METHODOLOGY TO TRANSFORM LOCAL ELEVATION DATA INTO OFFICIAL ELEVATION FOR RESERVOIRS IN COLOMBIA

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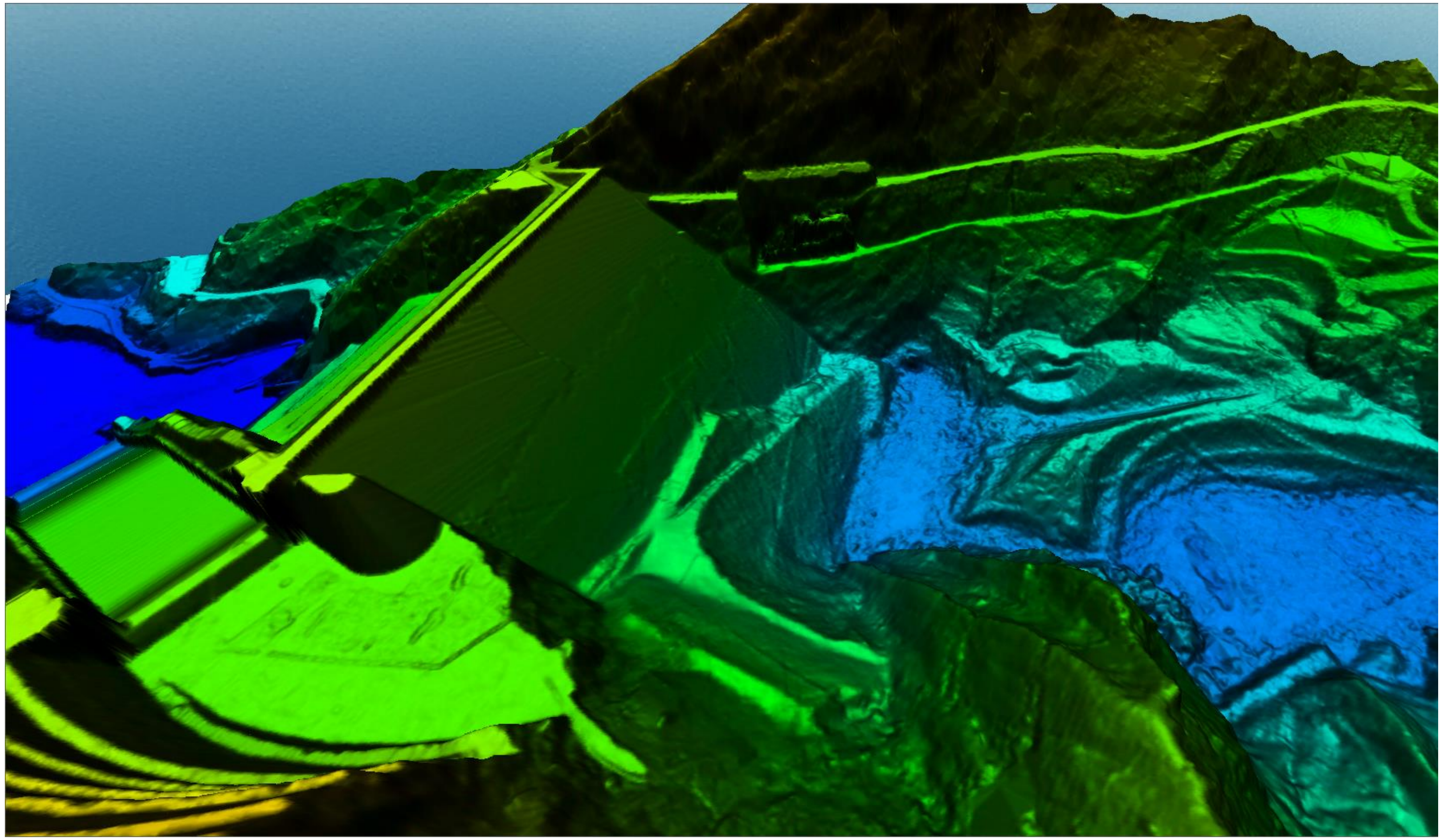
Overview

- Research Objective
- Background
- Related Research
- Methodology
- Anticipated results
- Limitations
- Project Timeline

