

“DEMIX” a global DEM comparison exercise under CEOS-WGCV umbrella

The European Commission's science and knowledge service

Joint Research Centre (JRC)

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DEMIX – what and why?

- literature is rich in **DEM validation and comparisons** of (almost) everything with everything else in many different places.
- methodologies vary and results are not always **representative or comparable** between studies and locations
- EO platforms and ‘data cubes’ make data increasingly available also at **continental to global scales**
- **new data sets** are coming up (“Copernicus DEM”), which might change the DEM ‘landscape’ quite a bit

A *new* DEM for



- 2010-2012 as part of the GMES Initial Operations (GIO) the **EU-DEM** was procured to serve as a reference data set throughout the 39 EEA member states (EEA39).
- Commercial procurement fusing **SRTM v4.1** (CGIAR-CSI) and **ASTER-GDEM V1.0** on a 1" lat/lon ETRS89/EVRS2000 grid later resampled to 25m ETRS89-LAEA (EPSG:3035)
- **Quality** was highly disputed (ASTER GDEM V2 became available end 2011). Overall accuracy was confirmed in 2014 at around 3m (RMSE), but varies with location, terrain, and land cover between 2 and 10m (RMSE) or 2-20m (LE95).
- Since 2014 the EU-DEM continuously ranked among the **3 most downloaded** datasets on EEA portal.
- In 2017 an initiative started to procure a global reference dataset: **Copernicus-DEM**.

Copernicus DEM - implementation

Objective → To procure a **global** high-resolution DEM
as **reference** for the **entire** Copernicus Programme

Key need → consistent coverage globally

Key use case → Sentinel-2 orthorectification (@10m)

Key constraint → procurement envelope



→ Only a **global** DEM **derived from space data** allows to meet the key points

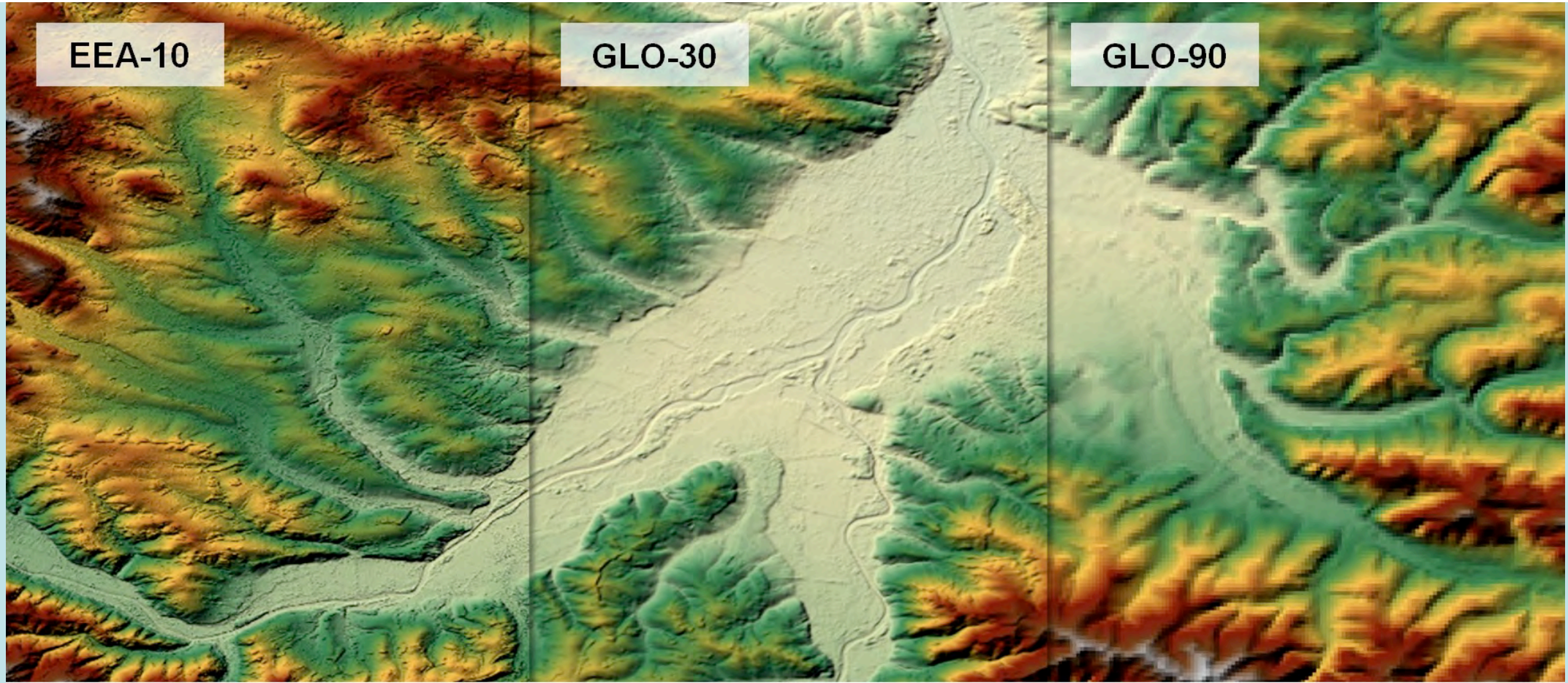
Under a competitive public procurement procedure by ESA the **WorldDEM[®]** product provided by Airbus Defence and Space GmbH, Germany was selected. This dataset is sourced primarily from the data of the German **TanDEM-X[®]** mission.

