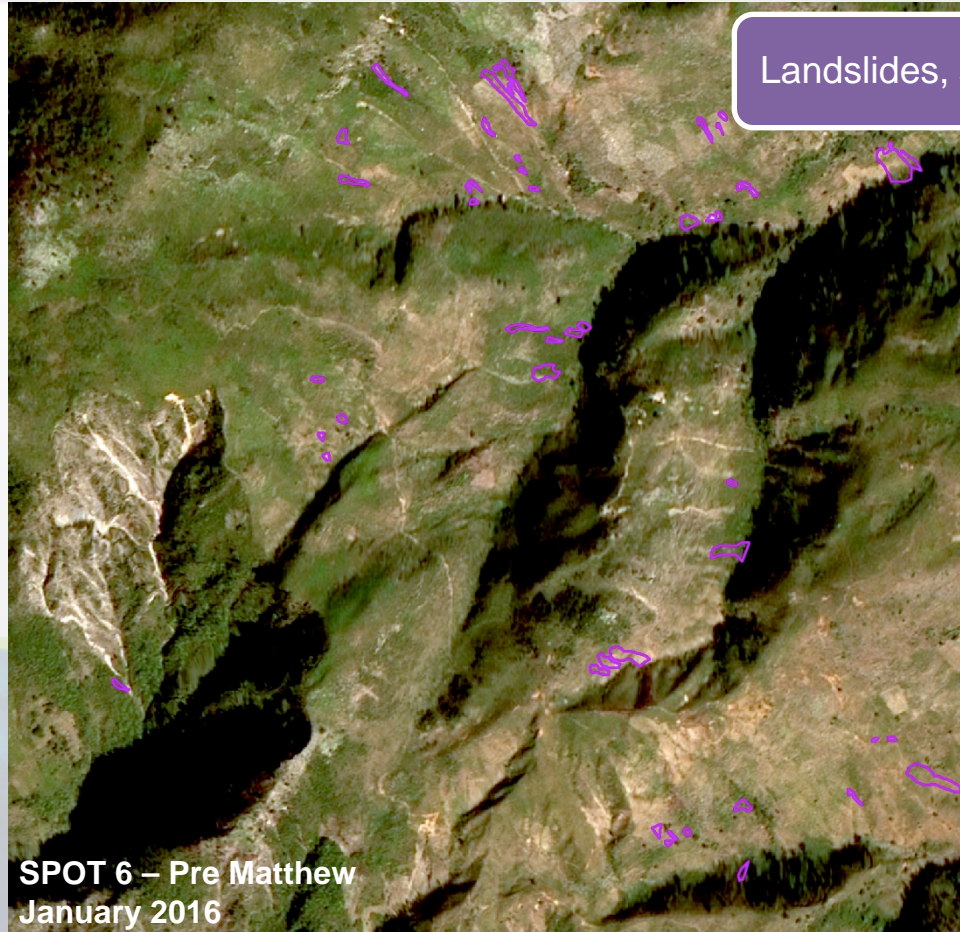


Workshop users #1 :

