



CEOS Recovery Observatory

MALAWI DEMONSTRATOR – October 2016

Example of state of the road S152 from the Thabwa Junction in the context of the recovery following the floods of January 2015

Non-exhaustive inventory. Refer to report for exhaustive assessment.

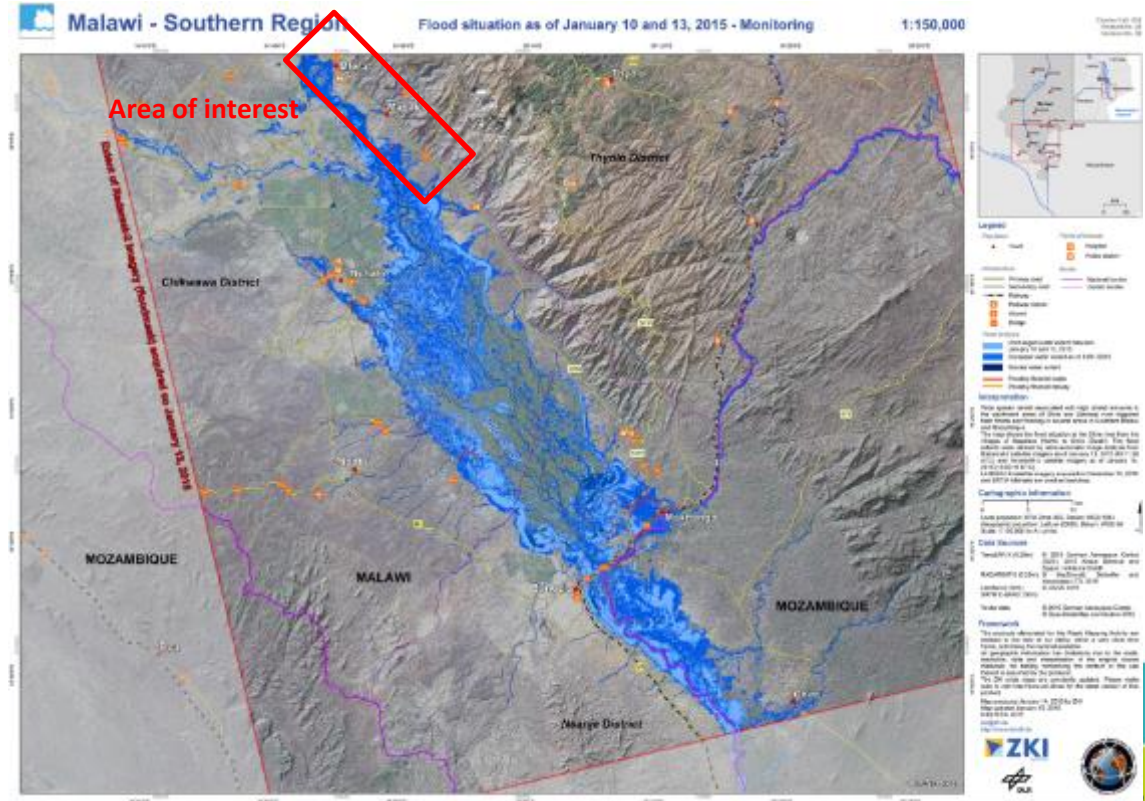
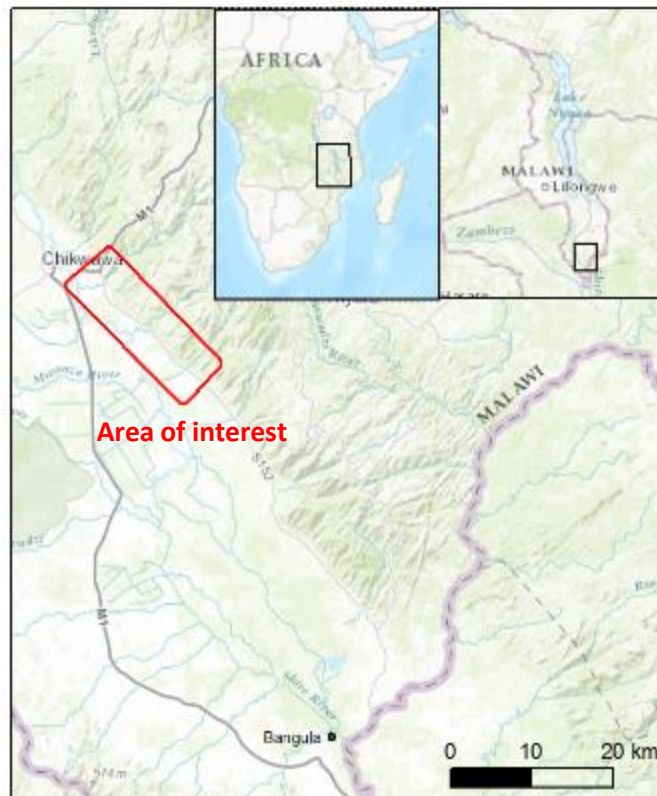