Copernicus-DEM – instances and licencing

DEM instance	Geographical coverage	Horizontal sampling	DEM licence
Global (GLO-90-F)	Global	90 m	Full, free and open
Global (GLO-30-R)	Global	30 m	Restricted
Europe (EEA-10-R)	EEA39	10 m	Restricted

- **GLO-90-F** license allows its unrestricted usage in full, free and open conditions
- **GLO-30-R** and **EEA-10-R** licenses allow usage for:
 - ✓ Sentinels data processing within CSC ground segment
 - ✓ Copernicus Contributing Missions data processing within contributing ground segments
 - ✓ Usage by Copernicus Services, Copernicus Entrusted Entities and EU Institutions/Bodies

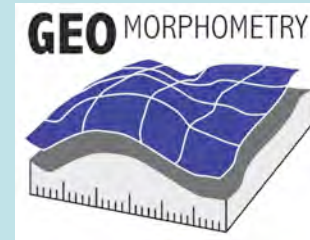
Copernicus-DEM – preview



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... and then?

- A reference data set for a program the size of Copernicus will be scrutinized
- In anticipation of user demands a benchmarking against well known and established data sets is envisaged
- How is this best done?
- Outreach to experts: Geomorphometry.org
- Involvement of Stakeholders: **Committee on Earth Observation Satellites Working Group on Calibration and Validation – Terrain Mapping Sub-Group**



Technological Prerequisites

- Terminology – what is being compared
- Metrics – min. is Δx , Δy , Δz ; desirable are morphological parameters
- Methodology – resampling, sample density, sample size, sample selection, sample exchange, sample comparison
- Algorithms – all calculations will be done with agreed algorithms and open software tools

Workshop done!
Methodology whitepaper in draft
CEOS TMSG re-activated

Approach

- a) Call for expression of interest to all CEOS agencies
Condition:
 - Access to at least continental scale DEM - preferably DSM
 - Commitment to release benchmarking results
- b) Select one global DEM as reference (by consensus, majority?)
Criteria:
 1. global coverage
 2. validated accuracy (x, y, z)
 3. grid spacing (as proxy for spatial resolution)
 4. accessibility

Approach cont'd

- c) Determine a suitable sub-tiling of the reference DEM
- d) Perform (correlation?) matching between the reference DEM and the S2-GRI (using shaded relief technique) and analyse eventual co-registration issues
- e) Calculate the agreed comparison metrics for each candidate with the reference
- f) Publish results

**Next workshop planned for Geomorphmetry 2020
21-26 June 2020, Perugia, Italy**

For discussion:

- Do we need a multiscale approach (30", 3", 1", 0.33")
- Do we need a global grid, if so, which is the most suitable?
- other?



Any questions?

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