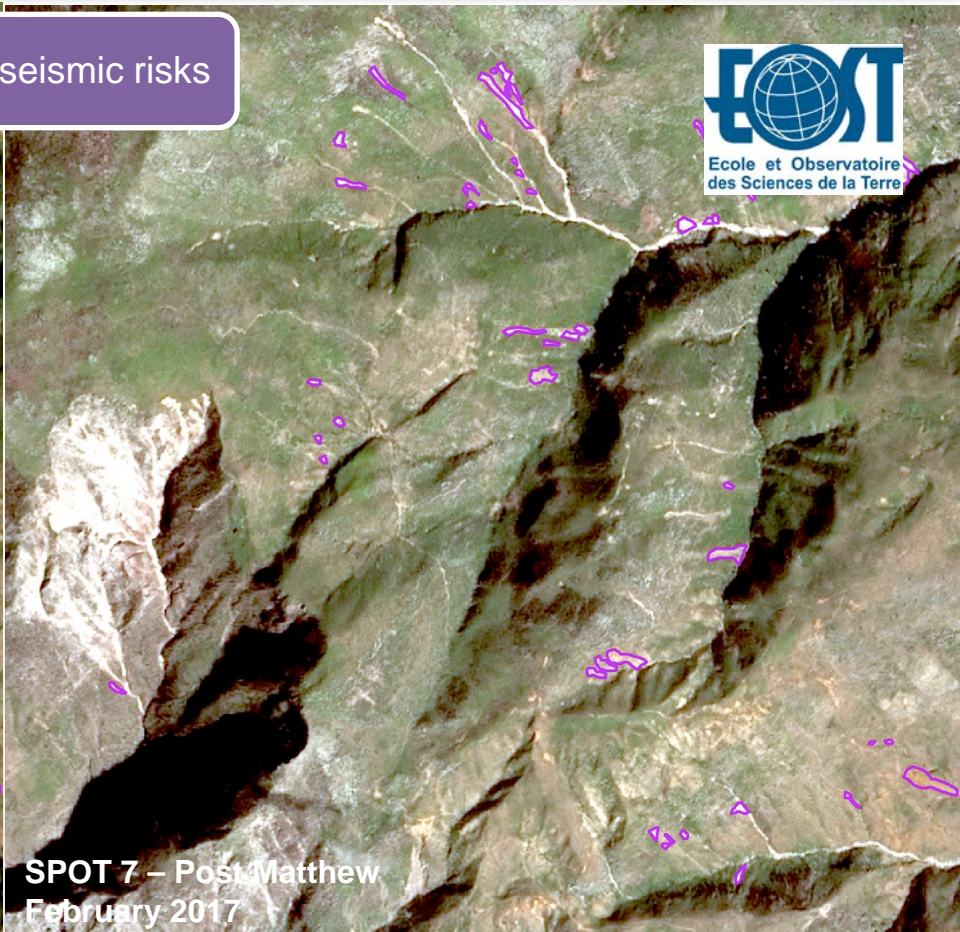
Concrete example



Landslides, seismic risks



SPOT 6 – Pre Matthew
January 2016



SPOT 7 – Post Matthew
February 2017

Application of ALADIM to pre / post-Matthews images (SPOT)

- Deposit channels are difficult to map (+ ~ 30% of affected areas).
- Shadows on the west and north slopes can cause an underestimation of total displacement.
 - Very complex landscape for automated mapping