Objective

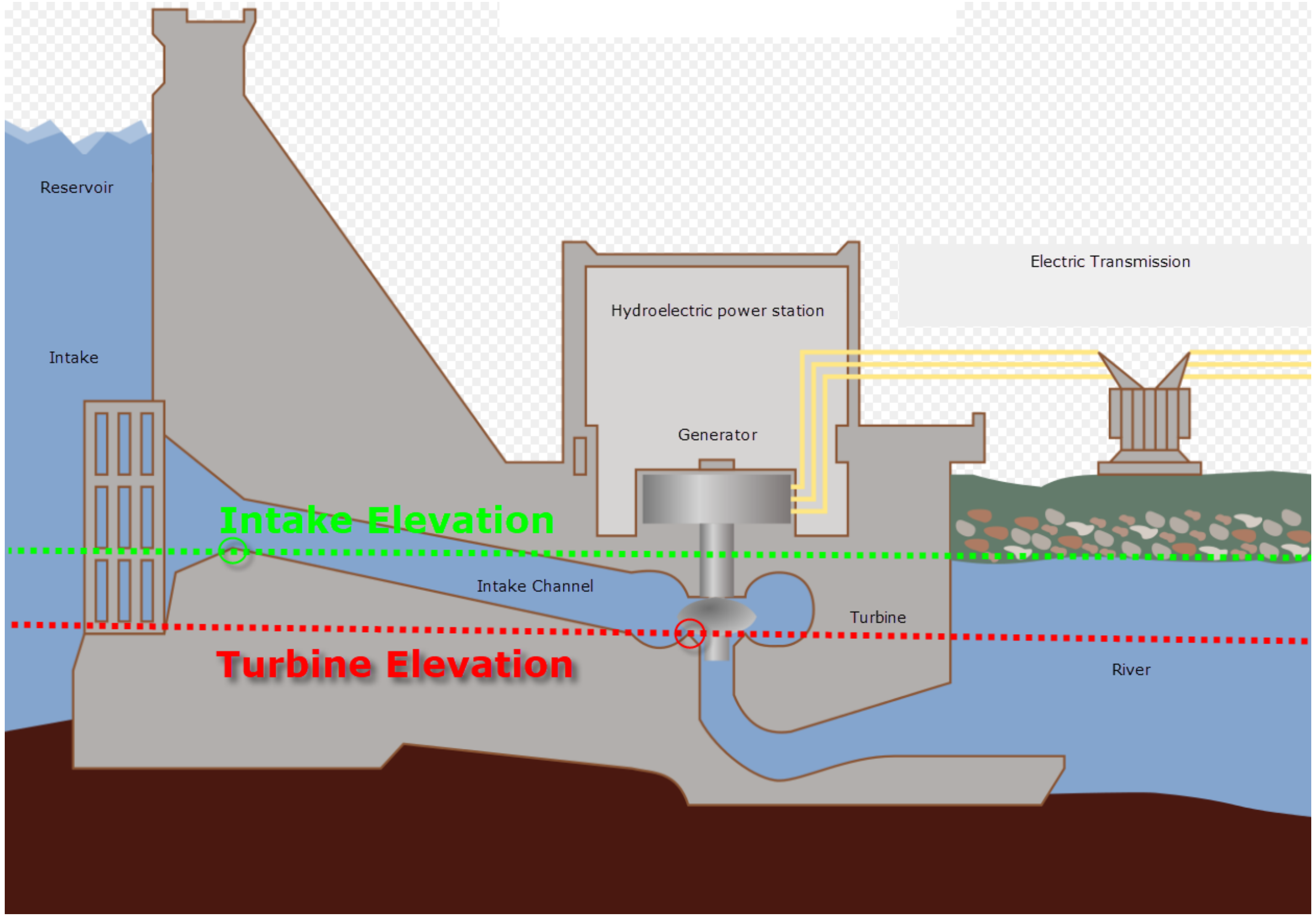
- All reservoirs in Colombia use relative elevations to control the altimetry at the DAM.
- These elevations neither refer to the National Geodetic Network or a known geoidal model.
- This project will create a methodology to migrate these arbitrary heights into the National Geodetic Network



