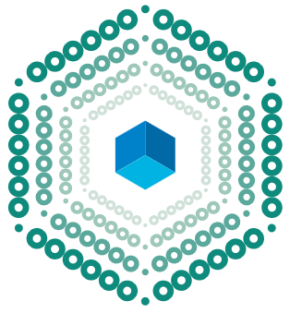


MEXICAN GEOSPATIAL DATA CUBE

INEGI'S GEOSPATIAL PRODUCTION: GENERAL OVERVIEW

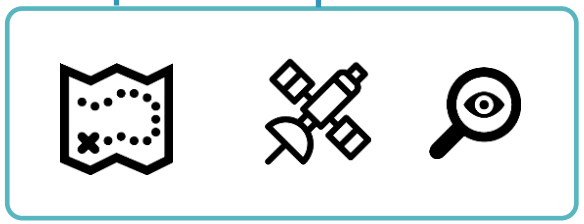
INEGI produces themed geospatial datasets;

initially these were paper maps (1970s, 1980s)

They are obtained from remote sensing imagery

previously, using aerial photographs, now it is done from satellite images

Currently processes only involve visual and exhaustive methods



INEGI'S GEOSPATIAL PRODUCTION: GENERAL OVERVIEW

Demand for more frequen and detailed maps increases

Drawbacks of the methodology:

-the limit imposition for spatial resolution of maps

-exhaustivity restrains the achievement of reasonable times in updating information

INEGI'S GEOSPATIAL PRODUCTION: GENERAL OVERVIEW

Needs identified:
-increasing leven of detail in produced maps
-timely delivery

Solution:
Big Data / Machine Learning
(address storage, managing and processing large volumes of data)

INEGI'S GEOSPATIAL PRODUCTION: GENERAL OVERVIEW

INEGI'S GEOSPATIAL PRODUCTION: GENERAL OVERVIEW

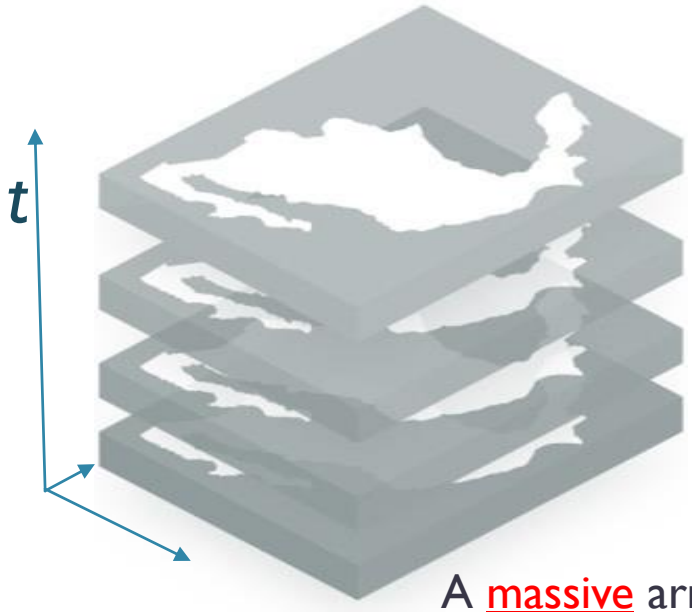
Due to **the big volume** and computational cost of processing Satellite Imagery, 2 main challenges in EO integration into national-level processes are: technology and infrastructure

INEGI is currently working in the implementation of the Mexican Geospatial Data Cube, which addresses both these challenges

It allows for **big data** time series analysis and will be oriented towards calculating SDG indicators, among other tasks…

OPEN DATA CUBE

What is a Geospatial Data Cube?

