Supplementary Materials

The algorithm proposed in Pinton et al. (2020b), is based on the following steps (adapted from Pinton et al. (2020b)).

STEP 1: a regular grid that covers the study domain is used to split the point cloud into subsets, defined as $PC_{n,e}$. These subsets are constituted of the points contained in the grid cells (n,e), which dimension is 30 cm × 30 cm, in this study.

STEP 2: For each point cloud subset $PC_{n,e}$, the elevation of the lowest point is calculated as follows:

$$z_{PC_{n,e}}^{min} = \min_{p \in PC_{n,e}} [z_p], \tag{A1}$$

where z_p is the elevation of the generic point p in $PC_{n,e}$.

STEP 3: a least-squares regression surface $F(x, y)$ is defined by using the coordinates of the lowest points of the nine cells constituting $ST_{n,e}$ (i.e., the group of nine cells, centered in the considered cell (n,e)). The surface is defined as:

$$F(x, y) = \beta_{0,n,e} + \beta_{1,n,e}\, x + \beta_{2,n,e}\, y + \beta_{3,n,e}\, x^2 + \beta_{4,n,e}\, y^2 + \beta_{5,n,e}\, xy, \tag{A2}$$

where $\beta_{0,n,e}$ is the intercept of the plane with a vertical axis passing for the midpoint of $ST_{n,e}$, and $\beta_{1 \ldots 5,n,e}$ are the partial regression coefficients of the regression surface. $\beta_{0,n,e}$ is also the origin of the horizontal coordinates of the surface. The regression plane instead, reads:

$$F(x, y) = \beta_{0,n,e} + \beta_{x,n,e}\, x + \beta_{y,n,e}\, y, \tag{A3}$$

where $\beta_{x,n,e}$ and $\beta_{y,n,e}$ are the eastward and northward slopes of the regression plane, respectively.

<u>STEP 4</u>: the vertical distance between the regression plane and the points of the point cloud contained in $ST_{n,e}$ is calculated as:

$$\Delta z_s^{surface} = [z_s - F(x_s, y_s)]_{s \in ST_{n,e}}, \tag{A4}$$

where x_s, y_s, and z_s are the coordinates of the s^{th} point of the point cloud. The origin of the coordinates x_s and y_s is the midpoint of $ST_{n,e}$.

<u>STEP 5</u>: for each $ST_{n,e}$, the transformed point cloud is obtained by summing the vertical distances $\Delta z_s^{surface}$, calculated for each point at STEP 4, to $\beta_{0,n,e}$. Thus, the elevation of the s^{th} point (z_s^{trans}) is calculated as:

$$z_s^{trans} = \beta_{0,n,e} + \Delta z_s^{surface}. \tag{A5}$$

<u>STEP 6</u>: the elevation of the lowest point of the transformed point cloud ($z_{ST_{n,e}}^{min}$) in $ST_{n,e}$ is calculated as:

$$z_{ST_{n,e}}^{min} = \min_{s \in ST_{n,e}} [z_s^{trans}]. \tag{A6}$$

To conclude, the elevation (z_s^{rel}) of the s^{th} point of the transformed point cloud, relative to the lowest point in $ST_{n,e}$ ($z_{ST_{n,e}}^{min}$), is calculated as follows:

$$z_s^{rel} = z_s^{trans} - z_{ST_{n,e}}^{min}. \tag{A7}$$

References

1. Pinton, D.; Canestrelli, A.; Wilkinson, B.; Ifju, P.; Ortega, A. A new algorithm for estimating ground elevation and vegetation characteristics in coastal salt marshes from high-resolution UAV-based LiDAR point clouds. *Earth Surf. Process. Landforms* **2020**, *45*, 3687–3701, doi:10.1002/esp.4992.