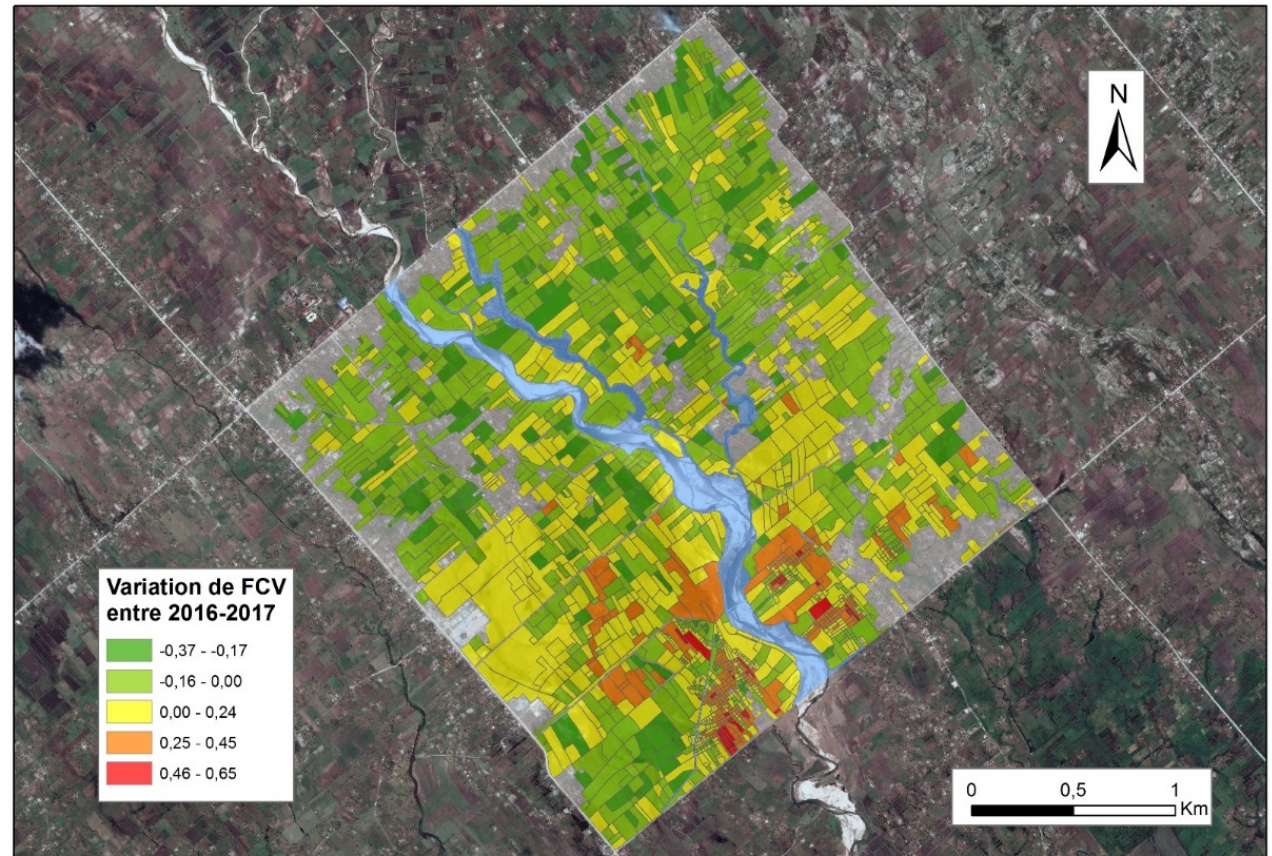


Agriculture

Secteur de la Plaine des Cayes

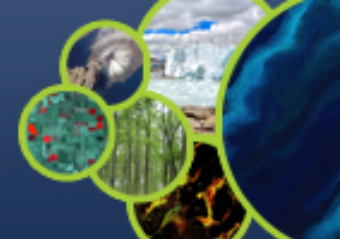
Evidence of pre/post-event variation

- SPOT6 MS of 08/01/2016 and SPOT 7 MS du 14/02/2017
- Fraction of the Vegetation Cover (calculate from NDVI) Evolution between 2016 and 2017





- Bathymetry 50km from shoreline (Global Bathymetry and Elevation Data at 30 Arc Seconds Resolution 2009)
- Data Base BRGM (Geological and mining research office)
 - Risk Atlas 2017
 - 36 studies on haiti from 1999 to 2015 with **GIS data related**
- Data Base CIAT
 - Administrative boundaries
 - Studies with GIS data related
Works on Cap Haitian
- CNIGS Orthophoto and **MNT 2014 : cell size : 1,5m**
- Artibonite project (2014) Out of RO area (water uses and waterhsed)
- PDNA : all documents and **GIS Data** (Boundaries / School / Health facilities / road etc)
- Cyclonic threat (2009)



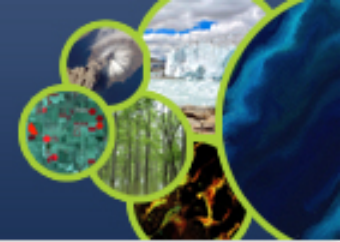
Thematic	Product	Frequency	DATA	Area
Forest and protected natural areas	Status of regeneration in protected areas - Classification and detection of change Monitoring of habitat resettlement (if possible). Map of forest ecosystems Forest Monitoring Follow-up of the Mangrove	Annual	Optical THR and HR	Macaya Park Grand Bois RB la Hotte
Coastal Zone	Monitoring of the coastal zone (zoom on change – scientific product) OCS – Coastal ecosystem	Annual	Optical THR and HR Sentinel 3	West and South coast only
Displacement of population and rural habitats	Removal / Construction of damaged buildings Change in use of urban land Temporary housing (progress and location) Type of reconstruction	2 per years for 2 years	Optical THR	Jérémie Additional Areas TBD ?
Health	Mapping risk of vector-borne diseases	Baseline 2017 then Annual	TBD - Need not confirmed at this stage	

Planned works 2/3



Agriculture and food security

Watersheds, flooding



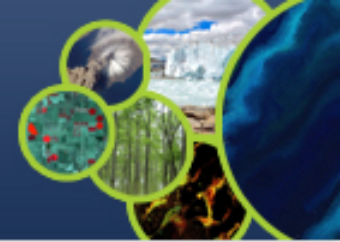
Thematic	Product	Frequency	DATA	Area	Comment
Watersheds Monitoring	Monitoring : RÉNOP (OCS); Ground movement ; loss of soil	Baseline + update after major events	MNT Optical and Radar HR and THR	Priority basins (vulnerability, stake, representativeness)	CIMA Foundation. / RASOR CNIGS Radar ability
	Mapping and assessment of flooded areas	Crisis	SAR Lidar	Entire Area with identification of key points according to the event	CNIGS (+expert in hydraulic modeling) Capacity to activate the Charter
	Early Warning : Hydrometeo monitoring model Flood routing	Real time (Flood period)	Pluviometry (automatic stations) ; weather image (Imerg); Radar; Caribbean Weather services	Priority basins (vulnerability, stake, representativeness)	CNIGS (+expert in hydraulic modeling)
Agriculture	Evaluation of agricultural change	Baseline before/after Then 2 to 3 times / year	HR and THR Optical	Zooms on the plains of Jérémie, Port Salut et Les Cayes Access required to field data (for sample sites and validation)	Nomenclature adapted to the South Basic product over the entire area, dynamically updated with Sentinel flows

