Committee on Earth Observation Satellites

Recovery Observatory (RO) Pilot

Haiti Hurricane Matthew RO Status and Next Steps

Presentation to WGD mtg#14
September 1st, 2020

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Outline

- **Haiti Recovery Observatory Pilot**
  - Progress since last WGD meeting
  - Capacity building
  - Legacy planning and wrap-up
  - Conclusion

RO Haïti Status Overview

- **Triggering of the RO by CEOS Chair - December 22, 2016**
- **Mission #1 to Haiti - end January 2017** Definition of activities in Haiti
- **…**
- **Mission #6 to Haiti - May 2019** 3th User Workshop (PàP + Jérémie)
- Sept 2019 – Dec 2019 : troubled period but some work progress however
- March 2020 : COVID

Key elements since Last WGD mtg

- Focus on **Capacity Building in 2020** (Internships, Trainings)
  - Training to be performed in Italy (delayed for now, due to COVID)
  - Training end 2020 to be performed remotely

- Continued **engagement of Copernicus EMS RRM** for value adding products
- Continued **engagement of space agencies** (ASI, CNES, DLR, ESA, NASA, NOAA) for data provision and value adding products :
  - NOAA available for health products elaboration
  - NASA for air quality topic

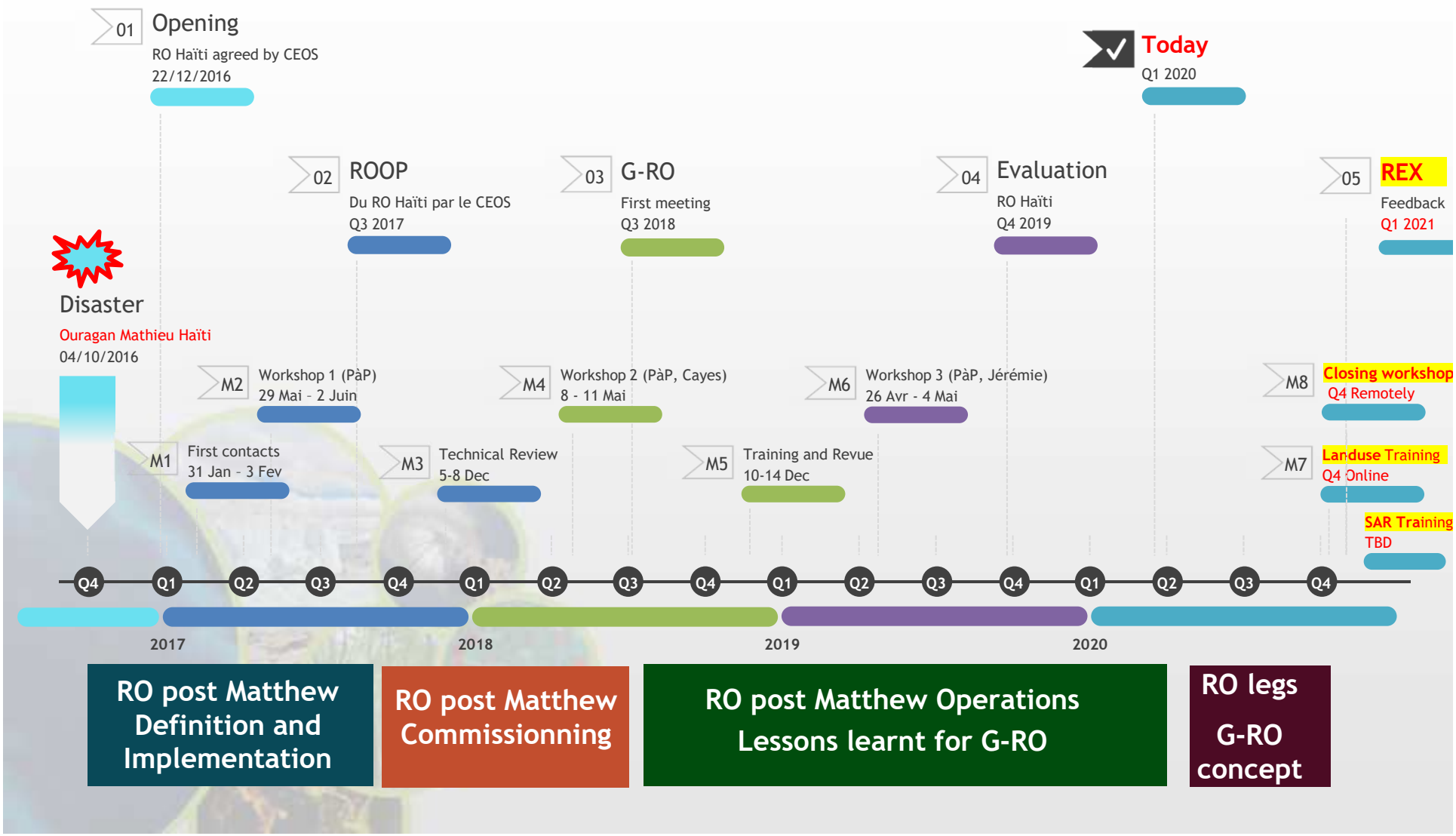
- Links with **WB on resilient agriculture** post Matthew projects : Nippes (ongoing)
- Links with **IADB projects on environment**: Parc Macaya /Ground Movement (delayed for now, due to COVID)
- Links with **UNEP / ONEV - Environmental Information System :** several layers related to RO (ongoing)