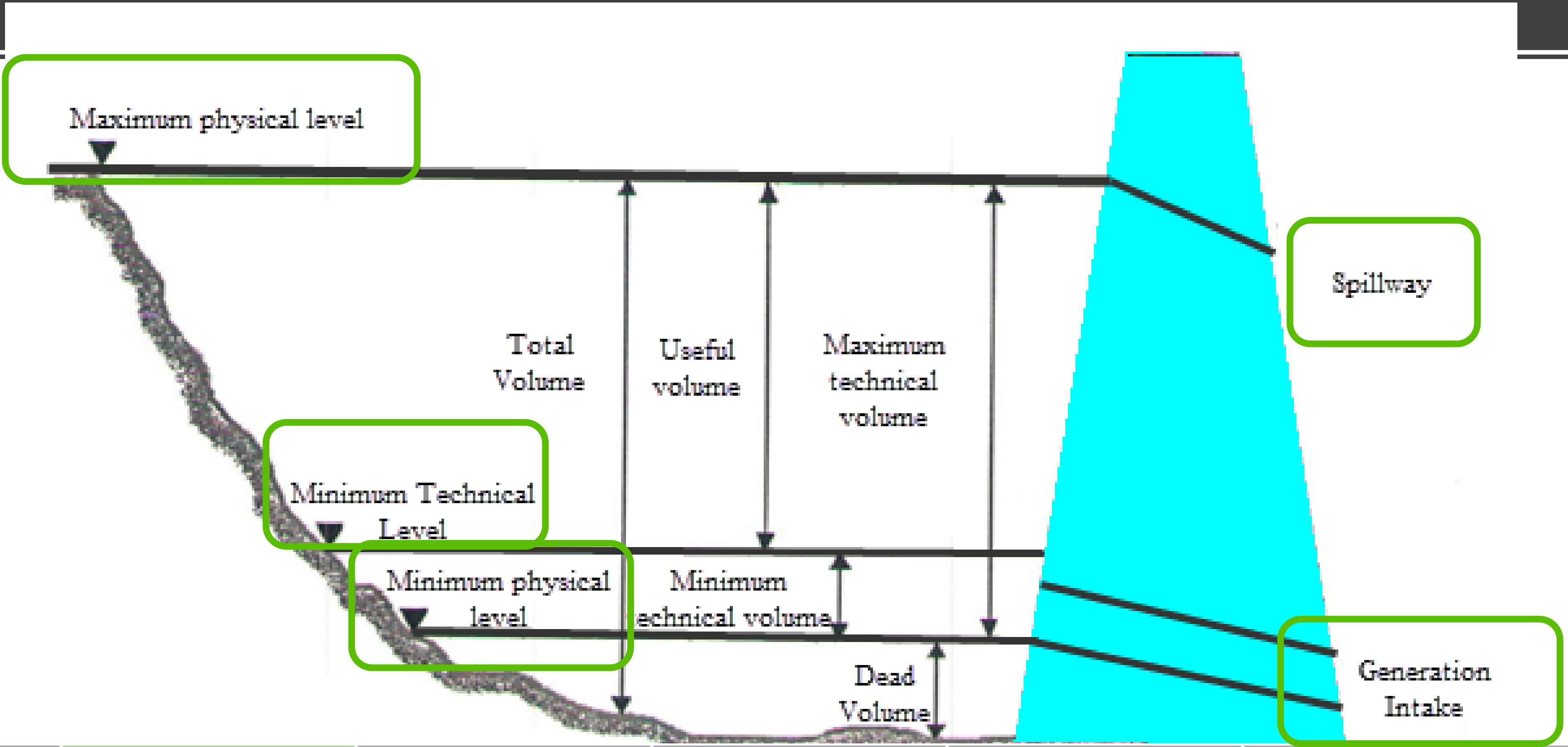
Why is this research important?

- 68% of the energy in Colombia is generated from Dams.
- Since this is a crucial service for the country, by law, each reservoir should update its DTM every five years in order to understand the sediment accumulation.
- Not having accurate altimetric values a multitemporal analysis is useless.

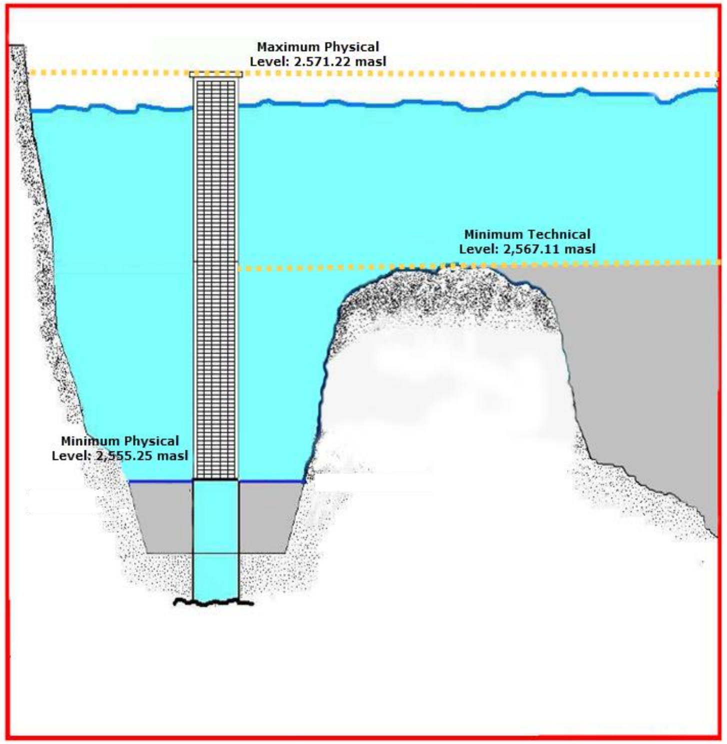
Hydroelectrical Energy



Hydroelectrical Energy



Objective | Background | Related Research | Methodology | Anticipated Results | Limitations | Timeline



