This document shows a comparison of the FABDEM releases v1.0 and v1.2. The FABDEM (Forest And Buildings removed Copernicus DEM) is a DTM (Digital Terrain Model) based on the Copernicus DEM GLO 30 (called here after COPDEM30). It should be noted that there is a version 1.1 which has not been publicly released.

The version 1.2 (Fig.1.a) published on the 18 January 2023 is available here. This version is based on the COPDEM30 release 2021_1. The version 1.0 (Fig.1.b) published on the 17 December 2021 is available here. The COPDEM30 release used to produce this version is not clearly identified, but it seems to be the release 2019_1 or 2019_2.

Fig.2 shows the difference between the two versions (v1.2 – v1.0). The result is rendered between -0.1 metres and +0.1 metres. Even with these stretching bounds, most of the difference is near 0. There are two main types of differences. The first ones are in tropical areas where the original tiles boundaries are visible. The second ones are at high latitude areas where misalignment between FABDEM and COPDEM30 has been fixed.

FABDEM releases comparison

pile_2D

Overview

Fig.1: Global view of the FABDEM v1.2 (left) and v1.0 (right). 3D_left 3D_right

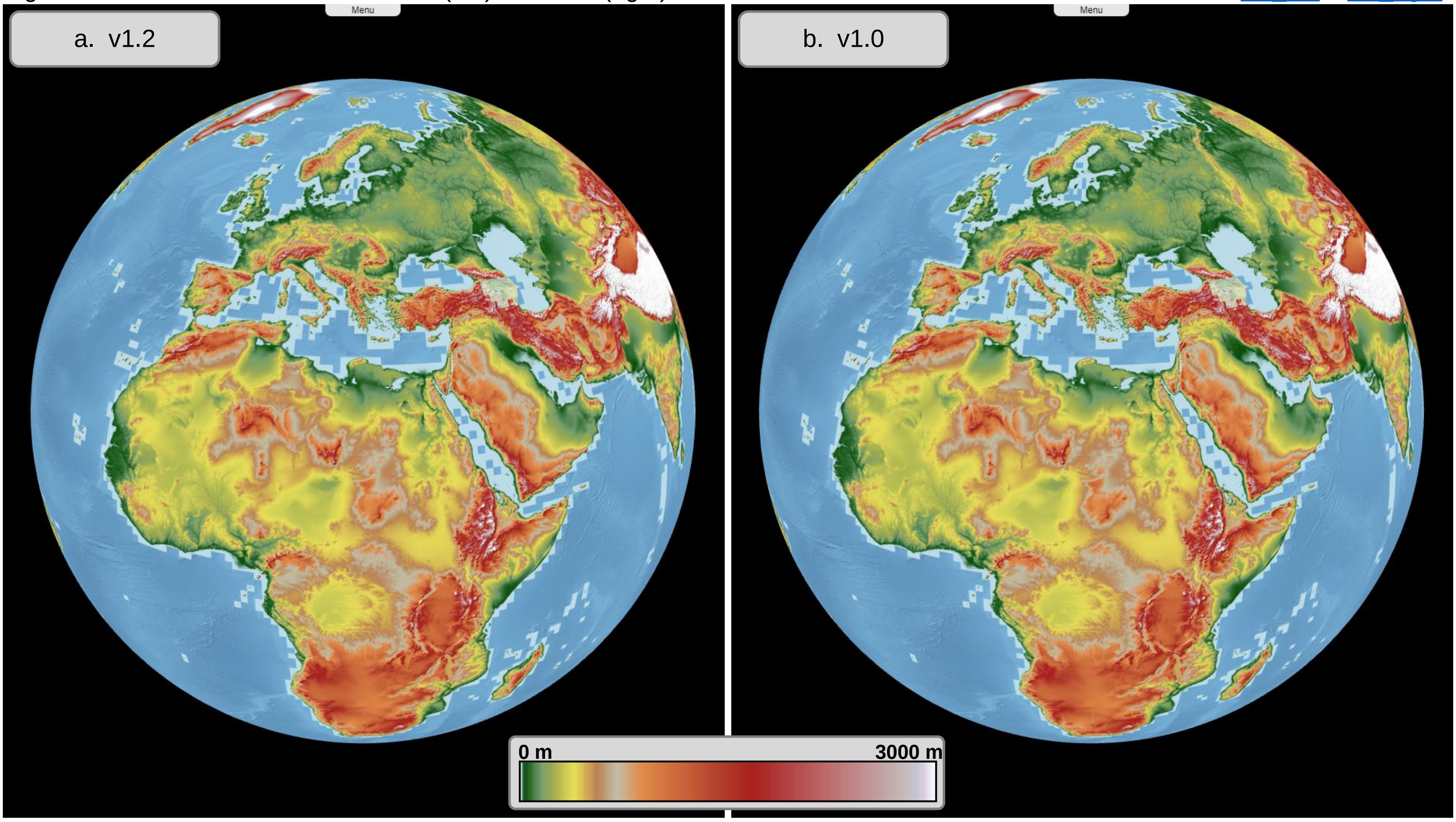
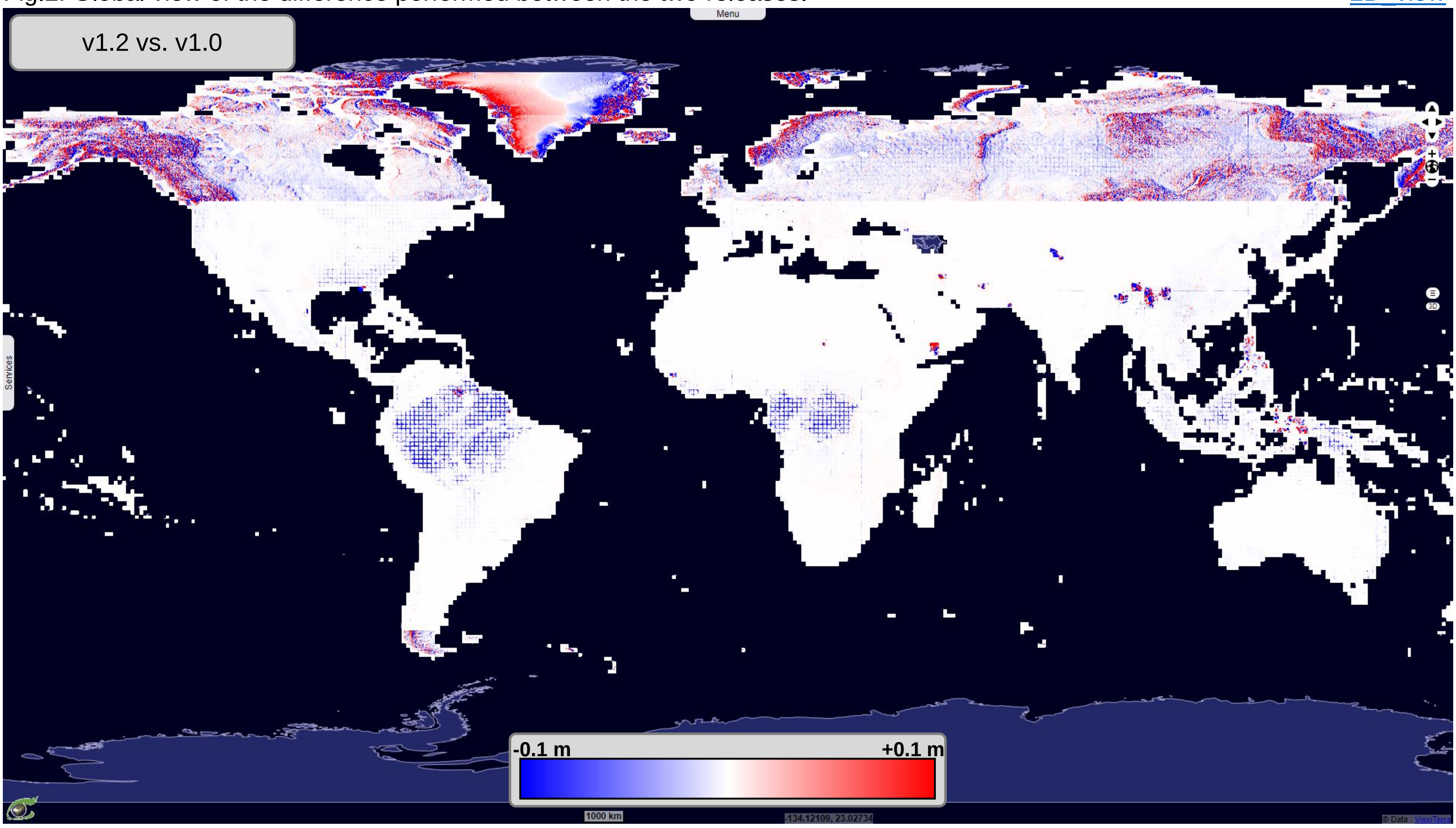