RO Thematic Products

Progress in 2020

Product	Key user	CEOS	Sat. Data
Buildings Mapping	CIAT / Planning Ministry	CNES/SERTIT, Copernicus EMS R&R	Pléiades, WorldView-3
Terrain Motion Change Detection	BME / URGeo	ASI, CNES/EOST	COSMO-SkyMed, Pléiades, Spot 6/7, TerraSAR-X
Watershed / Flood	ONEV / Agriculture Ministry	ASI/CIMA Foundation	Pléiades, COSMO-SkyMed
Agriculture	Agriculture Ministry	Copernicus EMS R&R	Sentinel-2, Spot 6/7, GeoEye-1, WorldView-2
Macaya Park Monitoring	ANAP / ONEV / Environment Ministry	Copernicus EMS R&R, CNES/SERTIT	Spot 6/7
Environmental Impact	ONEV / Environment Ministry	Copernicus EMS R&R	Sentinel-2, Spot 6/7, Pléiades, WorldView-2
Land Use	All	CNIGS, CNES	Sentinel-2
Vector-borne Disease risk	**Health Ministry / OMS**	**NOAA**	**L8, Images NOAA + statistic needs**
Air pollution	**CIAT / Health Min./ ONEV**	**NASA**	**S5P Tropomi**

RO Timeline


01 Opening
RO Haïti agreed by CEOS
22/12/2016
Today
Q1 2020
02 ROOP
Du RO Haïti par le CEOS
Q3 2017
03 G-RO
First meeting
Q3 2018
04 Evaluation
RO Haïti
Q4 2019
05 REX
Feedback
Q1 2021
Disaster
Ouragan Mathieu Haïti
04/10/2016
M1 First contacts
31 Jan - 3 Fev
M2 Workshop 1 (PàP)
29 Mai - 2 Juin
M3 Technical Review
5-8 Dec
M4 Workshop 2 (PàP, Cayes)
8 - 11 Mai
M5 Training and Revue
10-14 Dec
M6 Workshop 3 (PàP, Jérémie)
26 Avr - 4 Mai
M7 Landuse Training
Q4 Online
M8 Closing workshop
Q4 Remotely
SAR Training
TBD
Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
2017
2018
2019
2020
RO post Matthew Definition and Implementation
RO post Matthew Commissionning
RO post Matthew Operations Lessons learnt for G-RO
RO legs G-RO concept

Capacity Building 2020

- Links with **WB Haiti post Matthew project**: Agricultural resilience in Nippes
  - January Training of **two Haitian partners** (CNIGS) in Montpellier (France) at CIRAD on Land Use mapping

- January – Sept : **3 Internships** ongoing **in Haiti** at CNIGS (led by CNES/SERTIT)
  - Urbanization of agricultural areas: issues and challenges in Jérémie
  - Analysis of the mutation of agricultural areas: Dame Marie and Jérémie
  - Analysis of the dynamics of woodland cover and coastal erosion: Dame Marie

