The Infraestructura de Datos Espaciales de Uruguay (IDEUY) distributes open Digital Elevation Models (DEMs) of Uruguay. Two Digital Terrain Models (DTMs, excluding terrain and buildings) have been integrated into VtWeb, identified as URY_DTM_1_URB (1 metre of resolution, only urban areas covered) and URY_DTM_2.5_NAT (2.5 metres of resolution, national coverage).

Fig.1 is an overview of both DTMs, highlighting the difference of coverage between both DEMs over a dark blue background map. The 1 metre DTM (Fig.1, left) is composed of several unlinked patches of urban areas. On the opposite, the 2.5 metres DTM (Fig.2, right) covers the entire country of Uruguay.

Fig.2 is a close view of the south of Uruguay, over the capital city of Montevideo. Over this area, the two DTMs are visually compared to the classes of the ESA WorldCover 2021 map. One can see the coverage of the 1 metre urban DTM (Fig.2, centre) matches the built-up class of this land use/land cover map (Fig.2, left). This city is also covered in the 2.5 metres DTM (Fig.2, right), which is not limited to urban areas, but extends to the whole country.

Presentation of Uruguay VHR DEMs

pile_2D

Overview

Fig.1: Overview of the two VHR DEMs of Uruguay: URY_DTM_1_URB and URY_DTM_2.5_NAT