Planned works 3/3

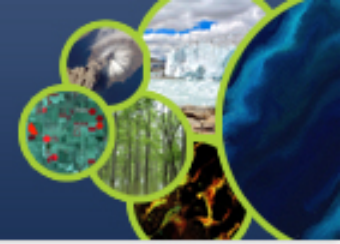


Landslides, seismic risks

Infrastructure and road network



Product	Frequency	DATA	Area	Comment
Landslide Automated change detection	Pré / Post event	Optical THR HR		Very high resolution required to identify low amplitude movement
Monitoring with quantification of displacements (horizontal deformation fields) By the application of correlation methods of time series images	3 to 6 months TBC	Optical HR, THR Stereo for MNT ?	Zoom on les Cayes – Jérémie Road Jérémie, les abricots	Final product: Maps with displacement fields / speed per period and a map summarizing the sectors and their movements over the period Access to field data essential (for characterization) Catalog displacements on zoom
Quarry Detection and Development	Bi annual	THR	Arniquet quarry	For regulation
Landslide Monitoring by radar amplitude image correlation tests	Bi annual	Radar TerraSAR-X	Idem monitoring	(e.g. offset-tracking) need of HR radar data
Mapping of Road network	Baseline + annual	Optical HR (primary road), THR for secondary VHR or HR SAR (after storms)	RO area	Calculation of RAI Comparison with CNIGS and UNDP network Precise MTN required Secondary dirt road



Produit	Key User	First Elaboration	Satellite data	Focal Point	Institution
Cartography of the building (Jérémie, Les Cayes, route d'Aquins)	CIAT/Ministry of Planning (MPCE)	Copernicus EMS; SERTIT (methodology); CNIGS (production);	Optical THR	Rose-May GUIGNARD	CIAT
				Pierre Alexilien Versaille MPCE/ CNIGS	
Land Use	All (reference data)	CNIGS/CESBIO /SERTIT	Sentinel-2, HR Optical	Jacques Philemon MONDESIR	MPCE / CNIGS
Forest Evolution / Environmental Impact	Ministry of Environment (MDE)	Copernicus EMS	Sentinel-2, SPOT, Optique THR	Pierre Emmanuel PHILIPPE	MDE/ Directeur des forêts
				Saint Phar JEAN	MDE/ ONEV
Agriculture	Ministry of Agriculture (MARNDR)	Copernicus EMS ; CNIGS/SERTIT	Sentinel-2, Optical HR, zoom THR	Ognel PIERRE-LOUIS	MARNDR/ DRFS
				David TELCY	MPCE / CNIGS
State and monitoring of the Macaya Park	ANAP / ONEV (MDE)	Copernicus EMS ; SERTIT	Optical THR, radar THR	Sait Phar JEAN	MDE/ ONEV
State and monitoring of watersheds	ONEV (MDE) - Ministry of Agriculture (MARNDR)	CIMA Foundation	Digital terrain model 1m/20cm and Radar THR	Jean André PIERRE	MPCE/ CNIGS
				Pradel FORMONVIL	MPCE/ CNIGS
				Saint Phar JEAN	MDE/ ONEV
Landslide / Quarry monitoring	BME / Ministry of Public Works (MTPTC)	EOST	Optical HR/THR, Radar TerraSAR-X	Samuel GENEVA	MTPTC/ BME
				Eric CALAIS	ENS France