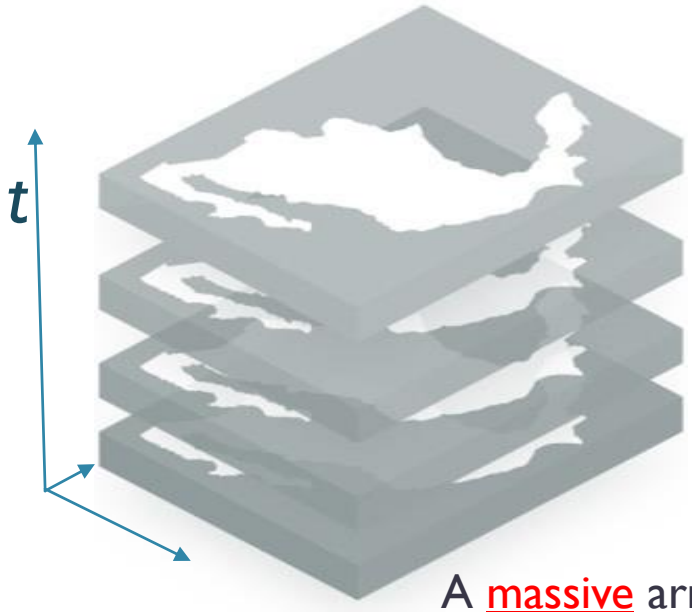


A massive array of multidimensional raster data.

…and what's the main pipeline?

Acquisition and Preprocessing → Analysis and Processing → Result Translation to Products

What is a Geospatial Data Cube?



A massive array of multidimensional raster data.

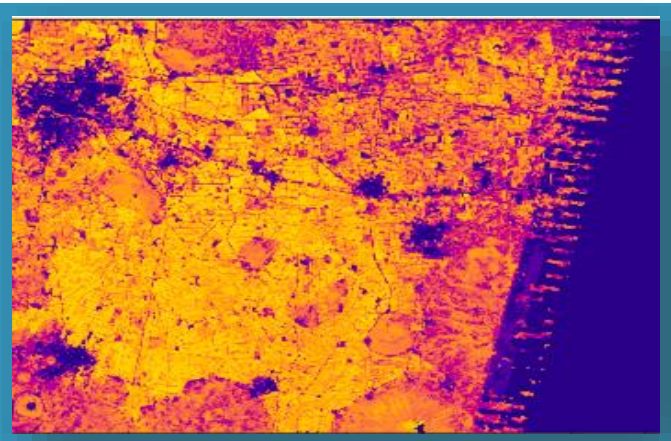
…what are the main advantages?

- *x,y* (analysis to pixel level allows to consider high cloudiness images)
- *t* (temporal dimension analysis)
- Time series (allows for change detection)
- SDG oriented monitoring

PROGRESS ASSESSMENT
Mexican GEOSPATIAL DATA CUBE

TESTINGS OF GEOSCIENCE AUSTRALIA'S ALGORITHMS DONE IN INEGI'S DATA CUBE SOFTWARE INSTALLED IN PERSONAL PC'S WITH LOCALLY STORED IMAGES.

Geomedian (Merida City)