Fig.2: Global view of the difference performed between the two releases. 2D_view



The version 1.2 inherits of the updates done in the version 1.1. The changelog available here explains that the version 1.1 includes a correction of the discontinuity between adjacent tiles in large homogenous forests.

Fig.3 shows the two releases v1.0 (Fig.3.a), v1.2 (Fig.3.b) and the difference between the two (Fig.3.c) over an example of tile discontinuity in the Amazon Forest. One may easily notice that the vertical discontinuity has been completely smoothed in the version 1.2. The difference witnesses this operation showing in blue the area where the v1.2 is lower than the v1.0 and in red the opposite.

Fig.4 shows the opposite example where a tile discontinuity slightly visible in the version 1.0 is worsened in the version 1.2. This example has a different pattern than the one in Fig.3. It could be due by another step in the post processing of FABDEM.

Releases comparison (1)

Tile discontinuity

Fig.3: Example of tile discontinuity correction (Amazon Forest).

2D_view

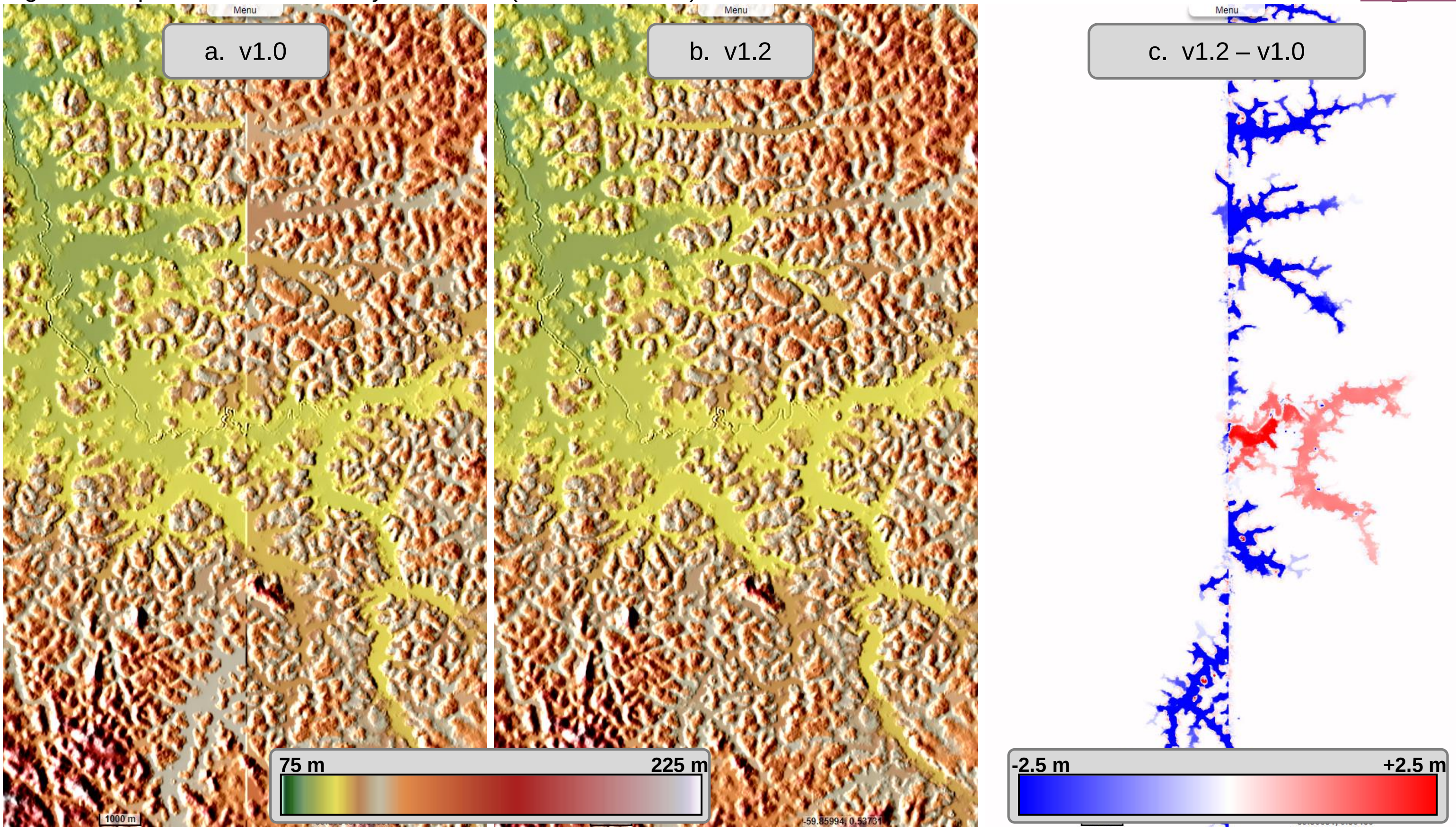
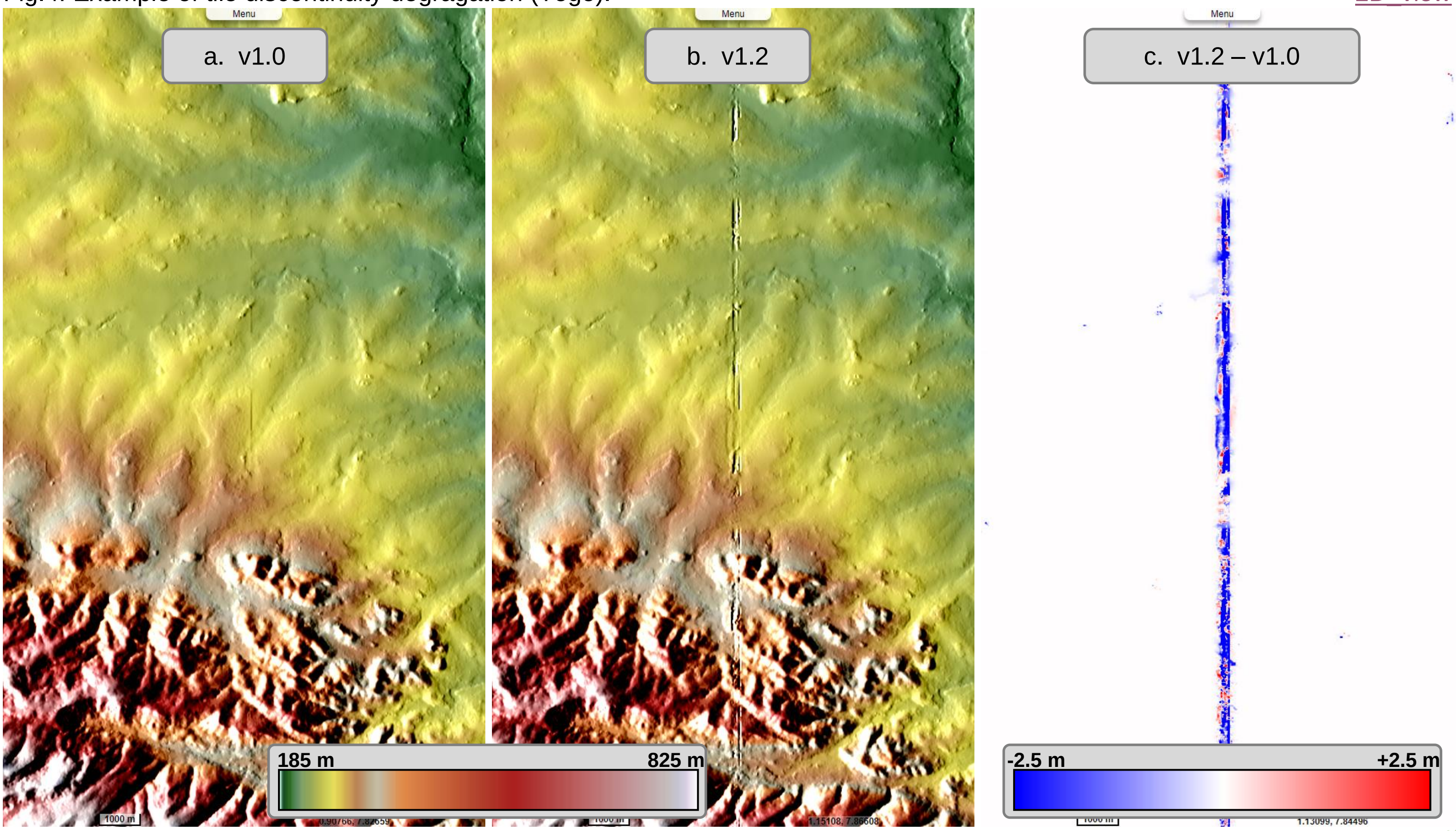