2D_left 2D_right

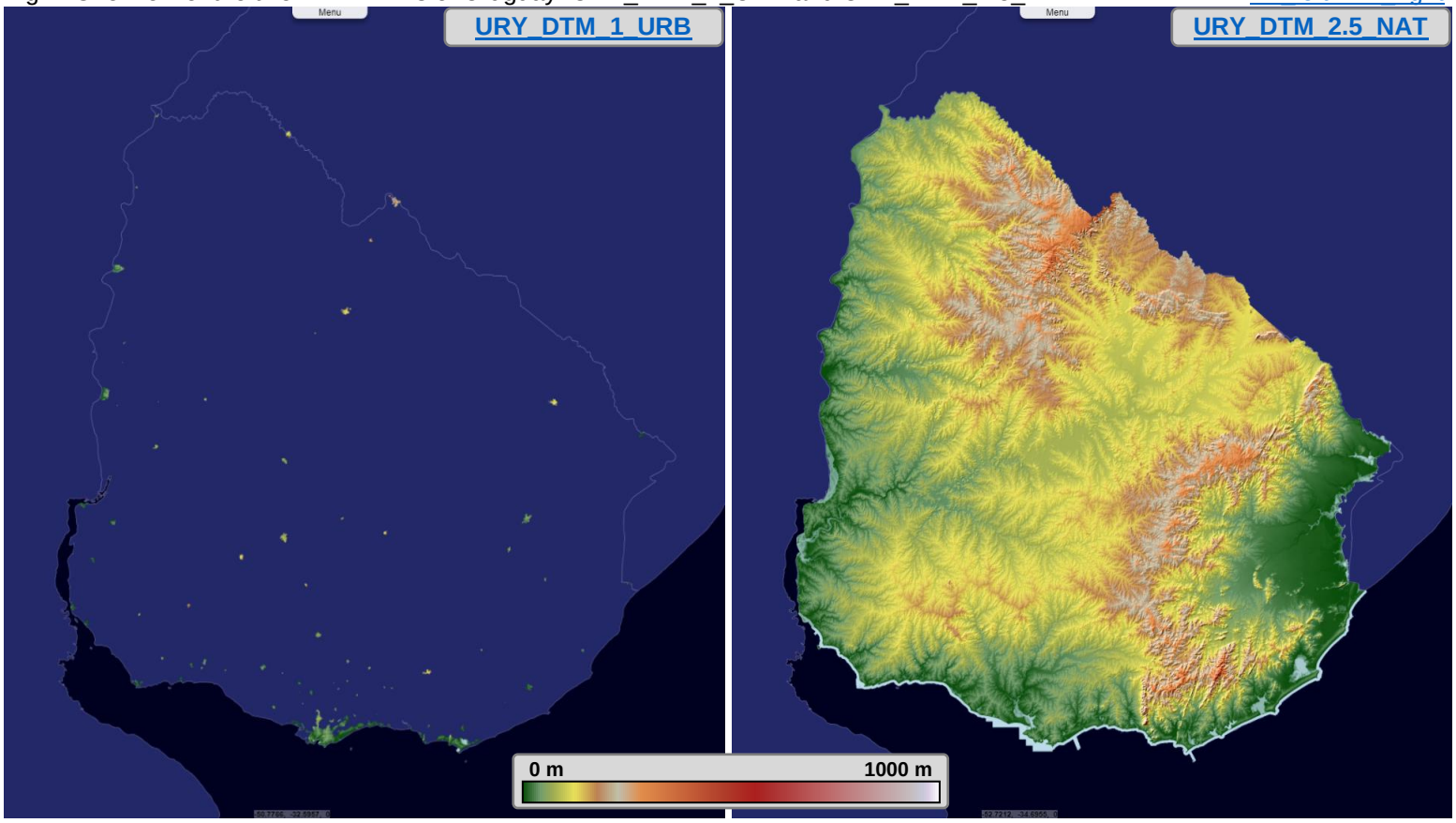
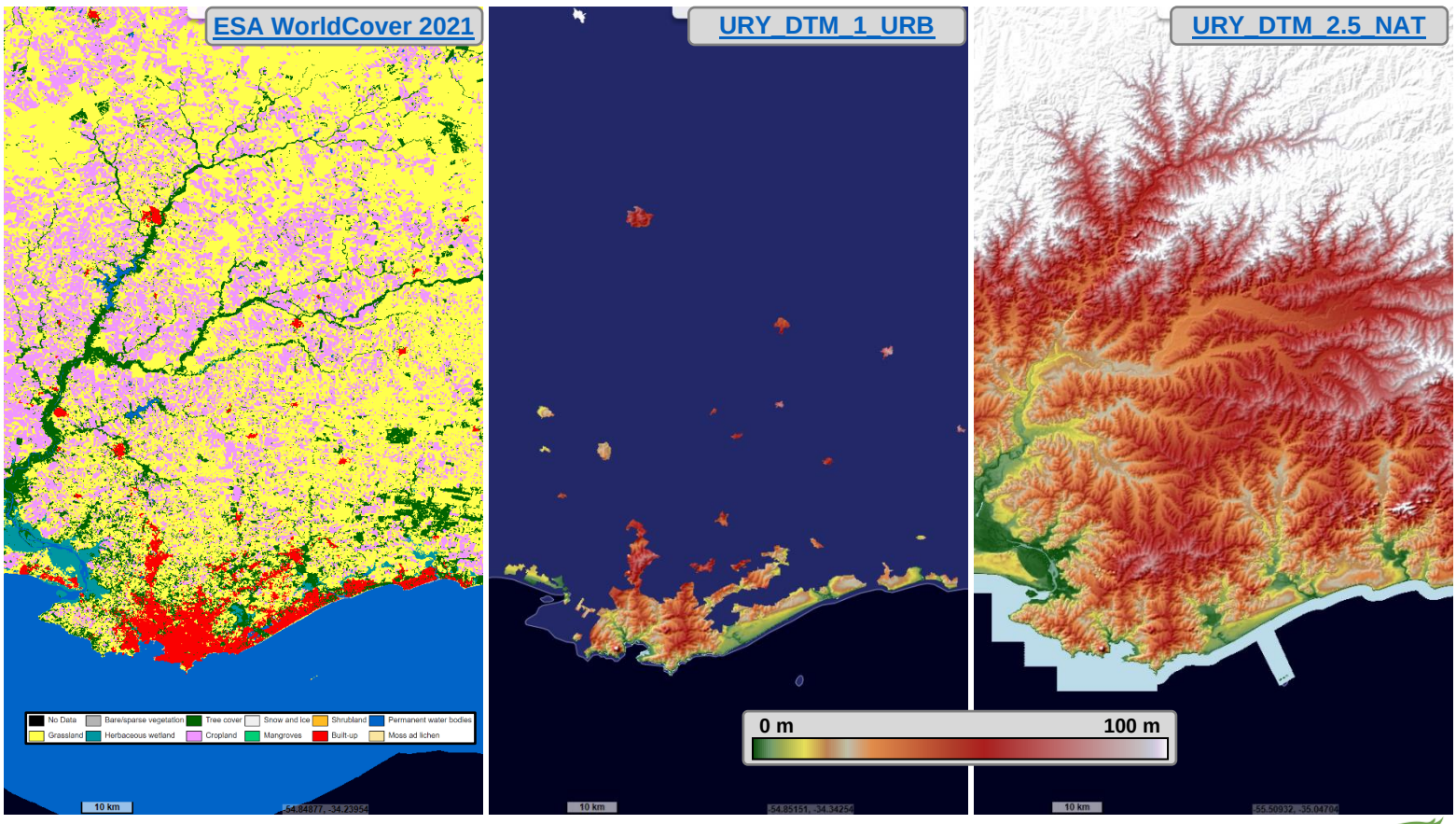


Fig.2: Coverage of the two DEMs vs. ESA WorldCover 2021

2D_left 2D centre 2D right



This page covers a first case study of the Plaza Independencia, in Montevideo, Uruguay.

In Fig.3, three DTMs are compared: FABDEM v1.2 (global DTM at 1'' arcsecond ≈ 30 m at equator), URY_DTM_2.5_NAT and URY_DTM_1_URB (the two DTMs of Uruguay, with resolutions of 2.5 m and 1 m, respectively). As expected, high frequency details of Plaza Independencia are retrieved in the VHR DTMs of Uruguay, but not in FABDEM which has a lower resolution. However, important differences of processing can be seen between the two DTMs of Uruguay. One can see the high frequency details of this area retrieved in the 1 m DTM, but completely smoothed out in the 2.5 m DTM. Moreover, tessellation (triangular shapes) can be observed in the 1 m DTM, while all the shapes are smoothed in the 2.5 m.

The elevation difference between the 2.5 m and the 1 m DTMs is highlighted in Fig.4. One can see differences reaching ±2.5 metres due to the aforementioned differences of processing.

Plaza Independencia

Montevideo

Plaza Independencia

Fig.3: URY_DTM_1_URB vs. URY_DTM_2.5_NAT vs. FABDEM v1.2 over Plaza Independencia, Montevideo, Uruguay.