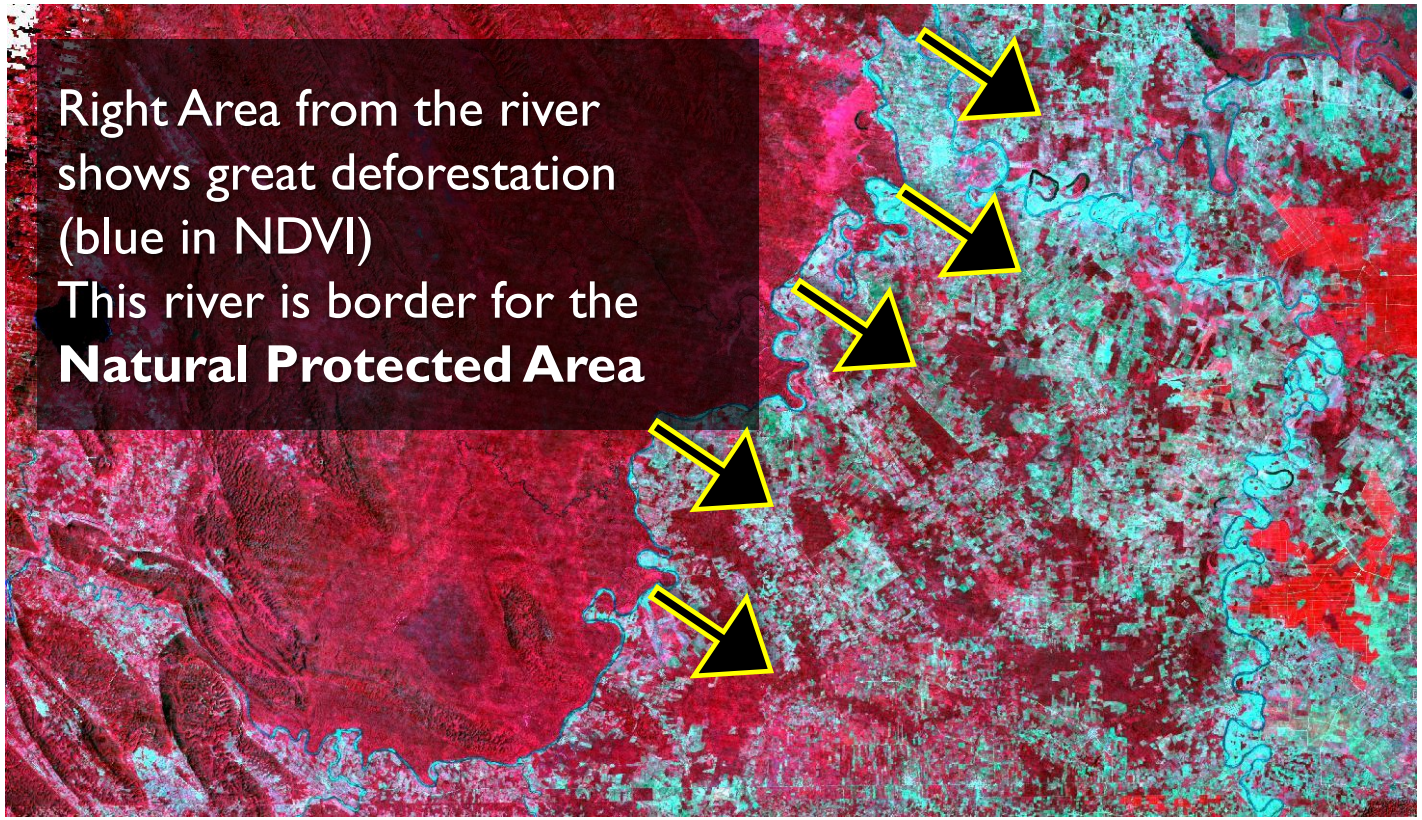
Max. NDVI (Guanajuato City)