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1. Context and overview of the study

Area of interest

- January 2015, severe rainfall caused historical flooding in Malawi
- Charter is triggered the 8th of January by the Department of Disaster Management Affairs of Malawi
- Road S152 (Thabwa-Masenjere-Fatima) has been particularly impacted by the rains.
- Emergency works have been carried out and completed in June 2015





- Post-event image:

Pleiades-HR 1B acquired on 11/08/2016, spatial resolution 50 cm

- Baseline (Google Earth):

26/10/2013 (pre-event). Source: Pleiades (CNES/Airbus DS), 50 cm

29/10/2014 (pre-event). Source: DigitalGlobe, 50 cm

20/01/2015 (post-event). Source: DigitalGlobe, 50 cm

27/01/2015 (post-event). Source: DigitalGlobe, 50 cm

- What we are looking for:

Any changes that have taken place after the flood event:

- Construction works
- Significant damages
- Any new activities

But also:

- State of the bridges, culverts, fording sites and aprons

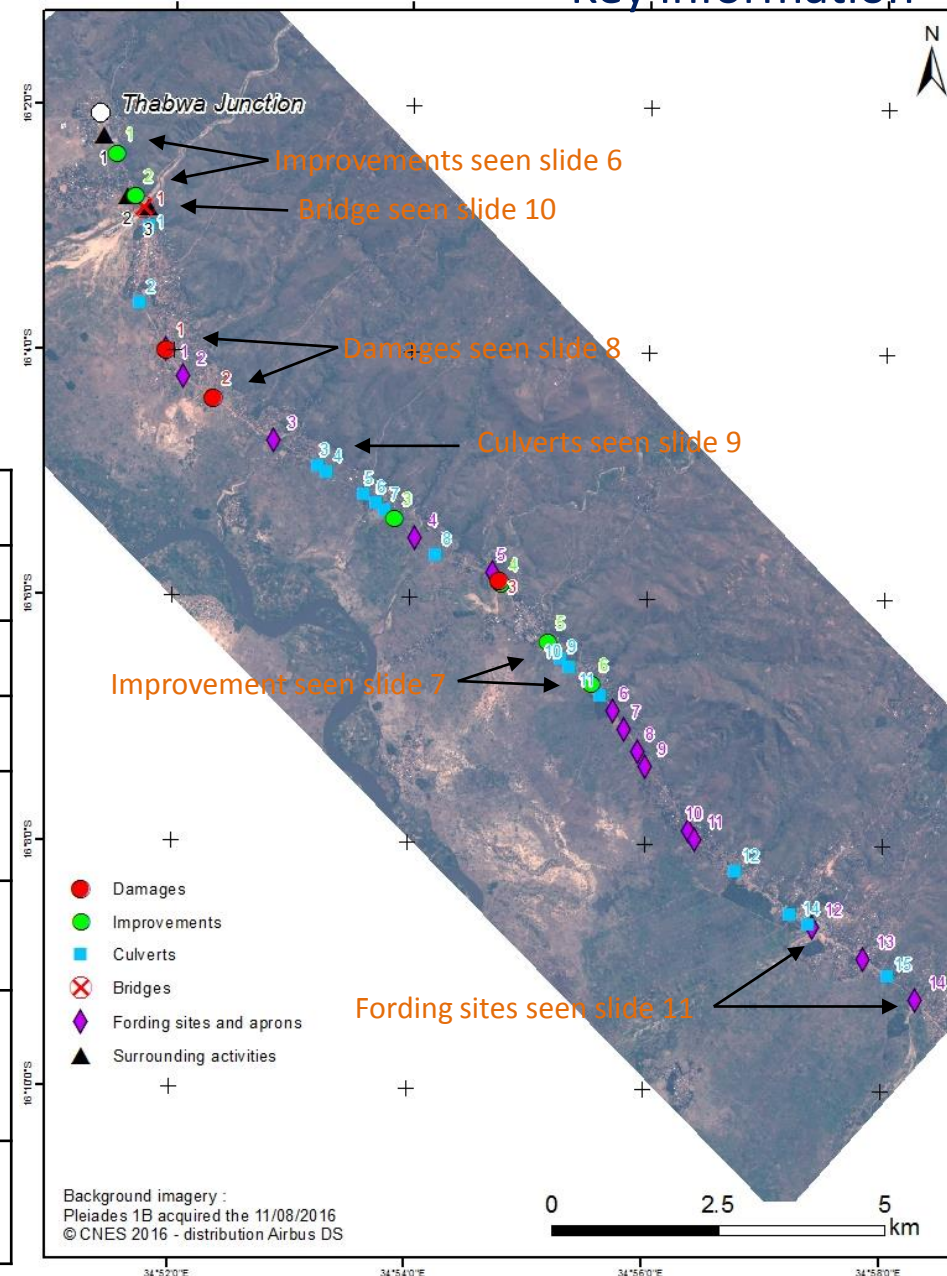


3. Situational analysis

Key information

Each symbol in the following map shows the location of the sites analyzed in the satellite images. Some sites are described in this document, with snapshots of full resolution satellite images (Pleiades image and the baseline). For an complete analysis of the sites, please refer to the report.