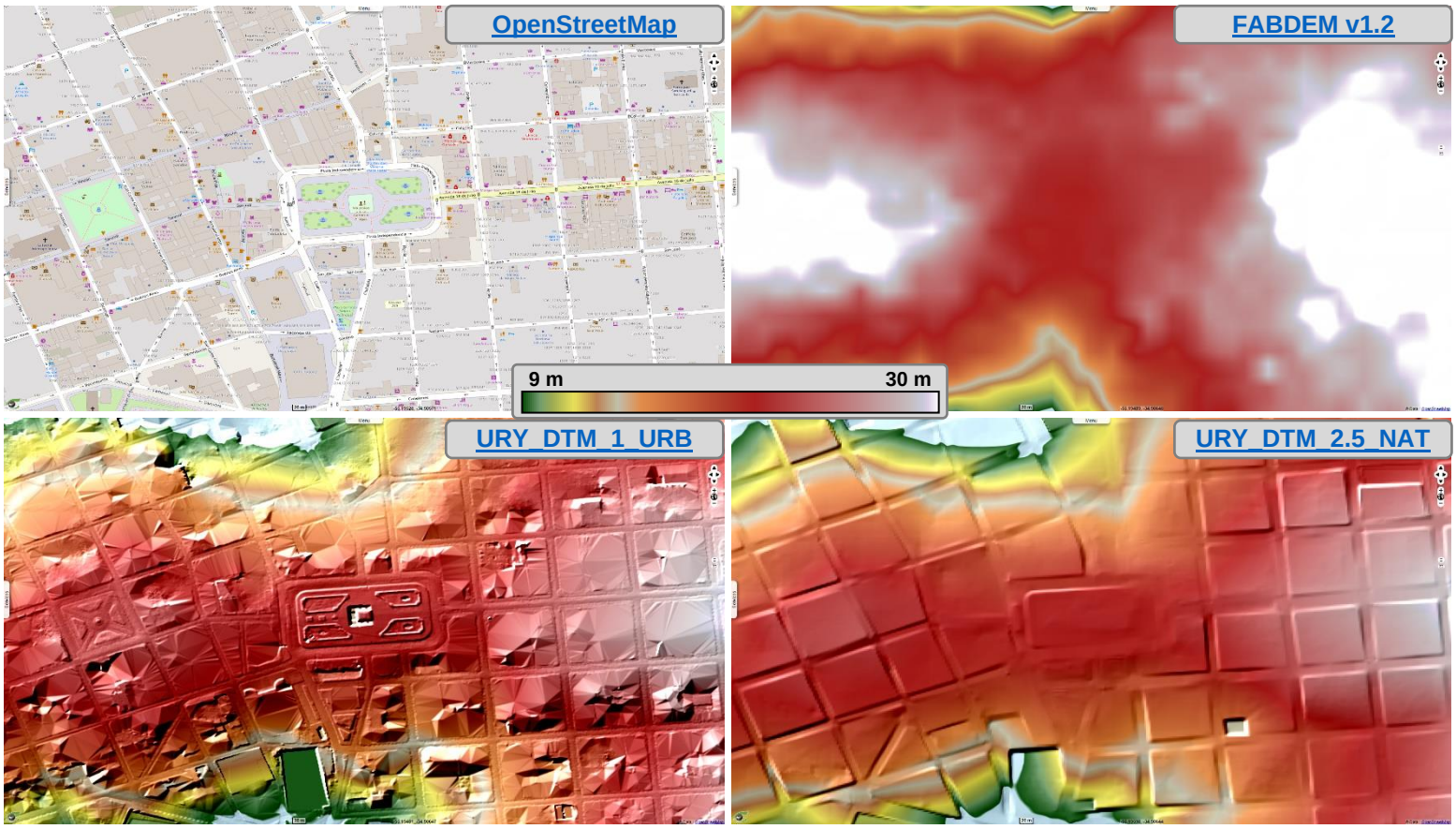
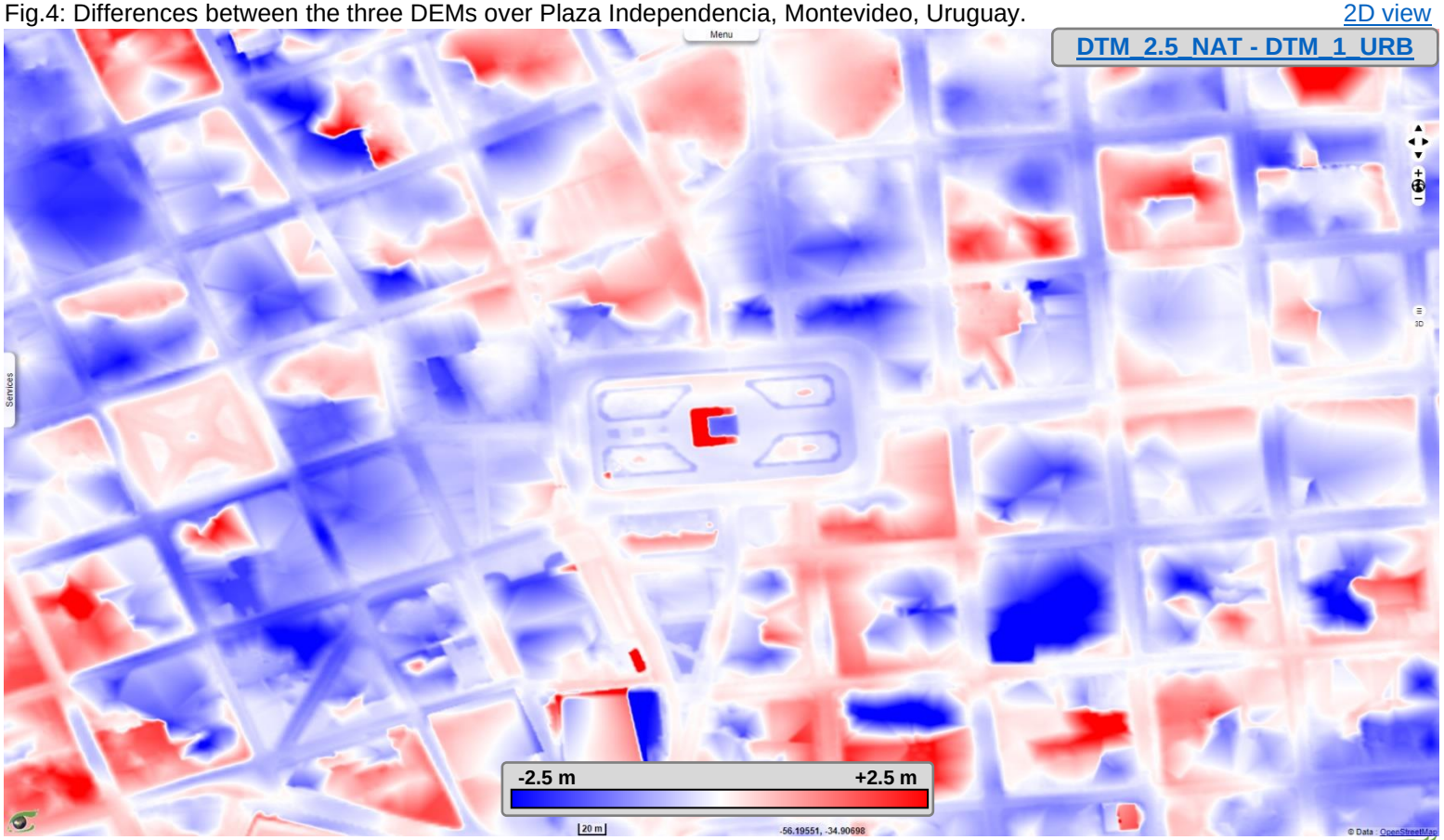