I should move to Mexico…
ESTADOS UNIDOS MEXICANOS
GOLFO DE MÉXICO

Currently implementing Open Data Cube at INEGI

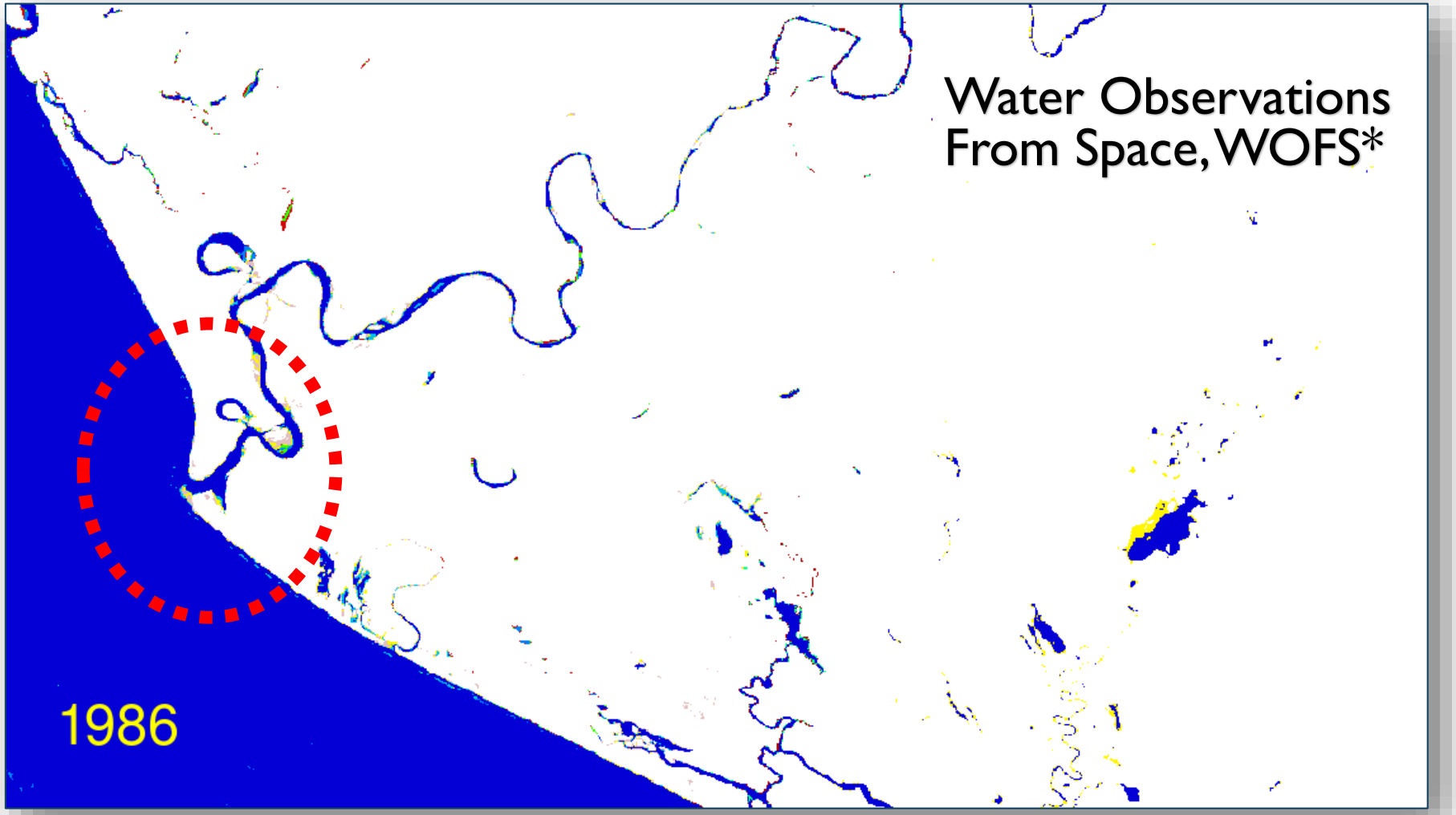
Example 1: Vegetation change in time

Montes Azules y Marqués de Comillas; 1986 → 2017



