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MDPI

supplementary

X-Ray Computed Tomography as a Tool for Screening Sediment Cores: An Application to the Lagoons of the Po River Delta (Italy)

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Five CT number profiles measured in a central sagittal (along the core axis) slice of core MV7 are shown in Figure S1, using different algorithms and two thicknesses of the investigated slice; the resulting CT images of the core are also reported. For brevity, an annotation is adopted, such as 'MIP (13.2)' to indicate the algorithm used (AIP, MIP or MinIP) and, between brackets, the investigated thickness in millimetres.

The figure emphasises how the measurement of the CT number depends on the setting of the software in which the sediment is observed. In MIP conditions, positive peak values occur whenever a denser structure is encountered. For instance, the presence of a shell valve at ca. 10-cm depth produces the highest CT number value (ca. 2500 HU). An opposite response is obtained in MinIP conditions, with value depletions occurring whenever the beam encounters low-density volumes (e.g., at depths of ca. 390 and 430 mm).

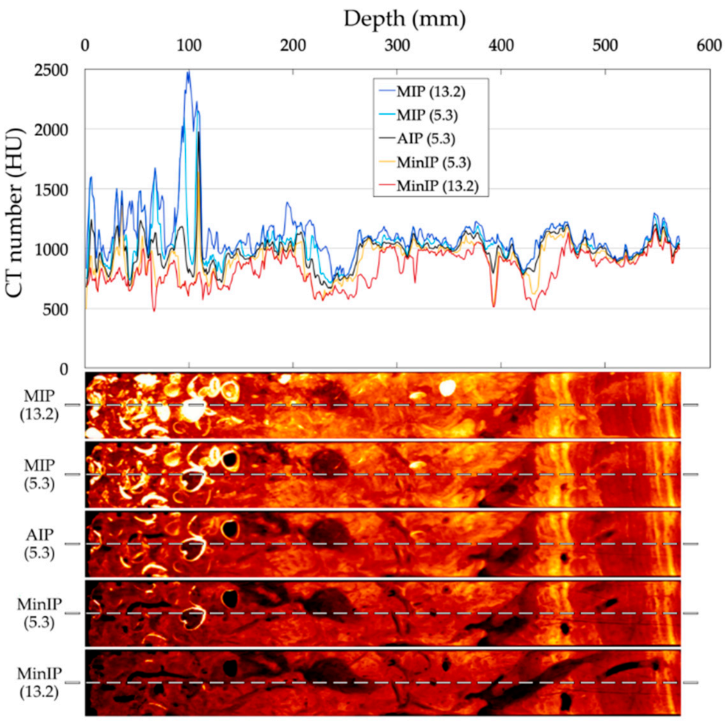

Figure S1. CT number profiles measured in a sagittal slice of core MV7, with five different algorithms and two thicknesses of the investigated slice, and the corresponding CT images of the core; the measurement axis is superimposed.

Even when the CT number is measured on the same sagittal slice with the same software setting, different responses are obtained, depending on the parallel profile positions along the sediment depth. Figure S2 shows the results obtained for core MV7, selecting five parallel profiles (a–e) in AIP (6.2) conditions.

