

Surface-Model and Orthophoto Geometry of the UltraCam Osprey 4.1 Barcelona-Beach Set

A gap-free 8 cm DSM/DTM/DTMOrtho coastal delivery, with a bridge-removed terrain variant.

Study data: Vexcel UltraCam Osprey 4.1 — Barcelona Beach, Spain (delivered product set).

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Abstract. The Vexcel UltraCam Osprey 4.1 Barcelona-Beach delivery is a compact coastal product set — DSM, DTM, and seam-lined DTM-orthophotos in RGB and colour-infrared — captured June 2021 at 7.5 cm nominal ground sample distance from 1 550 m above ground. All five rasters share one **8 cm** grid in EPSG: 32631 (UTM 31N) over a 0.443 km² scene. The terrain is near sea level (DTM mean 2.2 m) while the DSM rises to 49.5 m; the normalised surface reaches a **45.2 m** maximum object height with ≈23 % of the scene above 0.5 m. A bridge-removed DTM variant carves bridge decks from the terrain (**1.84 m** maximum removal) so the orthophoto drapes continuous water beneath them. The set is gap-free and geometrically clean, a coastal reference product for multi-site benchmarking.

8 cm

DELIVERED GRID · UTM 31N

45.2 m

MAX OBJECT HEIGHT (NDSM)

1.84 m

BRIDGE-DECK REMOVAL (DTM)

1. Dataset and delivered products

UltraCam Osprey 4.1 (f120), Barcelona Beach, Spain, June 2021; 1 550 m above ground, 7.5 cm nominal GSD, 80 %/60 % overlap; UltraMap v6.6; EPSG:32631. Delivered grid 11 264 × 6 144 px at 0.08 m → 901 × 492 m (0.443 km²). Every raster shares one georeferenced grid, so DSM, DTM, and the two orthophotos overlay pixel-for-pixel; the ortho products carry full overview pyramids.



Figure 1. RGB DTM-orthophoto, 8 cm — marina, urban grid, beach, and breakwater (seam-lined mosaic, gap-free).

2. Surface models

Model	Min / Max	Mean / Std	Valid
DSM	-1.48 / 49.54 m	4.91 / 7.32 m	100 %
DTM	-1.30 / 8.77 m	2.22 / 2.01 m	100 %

The DTM describes a near-flat coastal plain with sub-zero minima over the shoreline margin, while the DSM carries the built and vegetated canopy to ≈ 50 m. Both models are gap-free. The normalised surface has a 45.2 m maximum object height; ≈ 23 % of the scene exceeds 0.5 m and ≈ 12 % exceeds 10 m — the building front — with the remaining four-fifths the beach, esplanade, water, and road. The gap-free DSM/DTM pair is a clean reference for nDSM-driven workflows.



Figure 2. Digital surface model, hillshaded — the building front and harbour structures stand against the near-flat coastal plain.

3. Orthophoto products and bridge-removed variant

The RGB and CIR DTM-orthophotos are 8 cm three-band byte rasters rectified onto the DTM and seam-lined into a single mosaic; an accompanying seam-line raster records the per-pixel source partition. Both are mutually registered, and the colour-infrared product supports vegetation/water discrimination over the same footprint. The delivery also includes a parallel bridge-removed set — a DTM and RGB/CIR orthophotos, but no DSM. Differencing the two DTMs localises the edit to the bridge structures over the water channel, with a maximum vertical removal of 1.84 m. Carving the deck out of the DTM is the hydro-correct treatment: a bridge left in the DTM would lift its pixels and tear the water surface, whereas removing it lets the mosaic drape continuous water beneath the span. The DSM is withheld from this variant because the surface model, by definition the top reflective surface, must retain the bridge — an explicit statement of the surface-versus-terrain contract any orthorectification engine must honour.

Finished-product reference: there is no raw imagery or block orientation, only the rectified deliverables. Its value is as an external accuracy and product-geometry benchmark and a coastal counterpoint to the high-relief inland references in the same series.