Length analyzed	19.8 km
Nature of the road surface	bare soil
Number of bridges	1
Number of culverts	15
Number of fording sites and aprons	14
Number of populated areas crossed	13
Altitude of the start point (Thabwa junction)	100 m (SRTM 1")
Altitude of the end point (Chikadza)	97 m (SRTM 1")



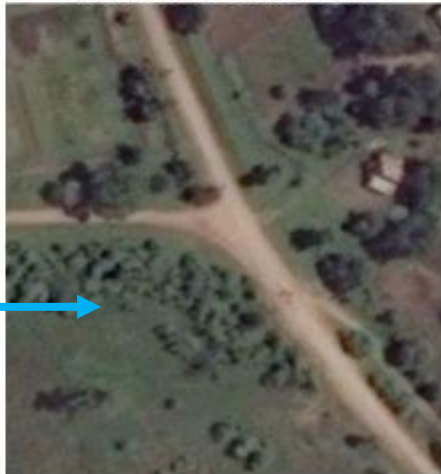





3. Situational analysis

General state of the road

The general state of the road is good. Since the baseline, it appears that the road has been rehabilitated and widened, in some locations from a width of approximately 5-6 m to 8-9 m.

Improvement #1 Road widened X = 698805.76 m Y = 8225735.04 m	Situation the 20/01/2015 	Situation the 11/08/2016 
Improvement #2 Crossing widened X = 699086.93 m Y = 8225103.89 m	Situation the 20/01/2015 	Situation the 11/08/2016 

Post-event image
Pléiades, 50 cm

Non-exhaustive inventory
Refer to report for exhaustive assessment





Post-event image
Pléiades, 50 cm





3. Situational analysis

General state of the road

	Baseline (DigitalGlobe, 50 cm Google Earth)	Post-event image (Pléiades, 50 cm)
Improvement #5 Road rehabilitated X = 705280.72 m Y = 8218384.72 m	Situation the 27/01/2015 	Situation the 11/08/2016 
Improvement #6 Road rehabilitated X = 705938.28 m Y = 8217758.22 m	Situation the 27/01/2015 	Situation the 11/08/2016 

