Demcompare : DEM comparison tool

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Qualification

Demcompare is a software developed by CS for CNES to address image quality issues in DEMs(1). It is employed at various scales to support these efforts. For instance, **demcompare** is used to assess the quality of DSM generated by the CO3D Image Processing chain against LiDAR Ground Truths data. Differences can be analyzed as a function of the terrain slope or land cover. Additionally, **demcompare** serves as a continuous benchmarking tool to ensure that the DSM generated by **CARS,** CNES's 3D reconstruction software, remain consistent and reliable as new features are introduced.

Overview

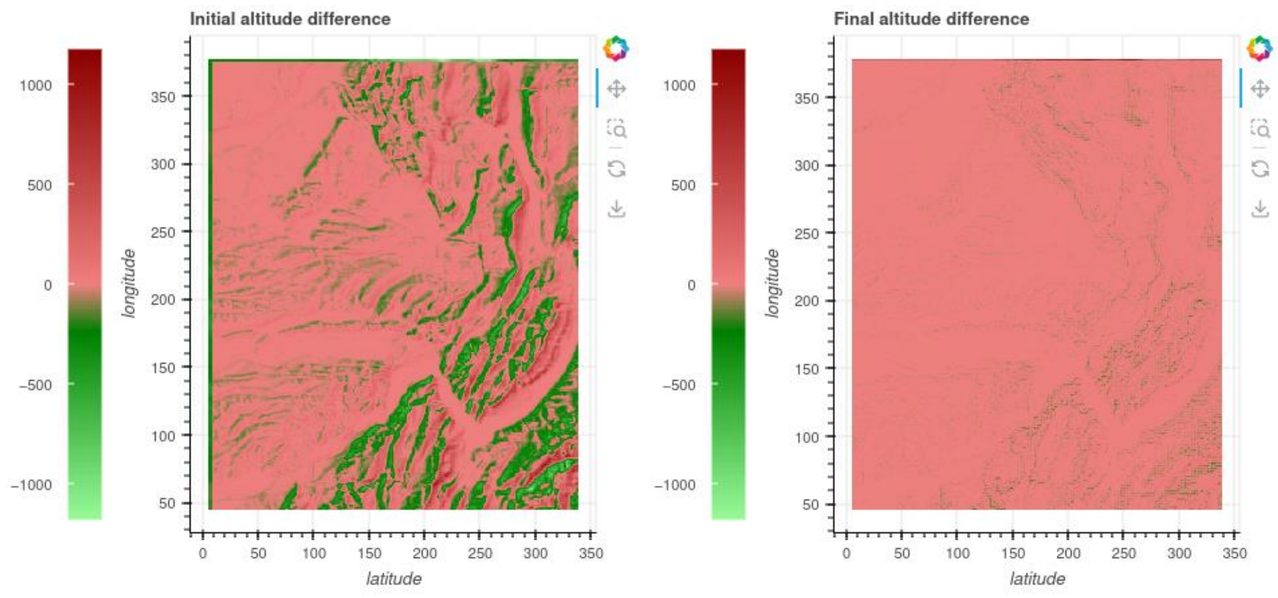
Demcompare is a python software that aims at **comparing two DEMs** together.
A Digital Elevation Model (DEM) is a 2.5D raster representation of elevation data used to model terrain.

- It is governed by CNES and distributed under the Apache V2 license.
- It can be executed via a command-line interface to generate a detailed report in PDF format.
- Additionally, its API enables seamless integration for advanced users or those working within a Jupyter Notebook environment.

Demcompare has several characteristics:

- Works whether the two DEMs share common format projection system or not, planimetric resolution, and altimetric unit.
- Performs the coregistration based on the Nuth & Kääb(2) universal coregistration method.
- Offers to choose which of both DEMs is to be registered and/or resampled during coregistration.
- Provides a wide variety of standard metrics which can be classified.
- Classifies the differences observed by terrain slope, land cover, validity mask or any meaningful data provided by the user

Coregistration and statistics



Metric's name	Measured metrics
mean	543.289
median	412.0
max	2854.0
min	136.0
sum	135822256.0
percentil_90	559.711
squared_sum	111206260736.0
nmad	237.216
rmse	666.95203
std	386.86179
nbpts	250000
percent_valid_points	100.0

Screenshots from the training notebooks of demcompare

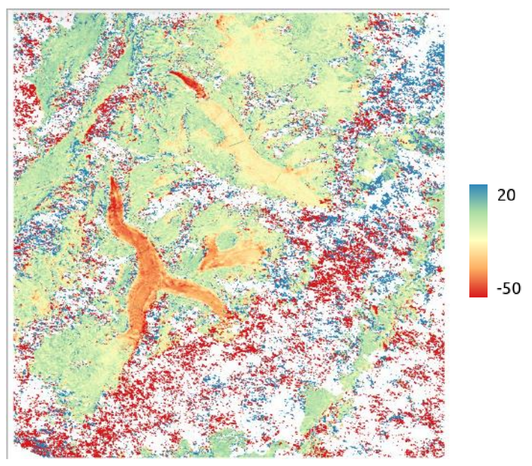
More about us

- We are merging with xDEM(3) to combine the best of both tools into one
- Related tools:
  - **CARS**
  - **Pandora**
- Find our calibration and validation center in our GOSMIC environment.
  - Accessible with standard browser (no plug-in, no specific rights)
  - AI-ready
  - Including IDE & Virtual desktop
  - Main entry point to access all your system services

Use cases :

Demcompare for **CARS** + SPOT HRS:

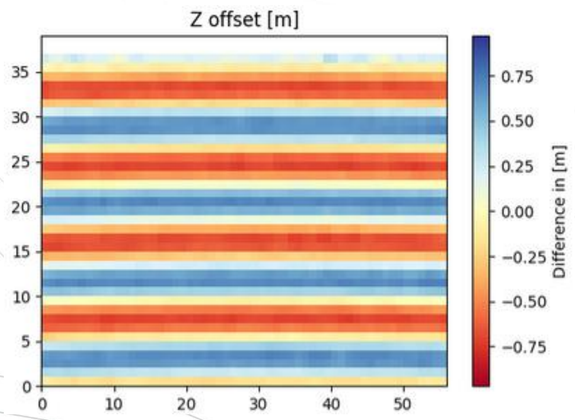
The co-registration method by Nuth and Kaab, implemented in **demcompare**, revealed that the CARS DSMs derived from SPOT data from 2003 are less accurately aligned compared to those from 2011. In 2003, displacements were measured at 33m in the x-axis and 58m in the y-axis. By 2011, these values had significantly decreased to 9m in the x-axis and 10m in the y-axis. The reference DSM used is from the Copernicus program.



Altitude difference (in meter) between DSM from SPOT 2003/2011 after coregistration

Studies of Low, Medium, and High Frequencies in a DSM

A global shift applied to an entire DSM does not provide sufficient information to identify biases, artifacts, or high-frequency components. To better detect these elements, we aimed to develop specific indicators. For example, to identify vibrations in a DSM, we recommend performing coregistrations by defined areas, organized into tiles. Then, representing altitudes differences for each of these tiles can help highlight these vibrations. An example of a visualization illustrating this process is presented with simulated DSM and artificial high frequencies.



Atitudes différences between a reference DSM and the same DSM with high frequencies

(1) cars.readthedocs.io/en/stable/exploring_the_field/index.html

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