Fig.4: Example of tile discontinuity degragation (Togo).

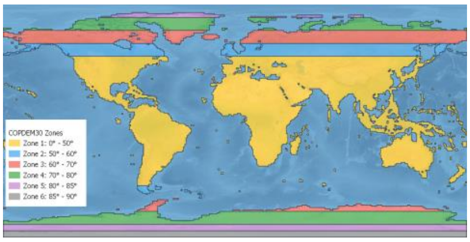
2D_view



One of the steps of the FABDEM generation was to oversample the COPDEM30 in order to obtain a constant horizontal angular GSD (1 arcsecond) all over the globe compared to the variable one of COPDEM30 (see the opposite figure). This step introduces a shift for the higher latitude in the version 1.0. This shift has been fixed in the version 1.2.

Fig.5 shows a zoomed view of the release difference over the higher latitude. The intensity of the difference increases in successive zone.

Fig.6 shows an artifact introduce by the grid alignment issue. On Fig.6.a and Fig.6b, are the result of a horizontal convolution applied to the DEM. This processing enhances the two vertical lines visible in Fig.6.a. These lines which disappear in Fig.6.b are clearly visible when we compute the difference between the two versions.



Zone	1	2	3	4	5	6
GSD	1.0"	1.5"	2.0"	3.0"	5.0"	10.0"

Releases comparison (2)

Grid alignment

Fig.5: Global view of the increasing difference due to the grid alignment issue. 2D_view