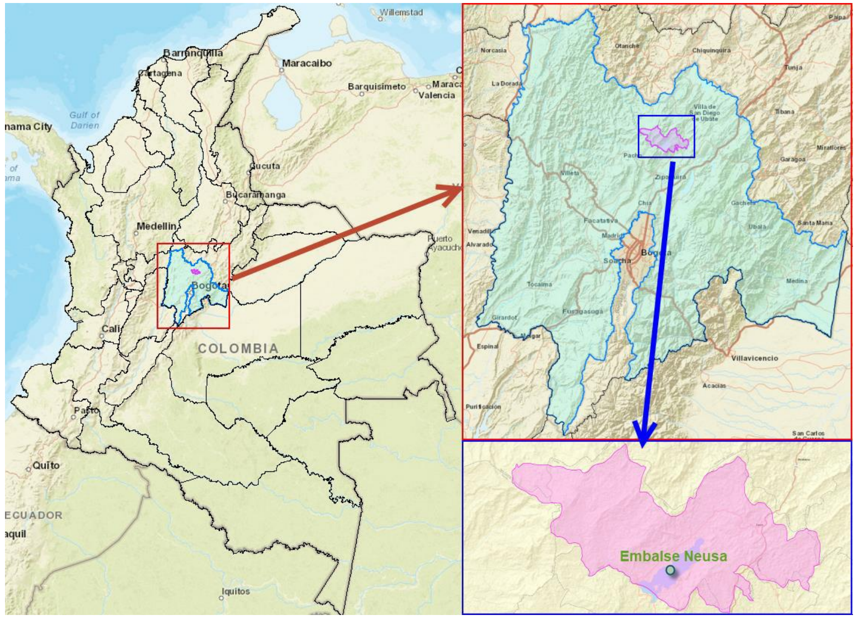
Characteristic Height	Arbitrary Heights	NGN Height	Difference
Minimum Physical Level	2556,50	2555,25	1,25
Minimum Technical Level	2567,00	2567,11	-0,11
Maximum Physical Level	2569,50	2571,22	-1,72

Background

- Most dams in Colombia where built before 1990
- During construction, the designers based their project on two elevations: Intake and turbine.
- Reservoir administrators don’t know how this elevation was defined.
- The elevations don’t correspond to:
  - Ellipsoidal Height
  - Orthometric Height
  - Existing Global Geoidal Model

Methodology

- The relative elevations will be compared to all three heights for two reservoirs:
- San Lorenzo Reservoir:
  - Located in Antioquia Department
  - Used for energy generation
- Neusa Reservoir
  - Located in Cundinamarca
  - Used for energy generation and control Bogota River Level.
- In both cases, the DTM was made by the integration of LiDAR and Multibeam Bathymetry on 2017

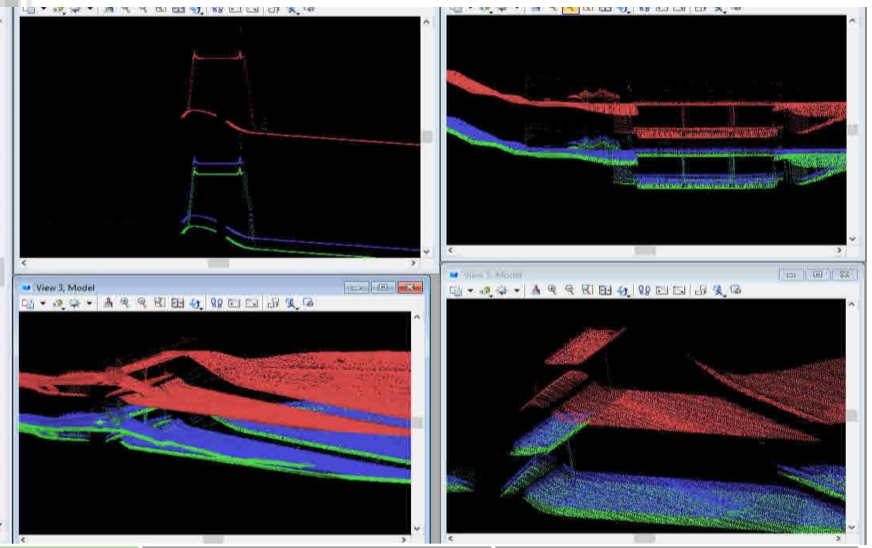


San Lorenzo Reservoir

Model	Elevation (MASL)	Spillway Arbitrary Height (MASL)	Difference (m)
Ellipsoidal	1274,63	1247	27,63
Orthometric	1256,33		9,33
EGM08	1254,42		7,42