Fig.4: Differences between the three DEMs over Plaza Independencia, Montevideo, Uruguay.

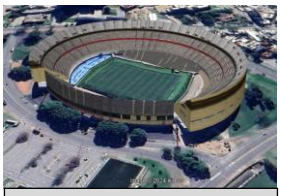
2D view



This page covers a second case study of the Parque Batlle, in Montevideo, Uruguay.

As previously done for the case of Plaza Independencia, in Fig.5, three DTMs are compared: FABDEM v1.2, URY_DTM_2.5_NAT and URY_DTM_1_URB (the two DTMs of Uruguay, with resolutions of 2.5 m and 1 m, respectively). Once again, as expected, high frequency details of Parque Batlle are retrieved in the VHR DTMs of Uruguay, including stadiums, bottom of buildings and roads. Once again, important differences of processing can be seen between the two DTMs of Uruguay. One can see the high frequency details of this area retrieved in the 1 m DTM, but completely smoothed out in the 2.5 m DTM. The tessellation (triangular shapes) can still be punctually observed in the 1 m DTM over this area.

The elevation difference between the 2.5 m and the 1 m DTMs is highlighted in Fig.6. One can see the important negative differences over the stadium (Estadio Centenario), for which the stands are depicted in the 1 m DTM, but not in the 2.5 m DTM.



Estadio Centenario

Montevideo

Parque Batlle

Fig.5: URY_DTM_1_URB vs. URY_DTM_2.5_NAT vs. FABDEM v1.2 over Parque Batlle, Montevideo, Uruguay.