Non-exhaustive inventory
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3. Situational analysis

Significant damages

Baseline
(DigitalGlobe, 50 cm Google Earth)

Post-event image
(Pléiades, 50 cm)

<p>Damage #1</p> <p>Damage in the road structure</p> <p>X = 699562.65 m Y = 8222798.70 m</p>	<p>Situation the 20/01/2015</p> 	<p>Situation the 11/08/2016</p> 
<p>Damage #2</p> <p>Damage in the road structure</p> <p>X = 700256.81 m Y = 8222071.60 m</p>	<p>Situation the 20/01/2015</p> 	<p>Situation the 11/08/2016</p> 





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3. Situational analysis

State of the culverts

	Baseline (DigitalGlobe, 50 cm Google Earth)	Post-event image (Pléiades, 50 cm)
<p>Culvert ID #3</p> <p>No change visible on the infrastructure</p> <p>X = 701847.14 m Y = 8221034.23 m</p>	<p>Situation the 27/01/2015</p> 	<p>Situation the 11/08/2016</p> 
<p>Culvert ID #4</p> <p>No change visible on the infrastructure</p> <p>X = 701972.40 m Y = 8220957.60 m</p>	<p>Situation the 27/01/2015</p> 	<p>Situation the 11/08/2016</p> 



Non-exhaustive inventory
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3. Situational analysis

State of the bridge

Baseline
(DigitalGlobe, 50 cm Google Earth)



Non-exhaustive inventory
Refer to report for exhaustive assessment

3. Situational analysis





State of the fording sites and aprons

Baseline

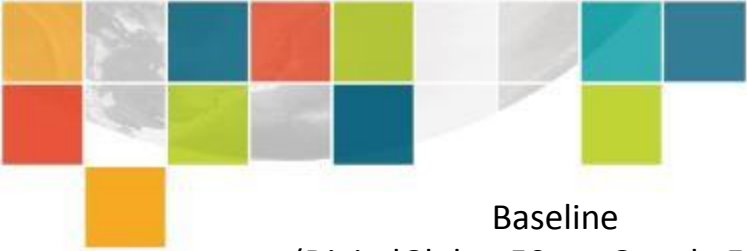
(DigitalGlobe, 50 cm Google Earth)

Post-event image

(Pléiades, 50 cm)

<p>Fording site ID #12</p> <p>Apron rehabilitated</p> <p>X = 709263.57 m Y = 8214112.40 m</p>	<p>Situation the 20/01/2016</p> 	<p>Situation the 11/08/2016</p> 
<p>Fording site ID #14</p> <p>Apron rehabilitated</p> <p>X = 710815.88 m Y = 8213003.08 m</p>	<p>Situation the 20/01/2016</p> 	<p>Situation the 11/08/2016</p> 

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3. Situational analysis

Surrounding activities

Baseline
(DigitalGlobe, 50 cm Google Earth)

Post-event image
(Pléiades, 50 cm)

<p>Surrounding activity ID #1</p> <p>Quarry</p> <p>X = 698631.18 m Y = 8226000.97 m</p>	<p>Situation the 20/01/2015</p> 	<p>Situation the 11/08/2016</p> 
<p>Surrounding activity ID #3</p> <p>Water development project</p> <p>X = 699294.22 m Y = 8224930.62 m</p>	<p>Situation the 20/01/2015</p> 	<p>Situation the 11/08/2016</p> 

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This study confirmed Very High Resolution Satellite capacities:

- significant enlargements of a road are visible
- significant rehabilitations of the road surface are visible
- above a certain size, damages in the road surface are visible
- water flows crossing a road are visible
- rehabilitations of aprons are visible, in case of deposits removal
- construction sites like water projects (irrigation for example) are visible

Without ground truth, it wasn't possible to assess which changes were not visible.

Considering project monitoring and evaluation, the cost-benefit ratio of space-based observation needs to be compared with traditional methods (field mission).