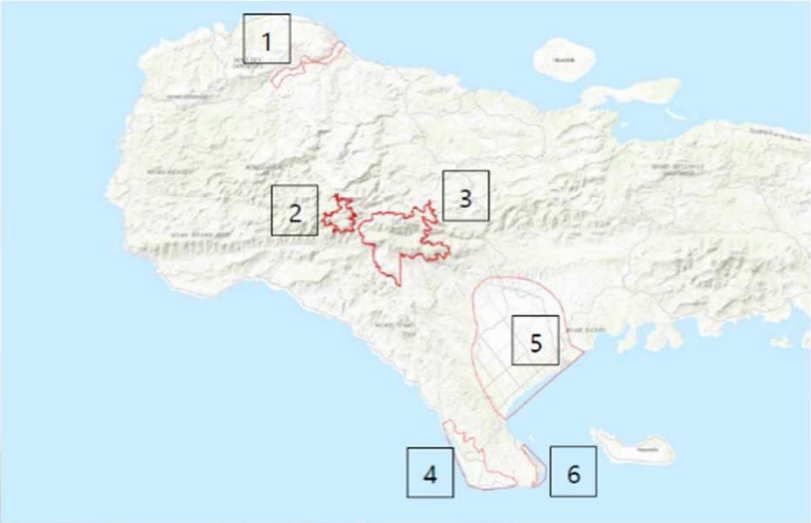
- March – August **1 Internship** by a Haitian student **in France** on Land-Use :
  - "Characterization of land use in an agricultural environment in the Dame-Marie sector (Haiti) by the application of the Moringa chain".

- Links with **IADB Haiti projects** : Macaya Park / Ground Movement - POSTPONED : Training of **two Haitian partners** (CNIGS) in Italy :
  - @ ASI with IADB & Macaya Park input (cf ASI section), with EOST contribution
  - @ CIMA for hydrometeo applications with RASOR

Copernicus EMS RRM

- **EMSN 051 " Environment" (2018)**

Area : Macaya Park, Port Salut, Les Cayes, Jérémie, Pointe Abacou and Costal line.



- Agricultural activities
- Coastal Line evolution
- Macaya Park classification and monitoring forest damage
- Mangrove monitoring

- **CNIGS/CIAT/ONEV** have **asked for two other RRM activations mid 2019** on two products, through EU Delegation : **Activation EMSN 063** launched in January 2020
- Result April 2020 :
  - **Agricultural monitoring**
  - **Macaya Park land use map** and **wooden areas monitoring**

Dame-Marie - HAITI

Agricultural Status - 2017

Change Map Pre- to Post-Matthew - Overview

Visible changes

- Woodland - Damaged
- Woodland - Disappeared
- Complex cultivation - Appeared
- Complex cultivation - Disappeared
- Persistent low-lying vegetation - Appear
- Persistent low-lying vegetation - Disapp

Dame-Marie - HAITI

Agricultural Status - 2019

Change Map Post-Matthew to 2019 - Overview

Visible changes

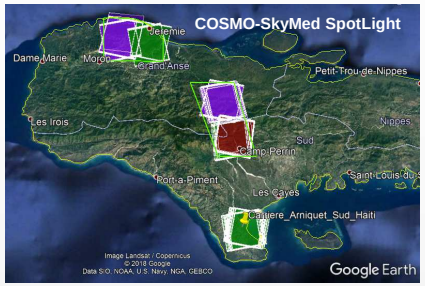
- Woodland - Regenerated
- Woodland - Regression
- Woodland - Disappeared
- Complex cultivation - Appeared
- Complex cultivation - Disappeared
- Persistent low-lying vegetation - App
- Persistent low-lying vegetation - Disa
- Transitional woodland shrub - Appea

ASI – Terrain motion products

ASI's scientific goal → To develop experimental scientific products tailored to obtain useful information on ground stability and motions for target areas of the RO

Satellite data analysis and ground truth activities

- COSMO-SkyMed acquisition campaign with VHR SAR over 3 hotspots (Jeremie, Camp-Perrin, Carriere Arniquet), started in Dec 2017 and ongoing
- X-band SAR change detection using COSMO-SkyMed and TerraSAR-X
- Sentinel-1 data processing with ESA GEP hosted services, to create interferograms, amplitude change and coherence maps
- Technical mission in Haïti in Apr-May 2019 (field checks, data validation, discussion with stakeholders)



Capacity building

- Apr-May 2019: scientific seminars on SAR data and applications held at LNBTP- Haïti during field mission
- Visit of 2 CNIGS staff members in ASI in Rome, to learn how to process Sentinel-1 data in GEP (on hold due to COVID-19)