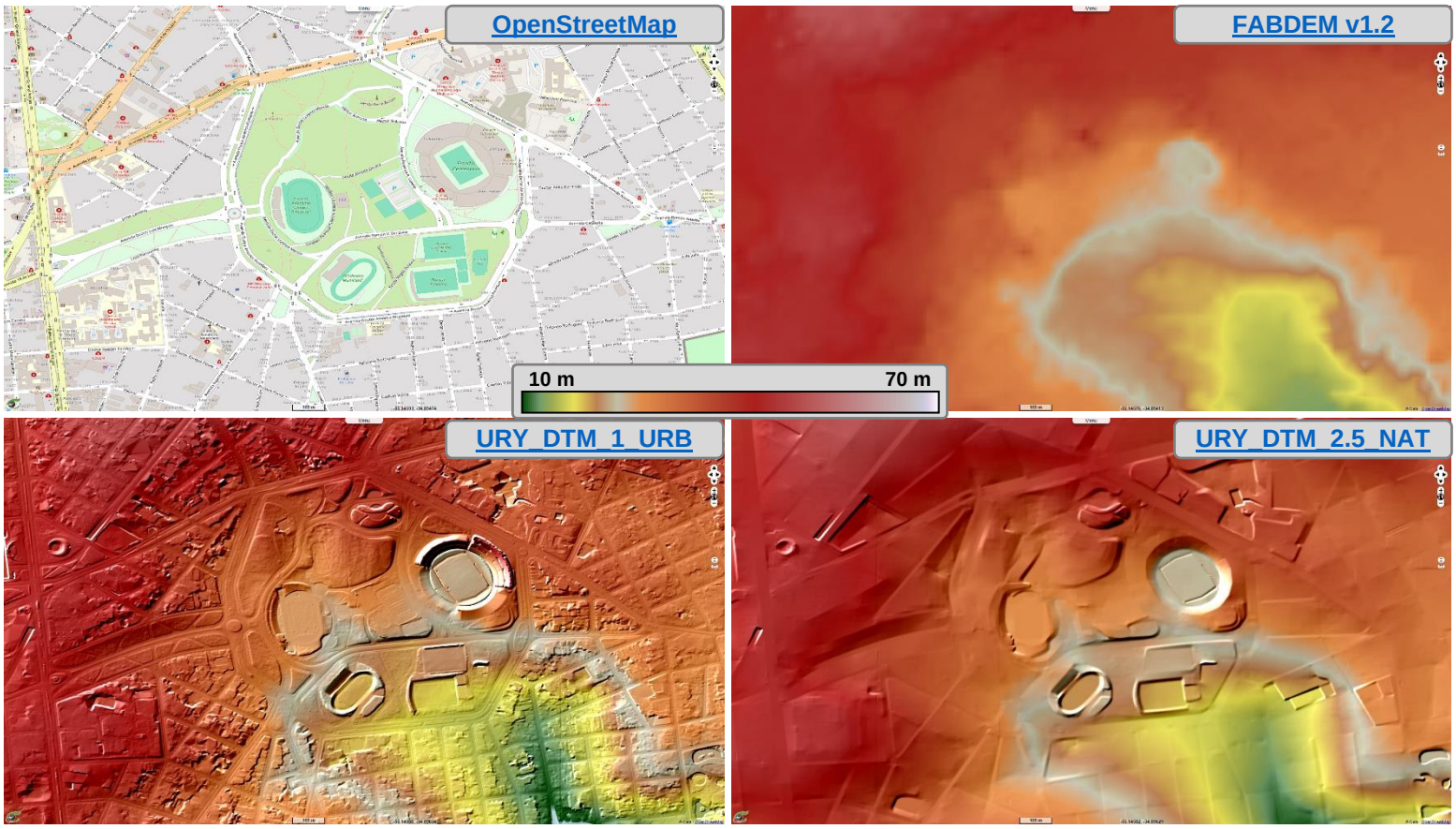
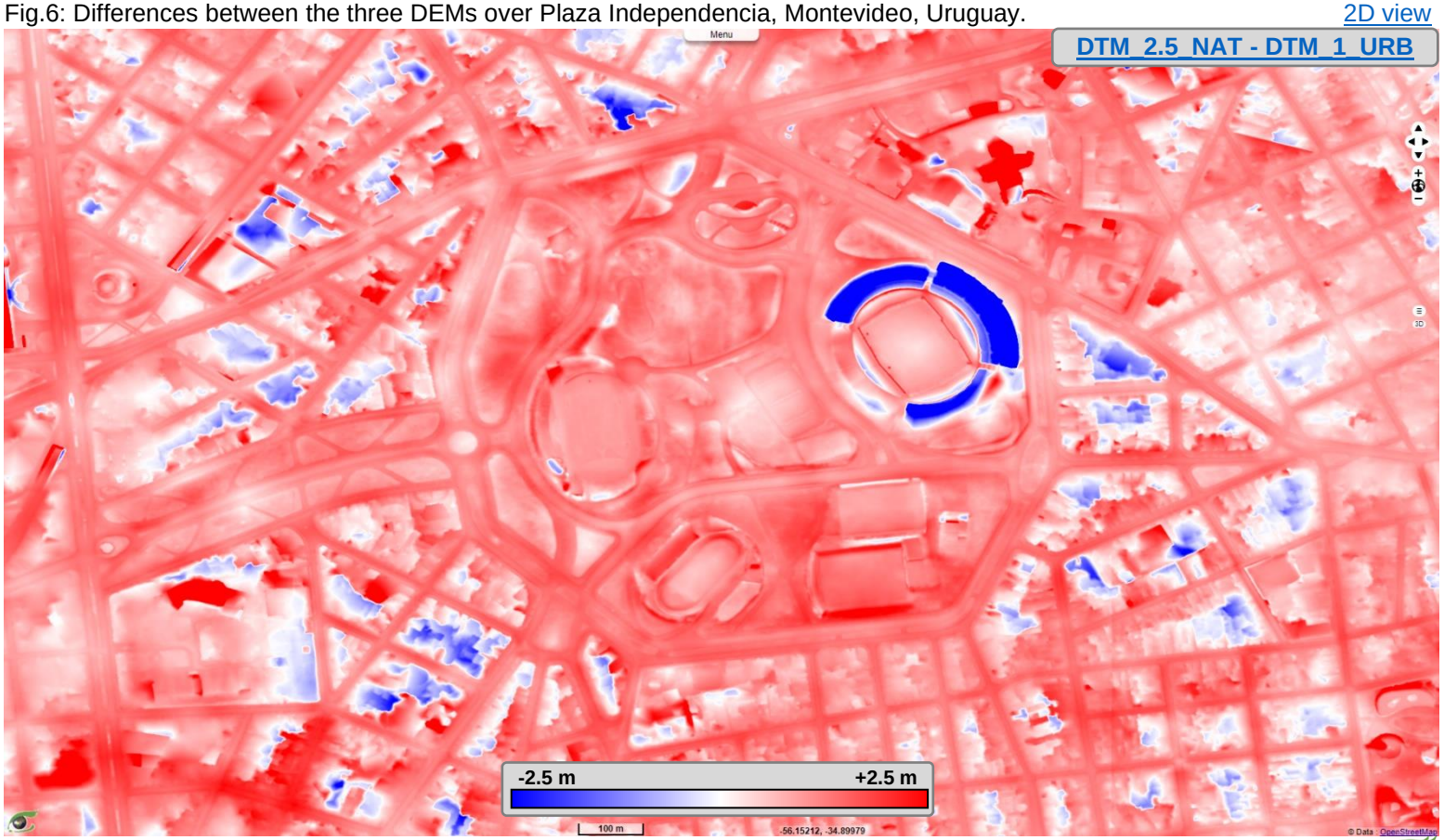