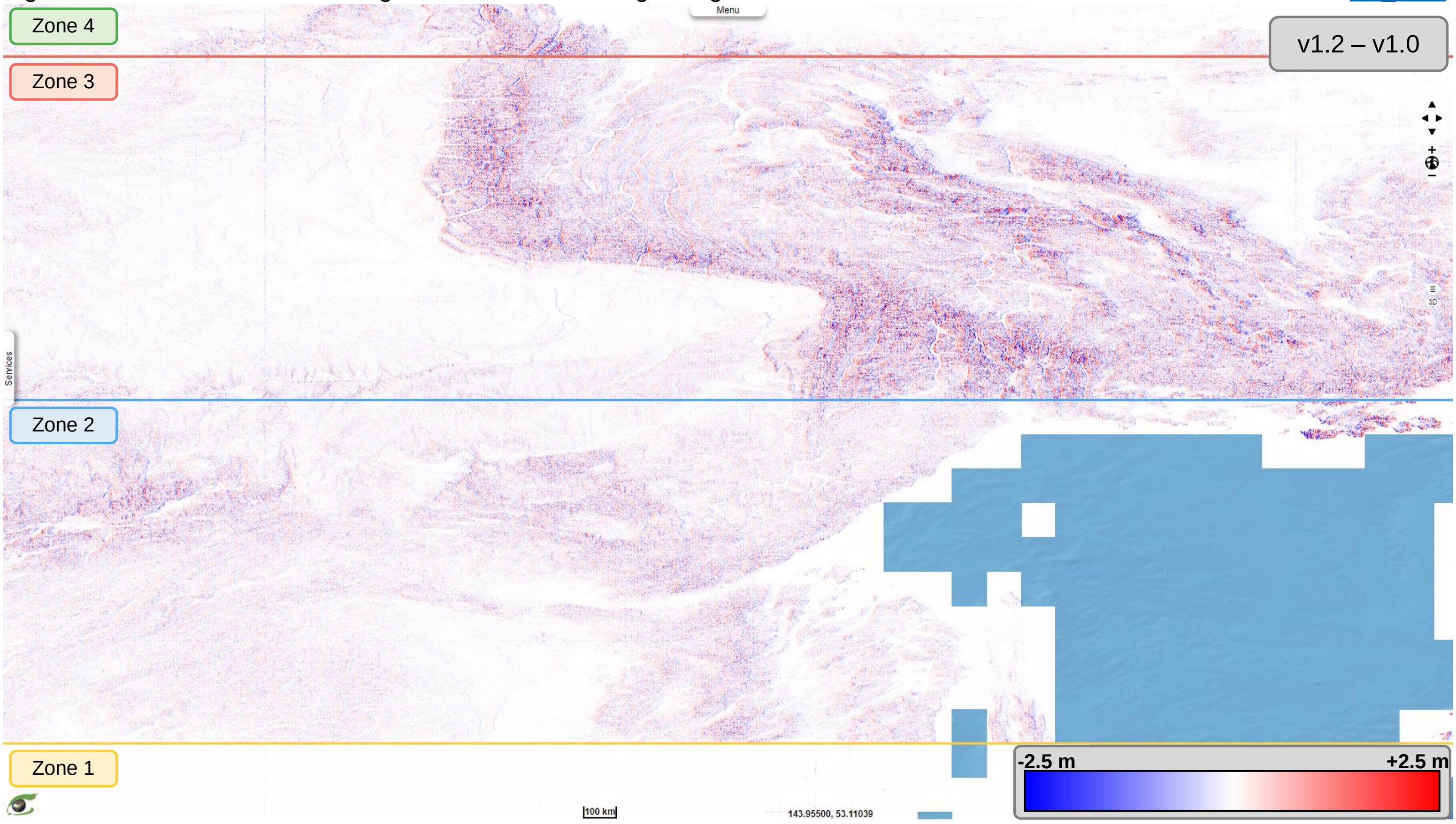


Fig.6: Example of artifact introduced by the grid alignment issue (Oriental Siberia). 2D_view