Data Types	Possible sensor contribution	Images	Main applications
<p>VHR Optical</p> <p>Pixel size: < 1 m</p>	<p>Pleiades, Geoeye, Worldview-1, Worldview-2, Worldview-3, QuickBird</p>	<p>GeoEye, Worldview-1/2/3: approx. 225 km², swath approx. 15 km</p> <p>Pleiades: 400 km², swath 20 km</p> <p>Could be tasked per sq km to fit specific AOIs</p>	<p>Housing, transport, health and education</p> <p>Agriculture, landcover, environmental monitoring</p>
<p>HR Optical</p> <p>Pixel size: 1 m < 30 m</p>	<p>Landsat-8, Sentinel-2, SPOT 6m</p>	<p>SPOT: 3,600 km², swath 60 km</p> <p>Landsat-8: 34,000 km², swath 185 km,</p> <p>Sentinel-2: 84,100 km², swath 290 km</p>	<p>Agriculture, landcover, landslides, environmental monitoring</p>
<p>Medium/Low Resolution Optical</p> <p>Pixel size: > 30 m</p>	<p>Sentinel-3, MODIS</p>	<p>MODIS: 5,428,900 km², swath 2330 km</p> <p>Sentinel-3: 1,612,900 km², swath 1270 km</p>	<p>Coastal apps, environmental monitoring</p>



Data Types	Possible sensor contribution	Images	Main applications
<p>VHR SAR</p> <p>Pixel size: < 4 m</p>	<p>Cosmo-SkyMed, ALOS-2</p> <p>TerraSAR-X, Radarsat-2</p>	<p>Cosmo-SkyMed, TerraSAR-X, Radarsat-2, in Spotlight mode the swath is 10 km.</p> <p>ALOS-2 Spotlight mode: Swath 25 km</p> <p>Sentinel-1, SM full res. mode: Swath 80 km</p>	<p>Focus on science products (interferometry, polarimetry)</p> <p>Landslides Ground movements Fault mapping Flood products</p>
<p>HR SAR</p> <p>Pixel size: 4 m < 30 m</p>	<p>Cosmo-SkyMed, ALOS-2, Sentinel-1</p> <p>Radarsat-2 (to be confirmed)</p>	<p>Cosmo-SkyMed, ALOS-2 Stripmap modes or ALOS-2 fine mode: Swath from 30 km to 50 km</p> <p>Cosmo-SkyMed, ALOS-2, Radarsat- 2 ScanSAR modes and Sentinel-1 in SM/IW high res mode: Swath from 200 km to 350 km</p>	<p>Focus on science products (interferometry, polarimetry)</p> <p>Ground movements (fault mapping, landslides) Flood products</p>
<p>DEM</p>	<p>World DEM, Lidar DEM</p>	<p>Entire Aol</p>	<p>Flood and landslide hazard products</p>

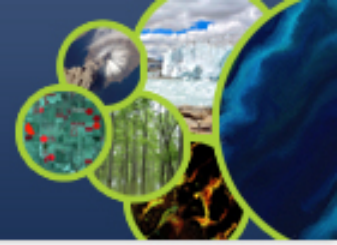


Describes the current understanding of data needs based on planned applications and products. To be discuss