Fig.6: Differences between the three DEMs over Plaza Independencia, Montevideo, Uruguay.

2D view



Hereafter are covered artifacts highlighted in the difference between 2.5 m and 1 m DTMs.

Shapes can be highlighted in the overview of the (DTM_2.5_NAT - DTM_1_URB) difference over Montevideo (Fig.7). Two types of shapes can be observed: rectangular shapes (Fig.7.A), certainly highlighting a difference of acquisitions, and “free-form” shapes (Fig.7.B), which could be due to several factors, including differences of processing and/or acquisitions.

These sudden changes of elevation differences are highlighted in Fig.8, which are close views extracted form Fig.7. In Fig.7.A, one can see a clear line separating negative differences (West side) to the positive differences (East side). Due to the rectangular shape of the positive differences, this phenomenon is certainly due to a difference of acquisitions used in the generation of both DTMs. However, in Fig.7.B, an irregular shape of differences shows negative differences, surrounded by positive differences. These could be due to processing and/or acquisition differences between both DTMs.

Montevideo

Tile artifacts

Fig.7: URY_DTM_1_URB - URY_DTM_2.5_NAT differences releaving tile artifacts over Montevideo, Uruguay. 2D view

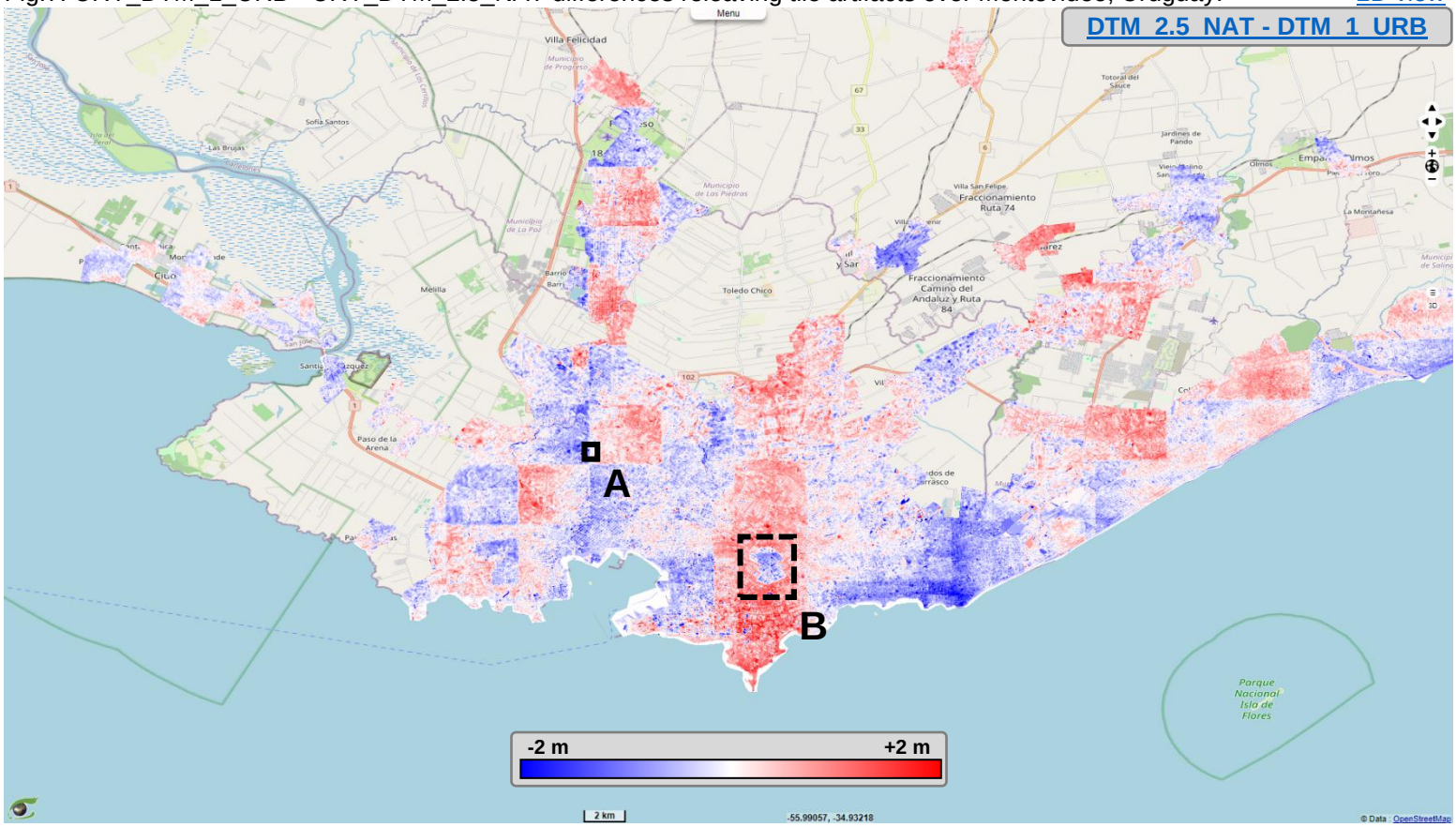
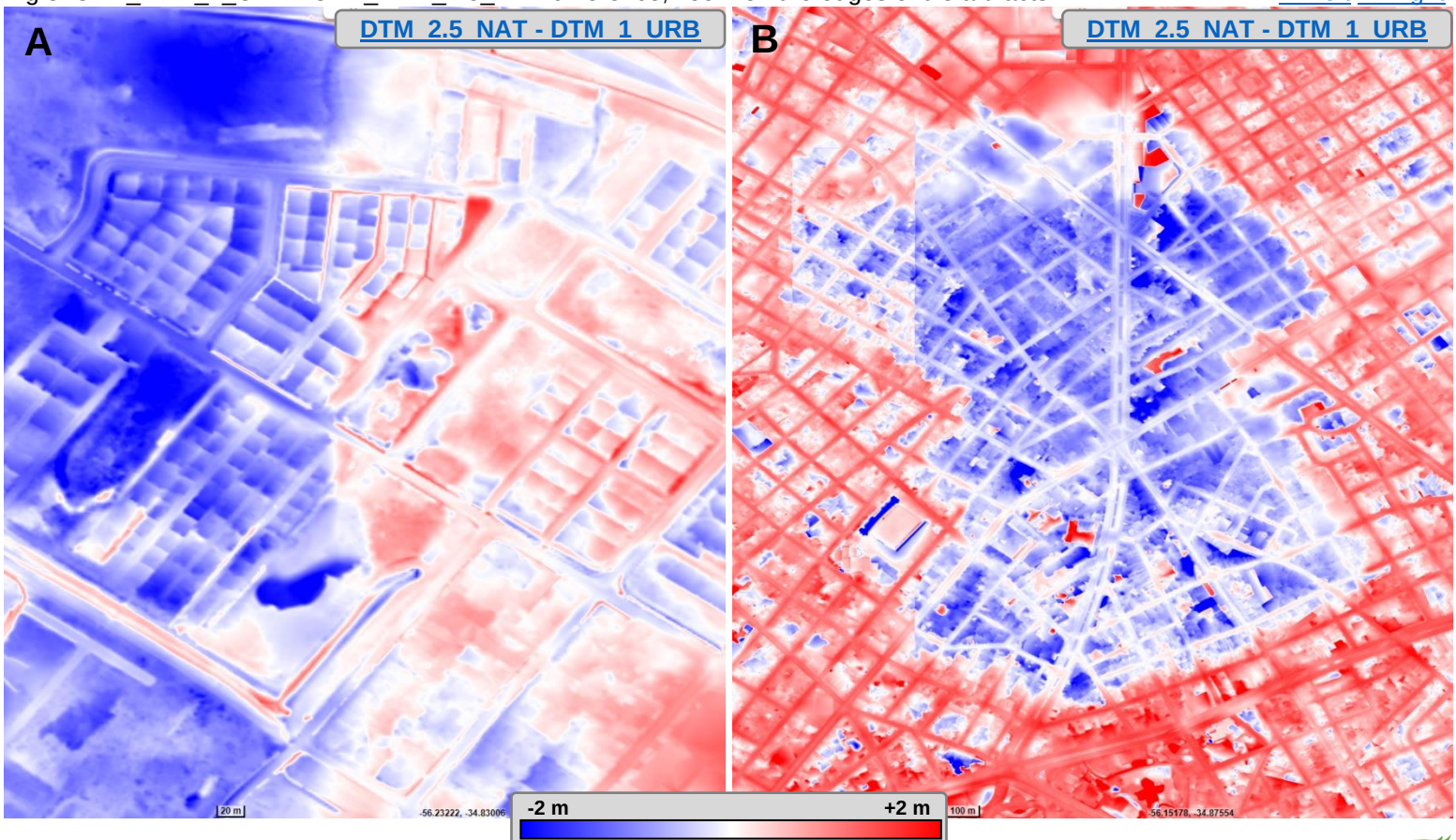


Fig.8: URY_DTM_1_URB - URY_DTM_2.5_NAT difference, zoom on the edges of tile artifacts. 2D left 2D right



This last case study covers the dam of Rincón del Bonete, in Uruguay.