ASI – Terrain motion products

Dissemination via ESA GEP Blog

"Observing surface deformation in Haiti after Hurricane Matthew with Sentinel-1 in GEP"

https://discuss.terradue.com/t/observing-surface-deformation-in-haiti-after-hurricane-matthew-with-sentinel-1-in-gep/845

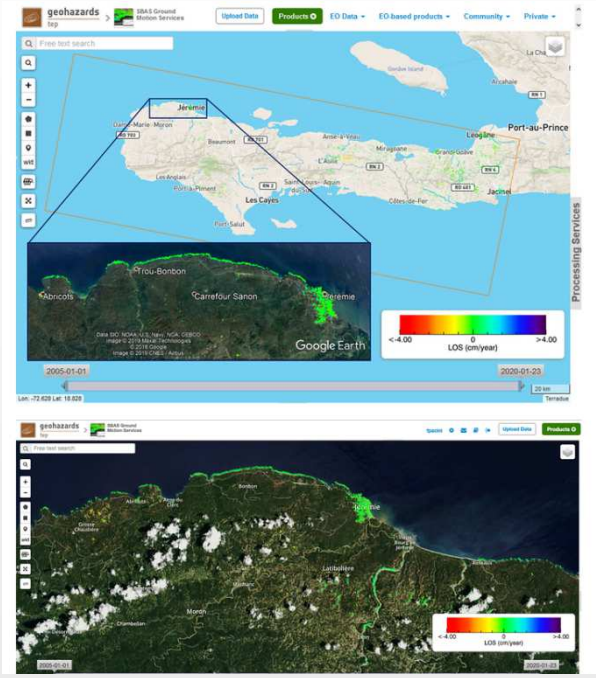
gep-blog asi, cnr-irea, p-sbas

fpacini Terradue staff Jan 24

To address the needs of the Haitian community involved in recovery and rehabilitation after the impact of Hurricane Matthew (category 4) on 4 October 2016, the Committee on Earth Observation Satellites (CEOS) triggered the 4 year-long Recovery Observatory (RO) project (https://www.recovery-observatory.org), aimed to demonstrate the value of using satellite EO to support recovery from a major disaster, and to work with the recovery community to define a sustainable vision for increased use of EO to this purpose.
Within this framework, the researchers of the Italian Space Agency (ASI) are testing the GEP to demonstrate its usefulness to generate satellite-derived thematic products based on SAR change detection (e.g. radar amplitude change and coherence maps), as well as Interferometric SAR (InSAR) for ground motion monitoring (e.g. differential interferograms, and time series).
A multi-temporal analysis of ground deformation has been recently carried out in GEP using the Parallel SBAS (P-SBAS) Interferometry Chain developed by CNR-IREA. Follow this link 2 and click on "Show results" at the bottom of the right panel to see the generated ground deformation map and time series.

A long data stack of 63 Sentinel-1 IW TOPS SLC scenes acquired in 03/12/2016-28/04/2019 along descending track T142 over the Haiti RO area of interest was used, spanning the whole region most affected by Hurricane Matthew, encompassing the 3 departments of Grand'Anse, Sud and Nippes.

More than 26,400 coherent targets were identified with P-SBAS, with LOS velocities generally in the range of ± 3 mm/year but as high as -40 mm/year in localised sectors, indicating movement in the direction away from the satellite sensor and therefore presence of unstable ground. The results are currently been analysed by ASI researchers to enhance the knowledge on surface processes occurring in Haiti, in the context of the field evidence and ground truth that they directly gathered during the technical surveys carried out in mid-2019 together with partners from Centre National de l'Information Geo-Spatiale (CNIGS) de la Republique d'Haiti and Centre National d'Études Spatiales (CNES).