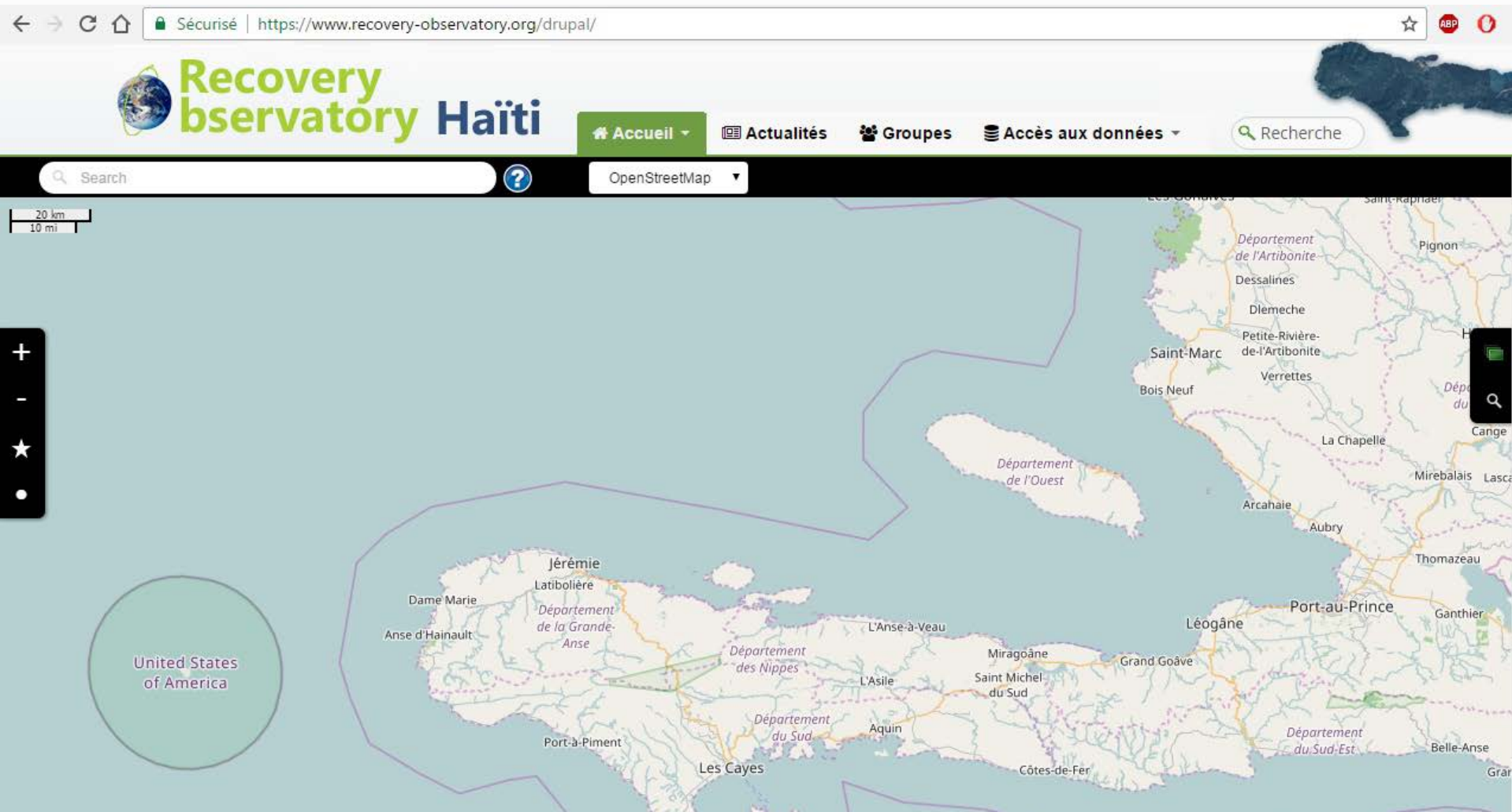
<i>Period/Sensor</i>	<i>SPOT</i>	<i>Pleiades</i>	<i>Cosmo-Skymed</i>	<i>TerraSAR-X</i>
<i>Baseline Data</i>				
<i>Pre-event</i>	10		4	8
<i>Post-event</i>	4	8	4	11
<i>Monitoring Data</i>				
<i>2017</i>	8	30	10 (34)	30
<i>2018</i>	8	30	10 (34)	30
<i>2019</i>	8	30	10 (34)	30
<i>2020</i>	8	30	10 (34)	30
<i>Total</i>	14+32	8+120	8+40 (132)	19+120
<i>Main Applications</i>	<i>Agriculture, Forests and protected areas, health</i>	<i>Coastal zone monitoring, population displacement, road networks, rural settlements</i>	<i>Water system monitoring – rapid change detection/ obstructions, (landslides stacks of 24 added to 10 annual)</i>	<i>Landslides</i>



<i>Period/Sensor</i>	<i>RADARSAT-2</i>	<i>ALOS-2</i>	<i>ROSKOSMOS VHR</i>	<i>Sentinel 2</i>
<i>Baseline Data</i>				
<i>Pre-event</i>	3	6		3
<i>Post-event</i>	7	6	4	6
<i>Monitoring Data</i>				
<i>2017</i>	10	6	15	30
<i>2018</i>	10	6	15	30
<i>2019</i>	10	6	15	30
<i>2020</i>	10	6	15	30
<i>Total</i>	10+40	12+24	4+60	9+120
<i>Main Applications</i>	<i>Water system monitoring, post event status</i>	<i>Change detection (also landslide coherence)</i>	<i>Coastal zone monitoring, population displacement, road networks, rural settlements</i>	<i>Land Use (all topics), Agriculture, Forests and protected areas</i>



Translation of key texts. Multilingual by October.

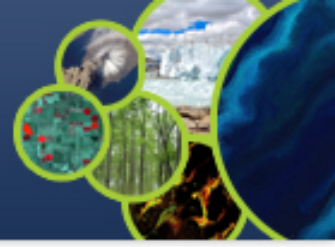
A screenshot of the Recovery Observatory Haiti website. The browser address bar shows the URL 'https://www.recovery-observatory.org/drupal/'. The website header includes the 'Recovery Observatory Haiti' logo, a navigation menu with 'Accueil', 'Actualités', 'Groupes', and 'Accès aux données', and a search bar. Below the header is a map of Haiti with various departments labeled, such as 'Département de l'Artibonite', 'Département de l'Ouest', and 'Département du Sud'. A scale bar in the top left indicates 20 km and 10 mi. The map also shows the 'United States of America' to the west.