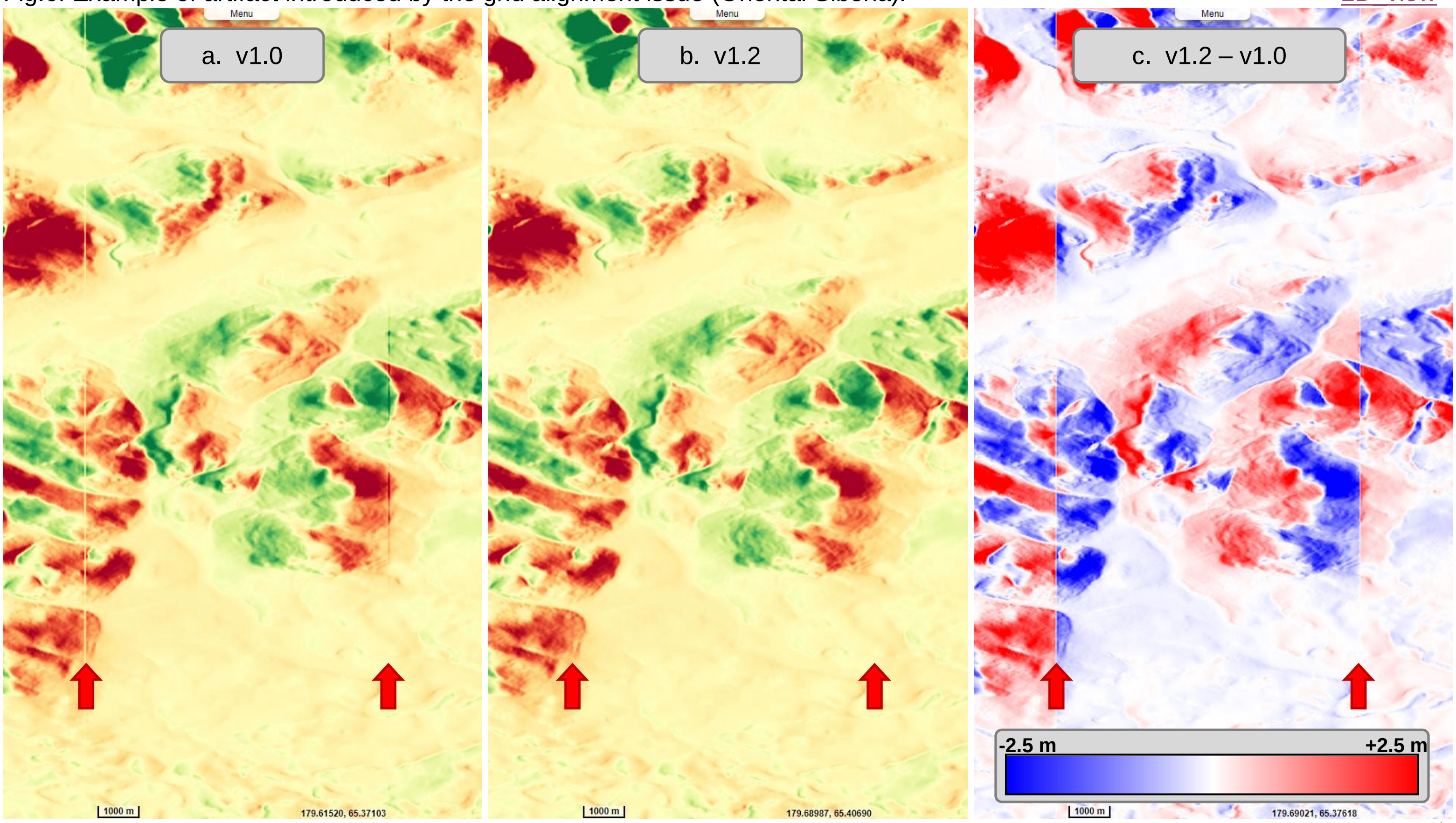


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Fig.7 shows an anomaly that appears in the v1.2 of FABDEM. The lower part of the tile **N29W086** is missing. The land part is flagged as background using the "NaN" value while the sea part uses as background the value "-9999". Furthermore, the land part of the tile **N29W085** seems to have been raised by more than 5 metres.

Other differences between the two versions are simply due to the update of COPDEM30.

Fig.8 is an example where one may see -in Fig.8.a the difference between **FABDEM v1.2** and **v1.0**, -in Fig.8.b the difference between **COPDEM30 2021_1** and **2019_1** and -in Fig8.c the difference between Fig.8.a and Fig.8.b. This case has already been studied in the document HYP-095-VtWeb-E_Comparison_of_Copernicus_DEM_releases_2020_vs_2019 (page 9)

Most of the difference visible in Fig.8.a are also visible in the Fig.8.b which witnesses that this update is due to COPDEM. Furthermore, the Fig.8.c highlights the updates accountable to the FABDEM v1.2.

Releases comparison (3)

Other cases

Fig.7: Example of tile anomalies introduced in FABDEM v1.2 located in Florida, United States. 2D_view