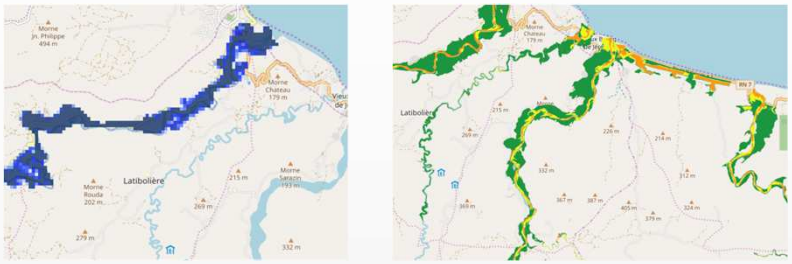
Upcoming dissemination

- Sept 2020: video presentation at IGARSS 2020 + peer-reviewed conference paper

CIMA – RASOR Training

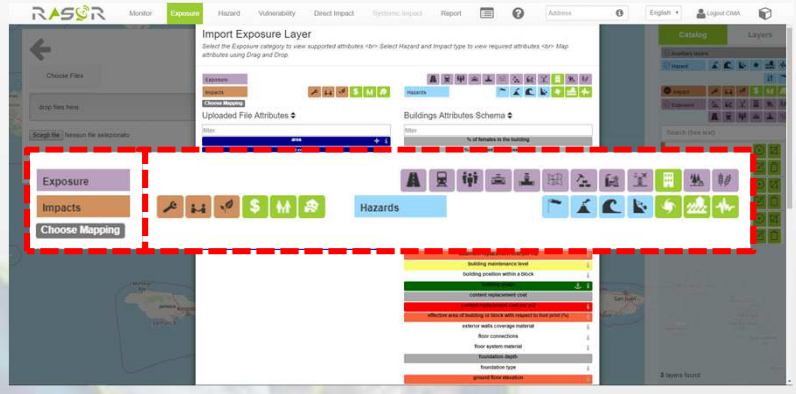
The training on hold due to covid will cover 3 main components:

1.



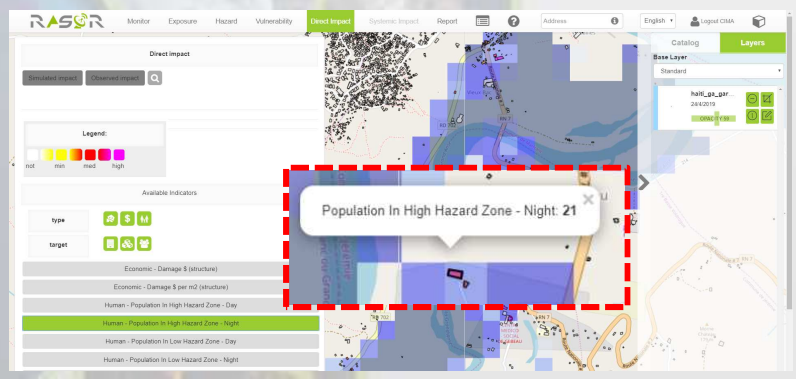
Hazard:
Uploading and generating new hazard layer

2.



Exposure and vulnerability:
Uploading different exposure shapefile and associating specific RASOR attributions and different vulnerability curves

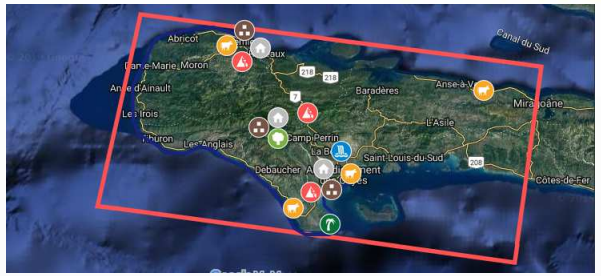
3.



Impact evaluation:
Generating impact reports and extrapolating the most relevant results

Planned events in 2020

- **Training at ASI and CIMA for 2 CNIGS experts**
  - + Link with EOST using ALADIM on GEP and discuss methodologies **to be rescheduled**



- **LandUse LandCover Training Session at CNIGS : probably ONLINE**
  - => Following previous training made in WB resilient agriculture project (CIRAD)
  - Operating IOTA2 tool for producing LULC maps from S2 data
    - After this training CNIGS should be able to produce **annual LULC maps on Haiti**
  - Extra : Charter PM training