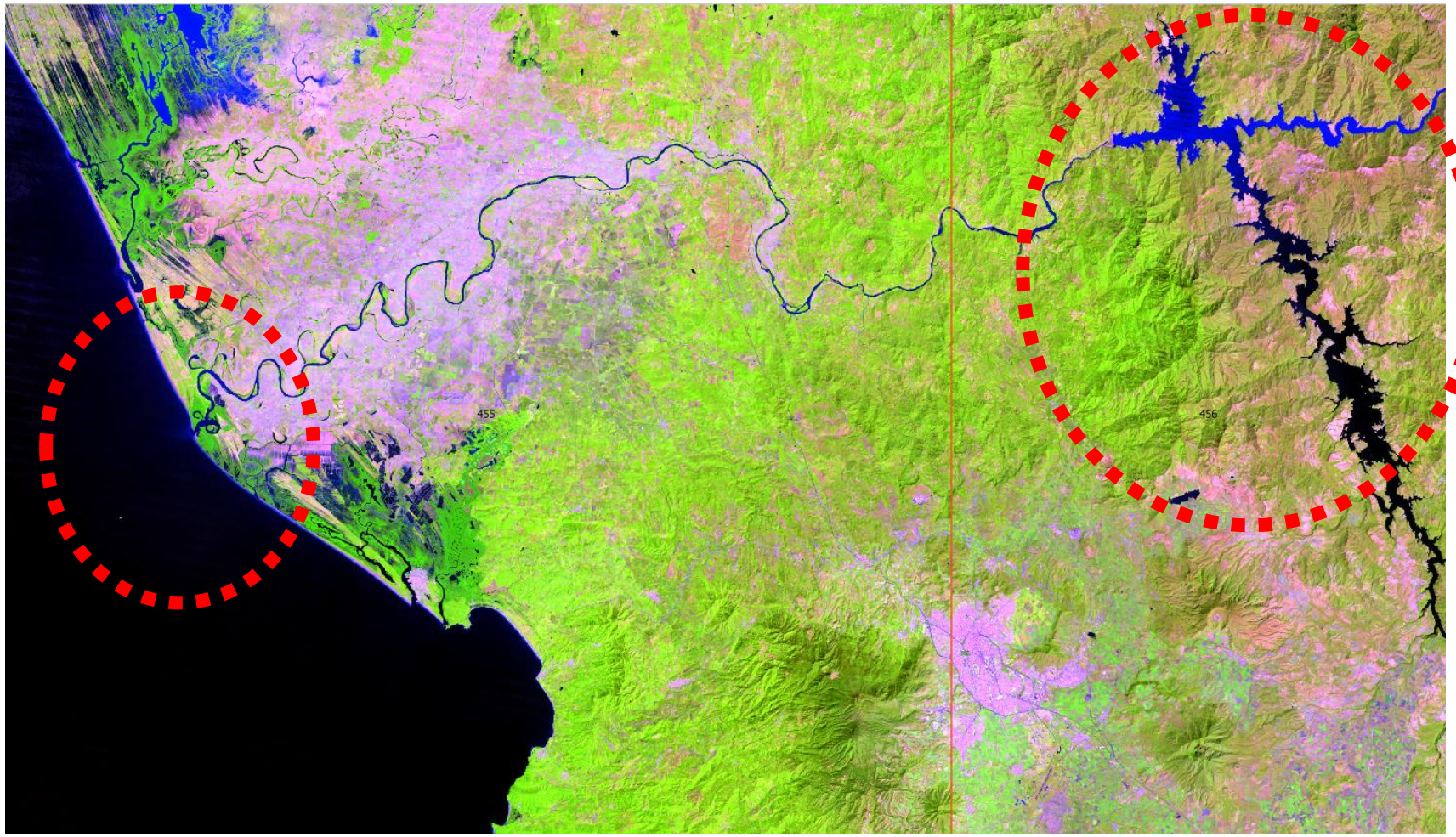
Currently implementing Open Data Cube at INEGI

Example 2: Coast erosion in the mouth of Santiago River



*WOFS Algorithm calculates the proportional presence of water at each pixel during certain amount of time