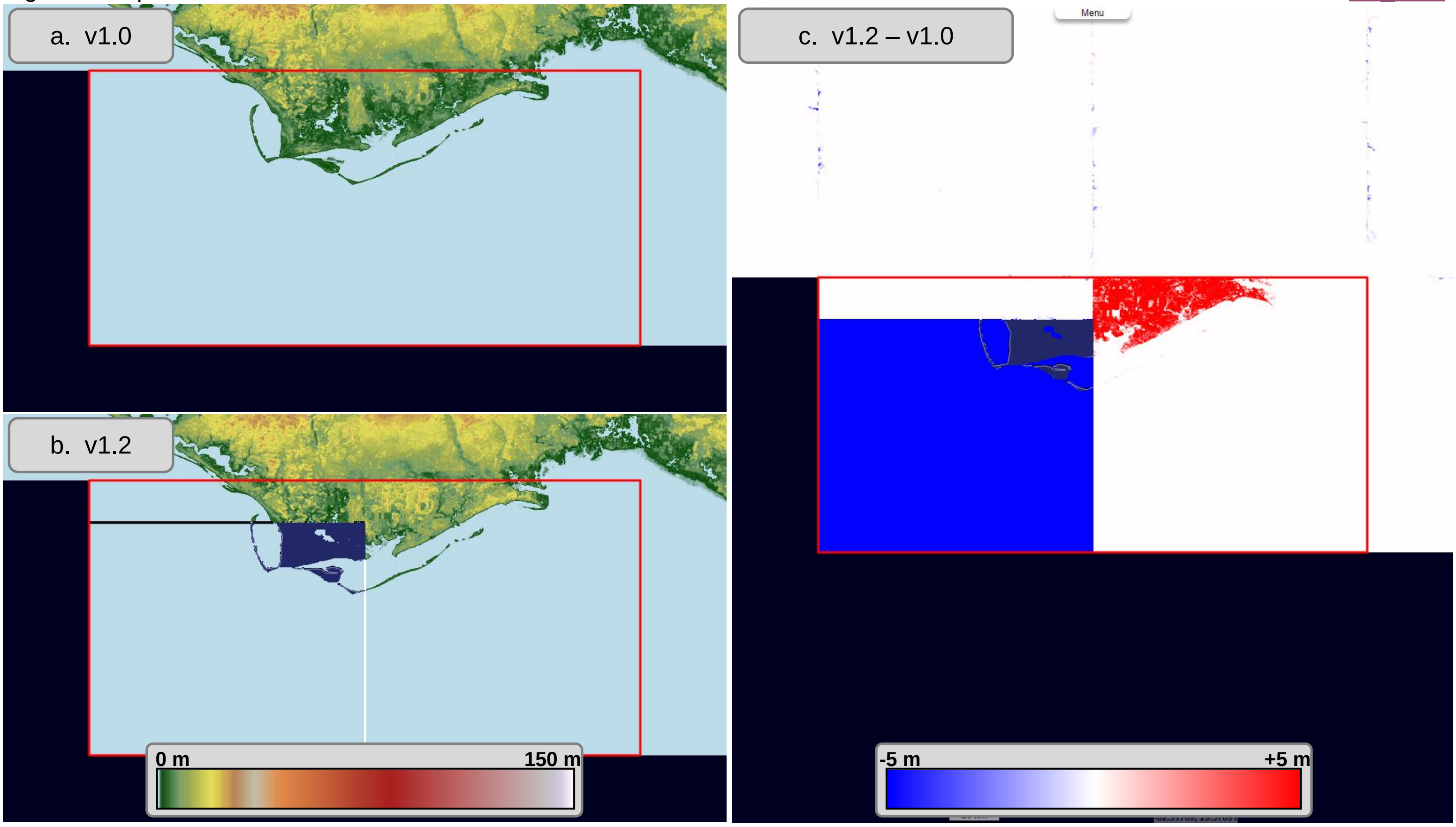
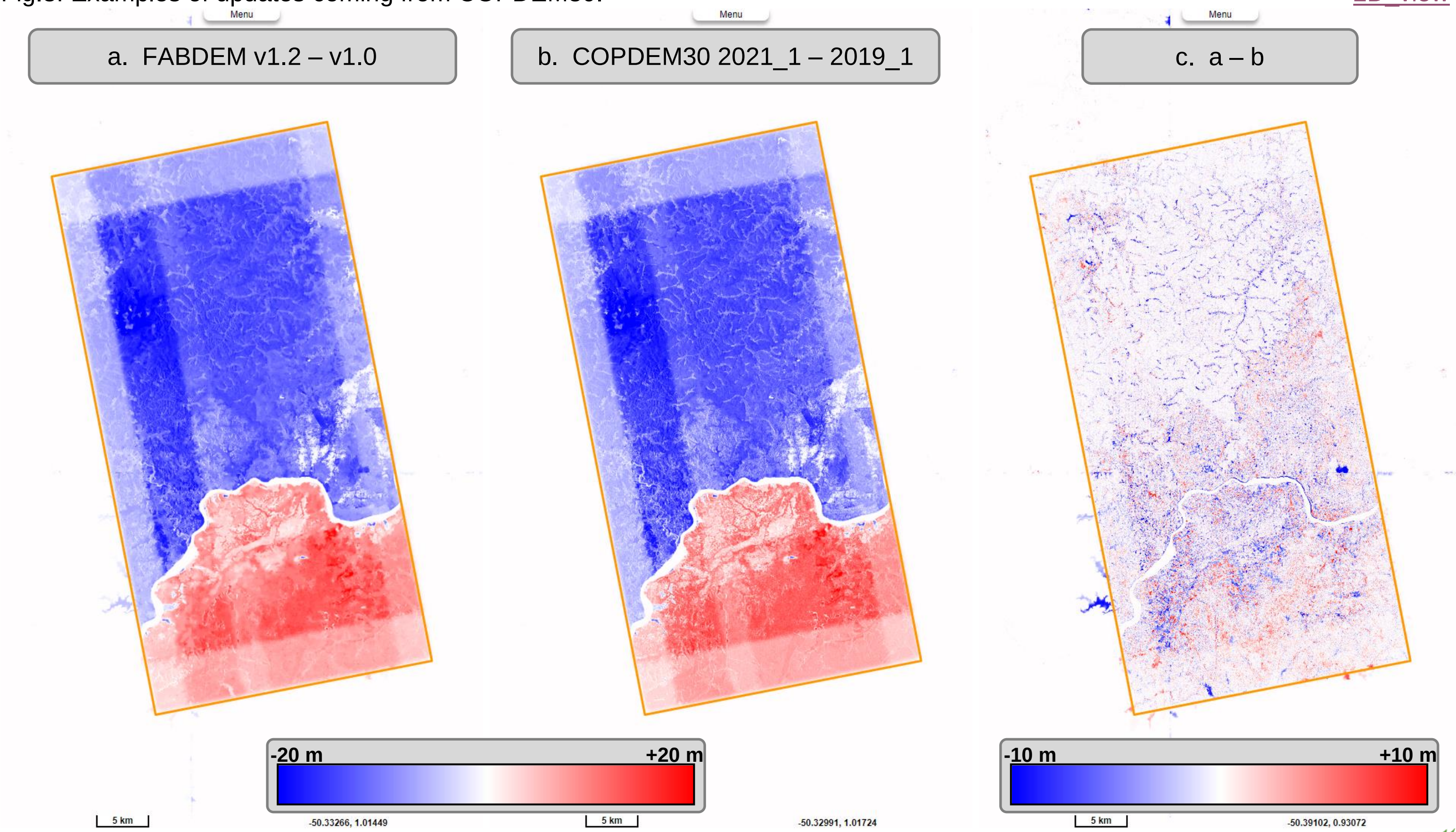


Fig.8: Examples of updates coming from COPDEM30. 2D_view



As stated previously, FABDEM is the result of a heavy post-processing of COPDEM30 in order to remove forest and building height from COPDEM30 to obtain a global DTM at 1 arcsecond. More details are available in the associated paper (https://dx.doi.org/10.1088/1748-9326/ac4d4f).