- Each layer represents an altimetric:
    - Red: Ellipsoidal
    - Blue: Orthometric
    - Green: EGM08
- The three elevation models have a huge height difference compared to the arbitrary height of the spillway

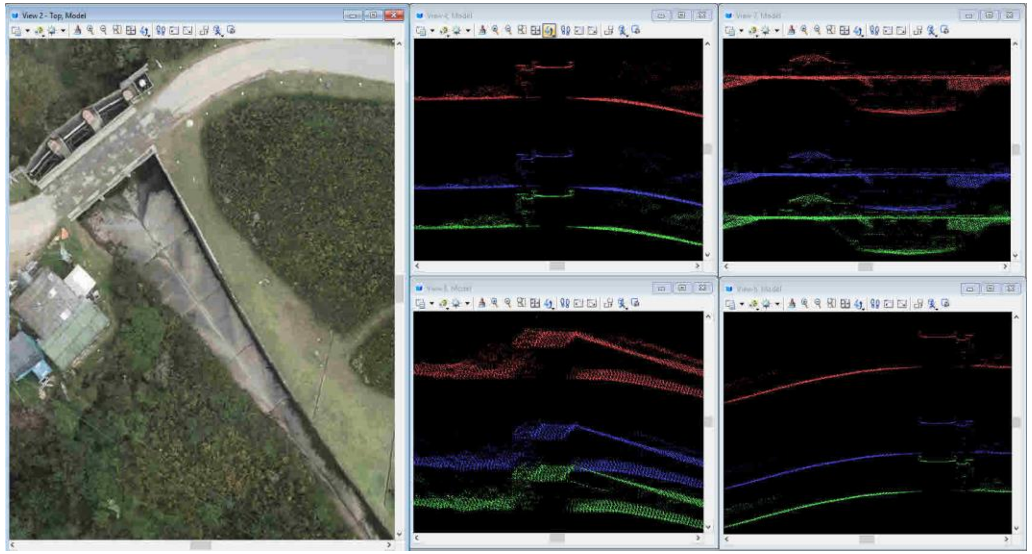
Characteristic Level	Characteristic Height (MASL)	Water volume Ellipsoidal (hm3)	Water volume Orthometric (hm3)	Water Volume EGM08 (hm3)
Minimum Physical Level	1214	0	6,1	10,5
Minimum Technical Level	1221,9	0	22,7	32,2
Maximum Physical level	1247	46,7	180,9	200,0



Neusa Reservoir

Model	Elevation (MASL)	Spillway Arbitrary Height (MASL)	Difference (m)
Ellipsoidal	2996,16		21,66
Orthometric	2978,05	2974,5	3,55
EGM08	2969,96		-4,54

- Each layer represents an altimetric:
  - Red: Ellipsoidal
  - Blue: Orthometric
  - Green: EGM08
- The three elevation models have a huge height difference compared to the arbitrary height of the spillway



Characteristic Level	Characteristic Height (MASL)	Water volume Ellipsoidal (hm3)	Water volume Orthometric (hm3)	Water Volume EGM08 (hm3)
Minimum Physical Level = Minimum Technical Level	2950	0	0,6	7,0
Maximum Physical level	2974,5	37,3	112,5	185,3

PROPOSED METHODOLOGY

Set a Point of Beginning (POB), referred to at least one Permanent station (CORS) and two National Geodetic Network control points.

Since Colombia doesn't have a dense net of control points, the recommendations is to built at least one control point per linear km, referred to as the first step.

A tool will be used to calculate water volume by cm, using the DTM generated using the National Geodetic Network.

Create a conversion chart to transform all arbitrary heights into National Geodetic Network.

Limitations

- The Main limitation Seen:
  - Colombia is on Andean Mountains, conditions at the reservoirs drastically.

Timeline

MAY 19

Data Preparation
Volume
Calculation

JULY 19

Analysis
And Data Presentation

JUNE 19

Volume
calculation

References

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Thanks for your attention