Example:
Coast erosion in the mouth of Santiago River

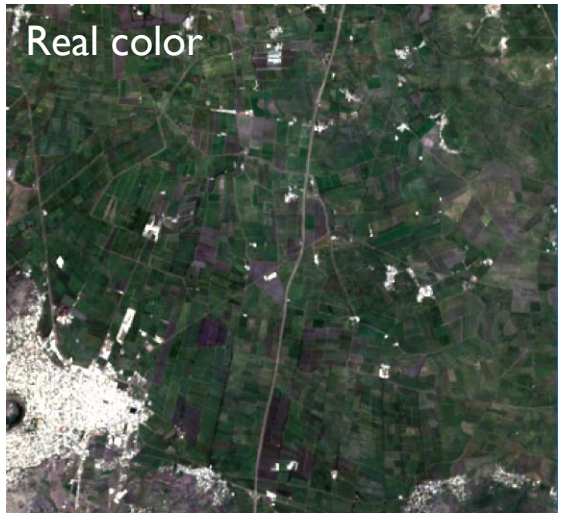


Dam Aguamilpa believed to be the reason for the erosion

Currently implementing Open Data Cube at INEGI

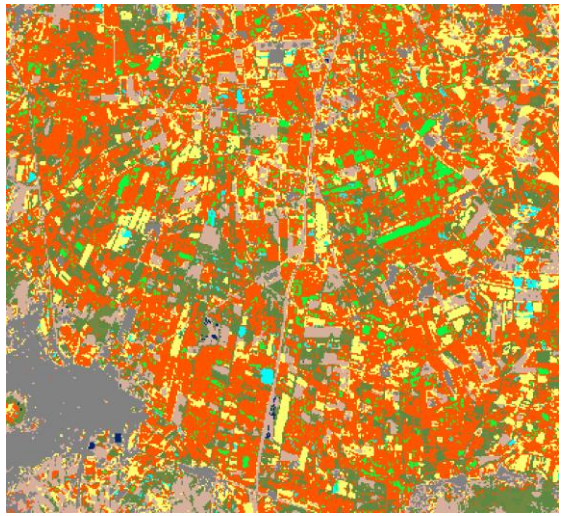
Example 3: Crop identification (*using Machine Learning*)

Geomedian Image (Landsat)
June to August 2015, Guanajuato



Field data
(2015)

Supervised