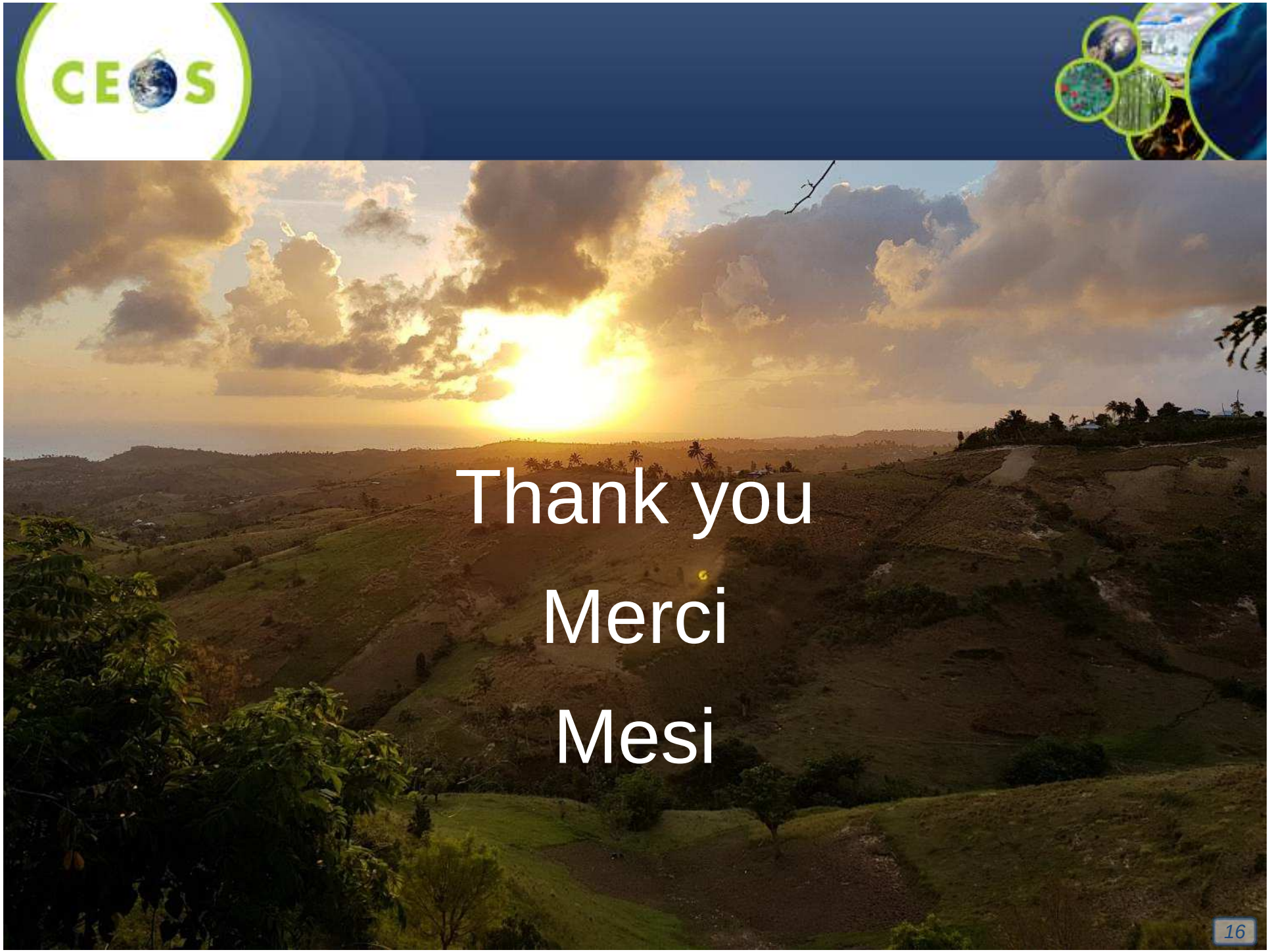
- **Final workshop : Virtual meeting end 2020** (date TBD with Haitian partners)
  - RO Pilot closure with high-level and decision makers outreach
  - RO products analysis and last delivery; Lessons learned; RO Legacy

Conclusions

- Troubled and lasting period (Riots .. now Covid) in Haiti delayed the Capacity Building roadmap. However due to our strong links with WB projects and Haitian community, the link is constant with our Haitians partners. The final planning is being defined, with remote events.

- The last thematic products through **Copernicus EMS063** respond to the last requests from 2019 user workshop (from several mayors). Feedback awaited from Haitian partners.

- The last mission, on hold for now, should be focused on **high-level and decision makers final workshops,** as well as **outreach** linked to the cyclonic season opening : how to hold it ?


Thank you
Merci
Mesi