- Day-to-day management of the RO – telcon every 3/4 months
- Member of the Haiti RO **Steering Committee (SC)** :
 - Michèle ORIOL (**CIAT**)
 - Boby PIARD (**CNIGS**)
 - Dwinell BELIZAIRE (**ONEV**)
 - Martine THERER and Chiara MELUCCI (**UNDP**)
 - Mare LO and Sergio DELL'ANNA (**WB**)
 - Simona ZOFFOLI and Giorgio BONI (**ASI/ CIMA**)
 - Stéphane CHALIFOUX (**CSA**)
 - Hélène de BOISSEZON (**CNES**)
- First SC meeting planned on 27th September 2017



- Development of first applications based on identified requirements from Users workshop
- Haitian Web Portal for all Spatial Data being established
- Technical mission end 2017, to validate 1st products, plan capacity building and dissemination
- Solicitation of new funding and partners to augment applications offered and to develop Capacity Building capacities
- Reporting to major stakeholders (WB, GFDRR, UN)



To August 2017 – Haiti RO Establishment

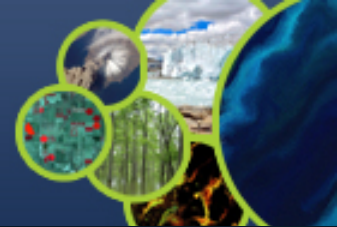
- Discussion of MOUs with Haitian users and partners, Establishment of IT infrastructure with charter images, baseline pre/post-event
- **First User workshop** in Haiti to provide further input to the ROOP and finalise the Haiti RO baseline.

Sept 2017 to early 2018 – Haiti RO Commissioning

- Incorporating the first products into the Haiti RO and ensuring easy access
- Definition of capacity building plan
- Solicitation of new partnerships (for value-adding and capacity building)
- Animating the user forum; Encouraging and promoting Haiti RO use. **First “early evaluation”**, with a report to Haiti RO Steering Committee

To end 2020 – Haiti RO Steady-state Operation / Generic RO definition

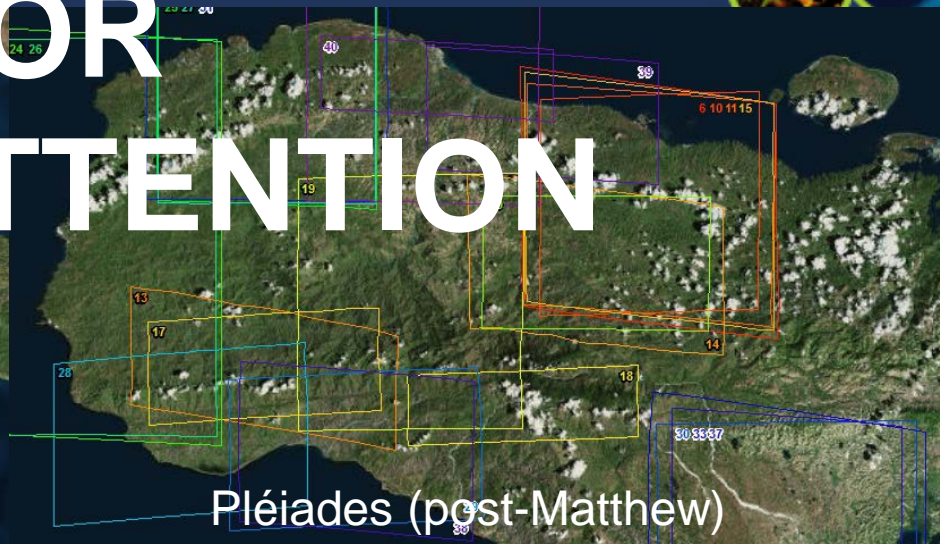
- Ensure IT updates, engage in capacity building activities, generate regular products, report on Haiti RO annually to stakeholders and partners
- Analysis of Haiti RO operation & results, to derive **Generic RO specifications**
- Preparation of **Haiti RO closure**, including evaluation and legacy strategies.