Random Forest Classifier



- Good definition on wide area polygons
- Currently working on higher resolution image tests - Sentinel

Currently implementing Open Data Cube at INEGI

Example 4: Urban Growth

Currently implementing Open Data Cube at INEGI

Example 4: National Geomedian (2015) …and 2011 is finished too!

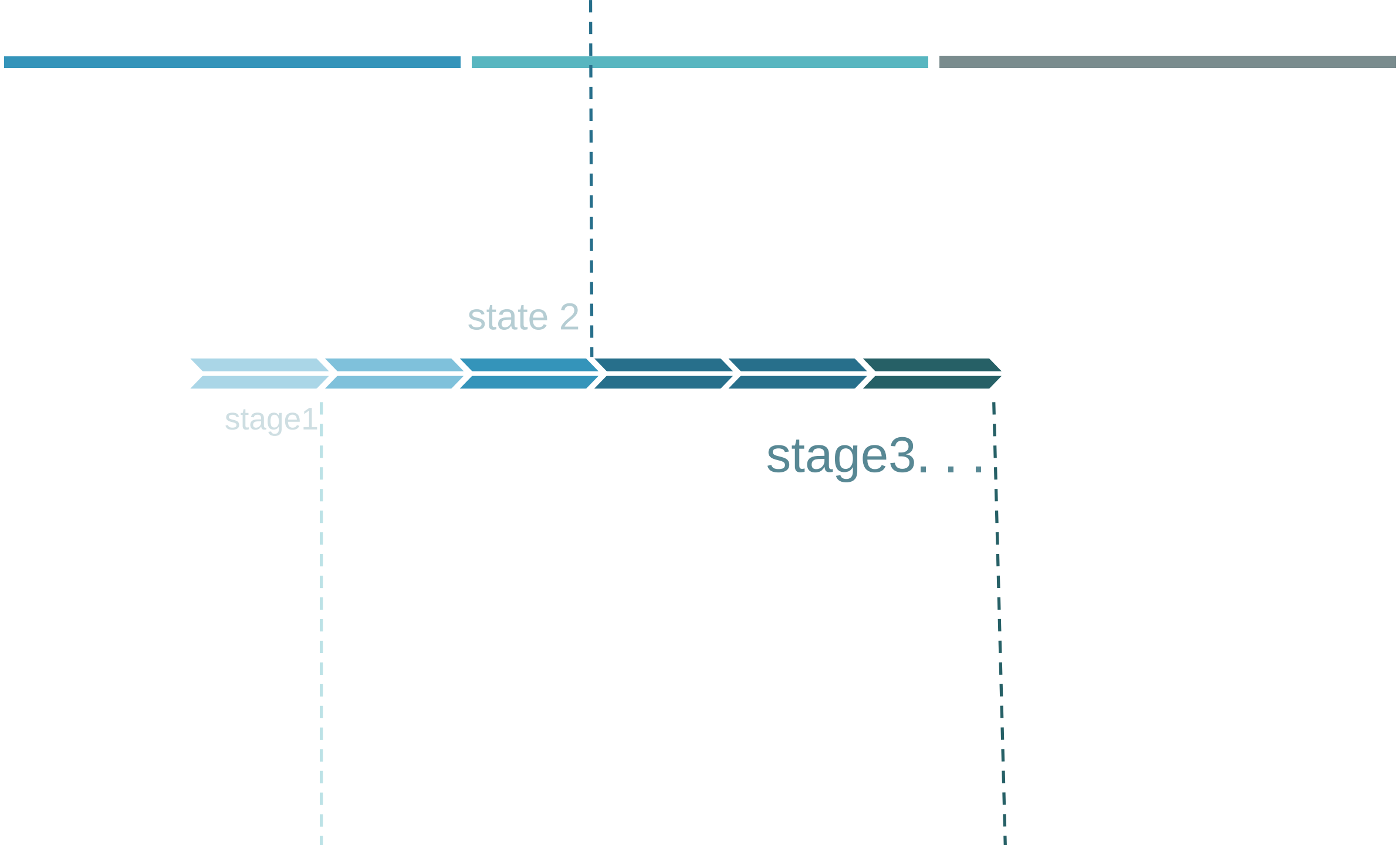
Mexico: 283 cells
cell: 100x100km
pixel: 25x25m