As this last case study is not in an urban area, it is not covered by the URY_DTM_1_URB DTM. As a consequence, only two DTMs are compared: FABDEM v1.2 and URY_DTM_2.5_NAT.

In Fig.9, an overview of URY_DTM_2.5_NAT and FABDEM v1.2 is given. As expected, one can see that the edge of the dam is accurately depicted in the 2.5 metres DTM, while this edge does not form a straight line in FABDEM.

This difference in high frequency details is furthermore highlighted in Fig.10, which showcases the elevation difference between FABDEM and the 2.5 metres DTM. One can see that the differences between both DTMs can reach ±20 metres, not only on the edge of the dam, but also on the East and West side of this area. These phenomena may be due to the different processing used for deriving both DTMs, as the ESA WorldCover map shows mostly tree cover (dark green) on land.

Dam of Rincón del Bonete

Rincón del Bonete

Overview of the dam

Fig.9: URY_DTM_2.5_NAT vs. FABDEM v1.2 over Rincón del Bonete, Uruguay.

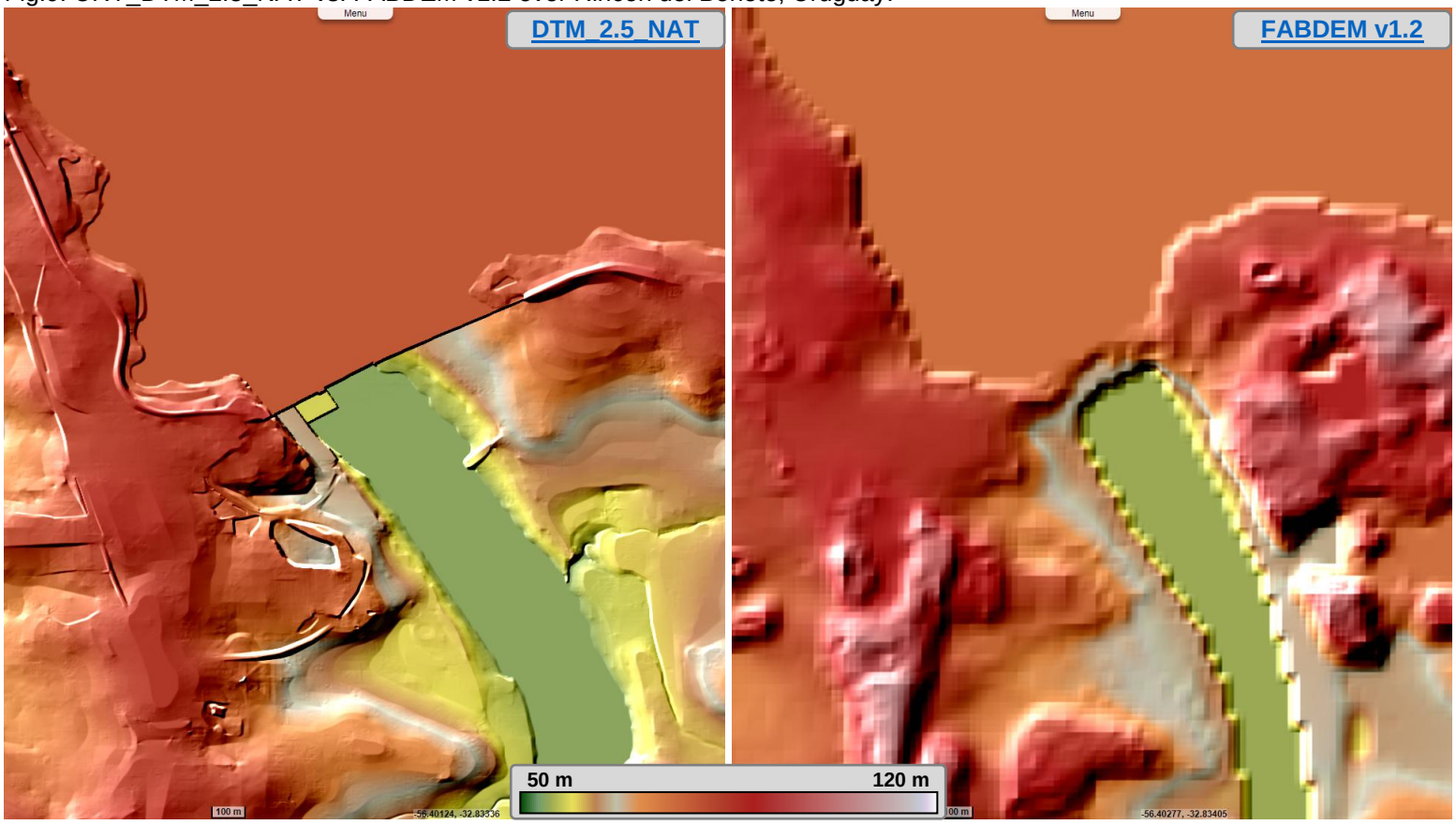


Fig.10: Differences between FABDEM v1.2 and URY_DTM_2.5_NAT over Rincón del Bonete, Uruguay.

2D view