Here after are shows two examples of the result of this processing by comparing FABDEM to COPDEM30. Because the two DEMs are provided over the same EGM2008, we can compare them directly.

Each figure shows the COPDEM30 and the FABDEM with the same colour scale, the difference between the two and the Land Use/Land Cover provided by the ESA World Cover 2021.

WorldCover - 2021 / v2

No Data	Bare/sparse vegetation
Tree cover	Snow and ice
Shrubland	Permanent water bodies
Grassland	Herbaceous wetland
Cropland	Mangroves
Built-up	Moss ad lichen

FABDEM vs. COPDEM30

Examples

Fig.7: Forest removal example where the right one has been removed while the left one is untouched. 2D_view

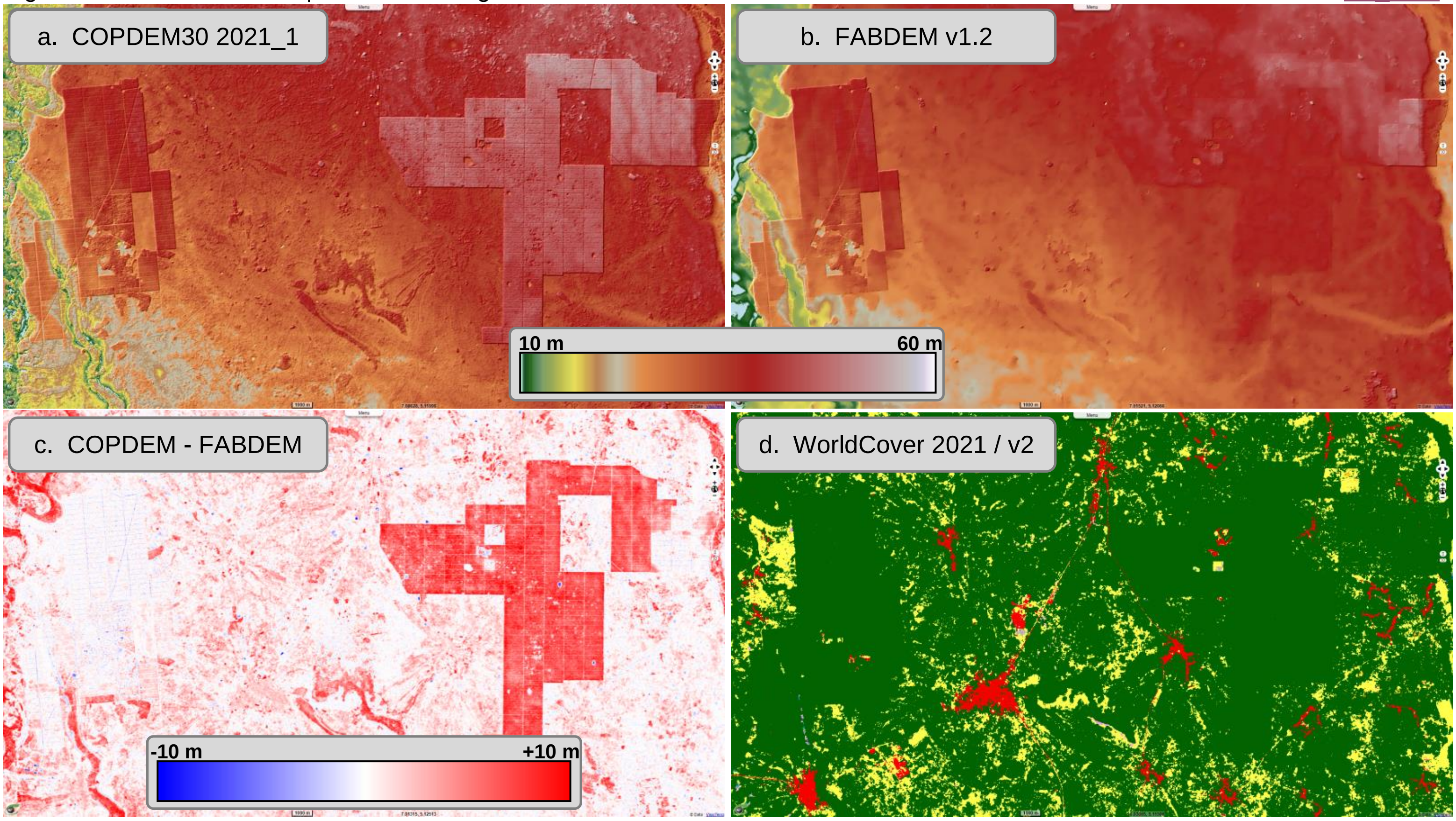


Fig.8: Example over Caen and its surrounding where the city and forest have been removed in FABDEM. 2D_view