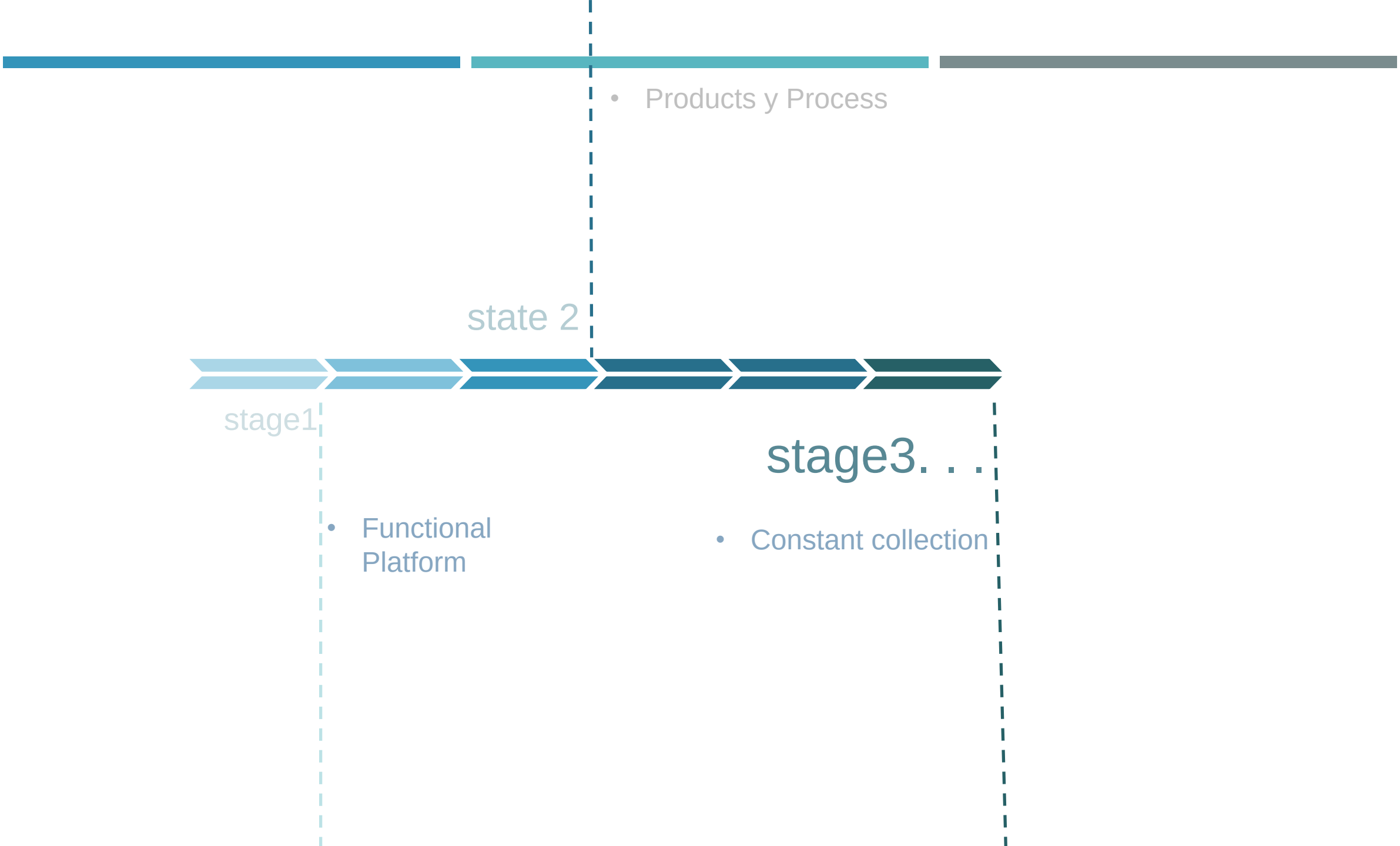
6,074 images processed
7.5TB

state 2

stage1

stage3. . .


state 2
stage1
stage3. . .


• Products y Process
state 2
stage1
stage3. . .
• Functional Platform
• Constant collection

- Products y Process
- 30 y - Landsat
  300 TB

USGS science for a changing world
LANDSAT

state 2

stage1

stage3. . .

- Functional Platform
- 2 Servers:

Oracle Cloud Machine

- 20 TB
(external HD)

- Constant collection

- 3 y - Sentinel
  300 TB

esa sentinel

+ DESIGN

- First products
- Plannig adoption (products - process) @National Level
- Publishing/Sharing with Ministry
- Tests on platform (CGI)

CUBO DE DATOS
GEOESPACIALES DE MÉXICO

+ DESIGN

- Computational Capacity Assessment
- Storage / Processing

Landsat archive / Oracle CM (Private cloud)

- First products
- Plannig adoption (products - process) @National Level
- Publishing/Sharing with Ministry
- Tests on platform (CGI)

CUBO DE DATOS
GEOESPACIALES DE MÉXICO

Currently implementing Open Data Cube at INEGI

WORKS ON INDICATOR 15.4.2
mountain GREEN COVER

First classification is a conversion from the 2014 Land Use/Land Cover map to 6 classes

ODC process allows constant update to the national classification because it is generated automatically

Spared resources can be applied to expert and field validation for quality assessments

STEPS (chronological)	without ODC	Progress	with ODC	Progress
Use Intergovernmental Panel on Climate Change definitions (6 classes)	✓	✓	✓	✓
Land Use/Land Cover Map	✓	✓	✓	✓
Obtain converted classification (original to 6 classes)	✓	✓	✓	✓
Draw sample from converted data			✓	✓
Use sample and *6 other ODC indicators* as training dataset for classification			✓	ODC indicator (geomedian)
Run national classification with Machine Learning			✓	
Link result raster to Digital Elevation Model (DEM) for mountain areas	✓	✓	✓	
Calculate Green Cover index on DEM mountain area mask	✓	✓	✓	
Possible field validation for quality assurance in subsampled dataset			✓	
Provide feedback to FAO	✓	✓	✓	


3
Operational
6
Under Development
31
Under Review or Expressed Interest

THANK YOU.

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