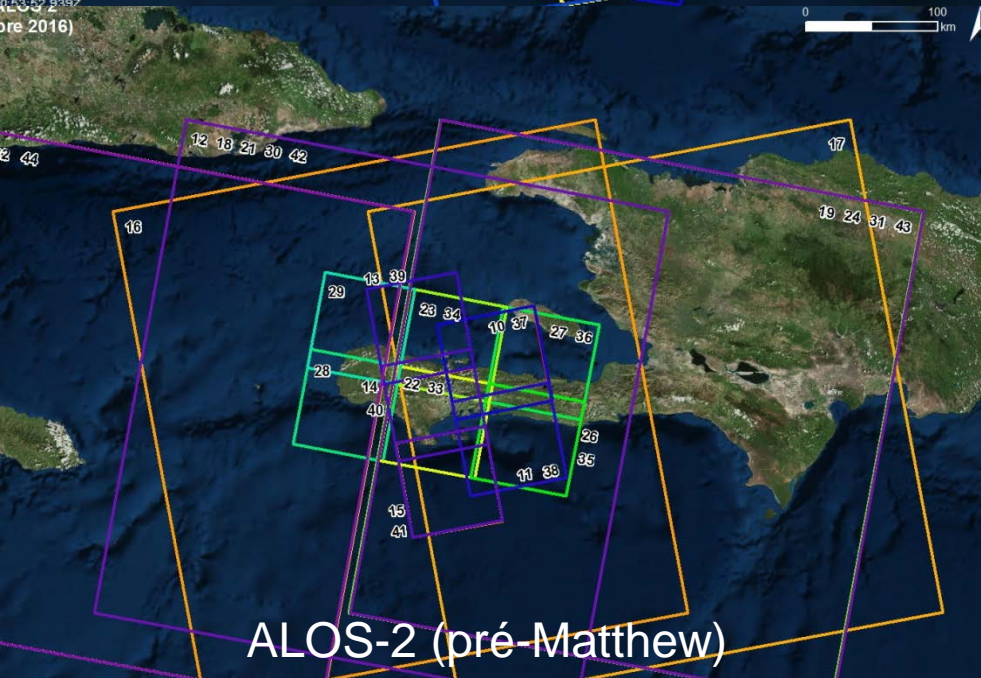
FOR YOUR ATTENTION



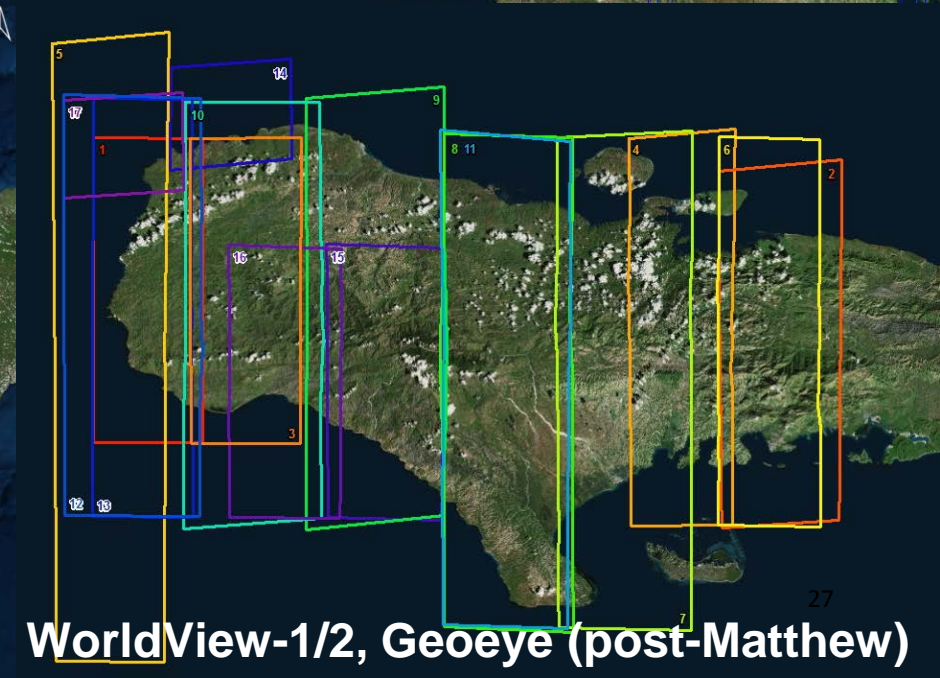
TerraSAR-X Tandem-X (post-Matthew)



Pléiades (post-Matthew)



ALOS-2 (pré-Matthew)



WorldView-1/2, Geoeye (post-Matthew)