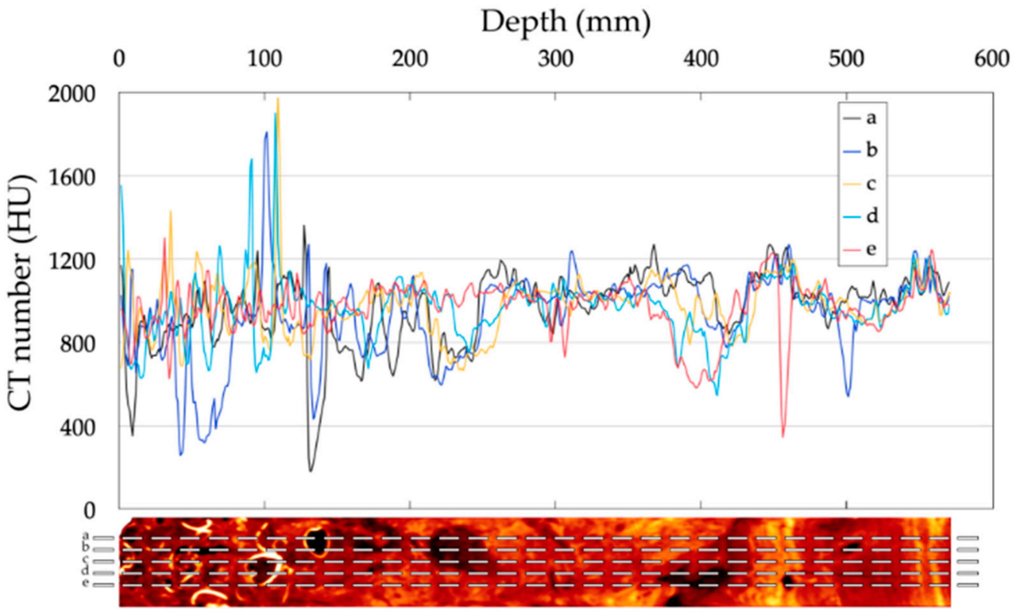

Figure S2. CT number profiles measured in five sagittal slices (a–e) of core MV7 in AIP (6.2) conditions.

At numerous depths along the core, the CT number values differ considerably from one profile to another, due to the presence of denser or less dense volumes, and essentially due to the inhomogeneity of the layers. For instance, Figure S3 reports a detail of sediment core MV7 at 455-mm depth, where among the five profiles, only profile <e> shows a minimum of the CT number, down to 354 HU. The latter is due to the presence of an oblong low-density volume, highlighted in Figure S3c.

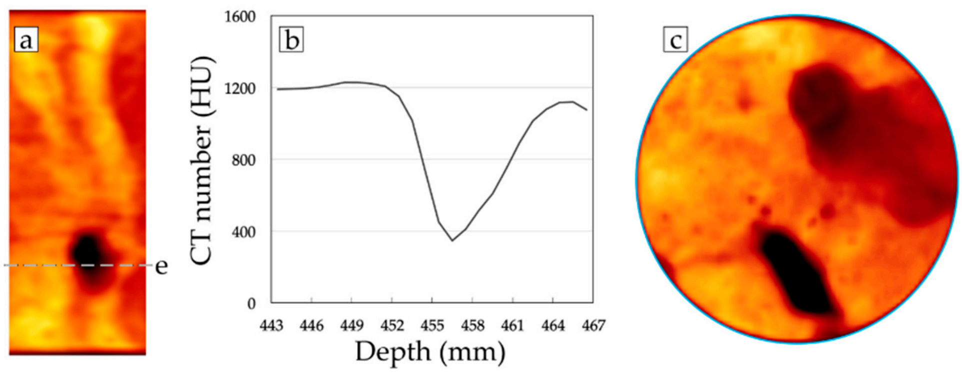

Figure S3. a) Detail of CT image of core MV7 and position of profile <e> shown in Figure S2, where it intersects a low-density volume; **b**) CT number values measured along a segment of profile <e>; **c**) axial CT image of the same low-density volume. Both CT images obtained under AIP (6.2) conditions.

The possibility of investigating small down-core variations in the sediment composition with the CT scan is highlighted in Figure S4. Near the base of core MV7 (at 554-mm depth), two thin high-density sandy laminae (ca. 1240 HU) and their interlayer (ca. 1100 HU) are discriminated with respect to the density characteristics of the under- and overlaying sediments (ca. 1000 HU). Rendered images (c) and (d) highlight the inhomogeneity of the layer, with the denser volumes (silver to gold) standing out from the less dense ones (bronze to dark red).

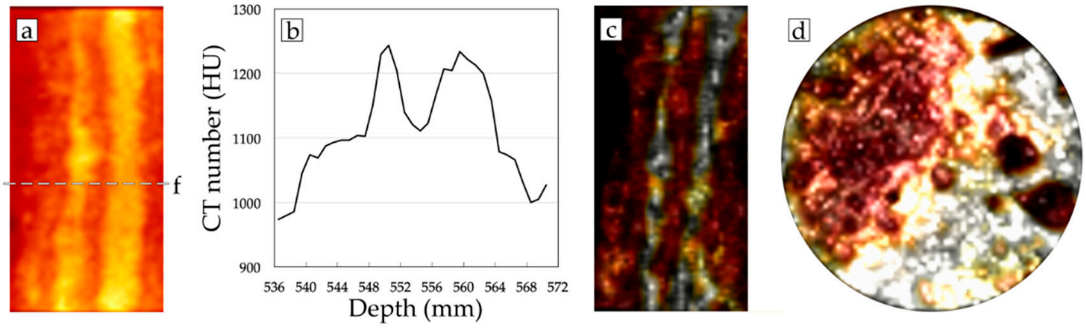

Figure S4. a) Detail of CT image at depths close to the base of core MV7 (around 554-mm depth) and position of the stroke of profile <f> where **b**) CT number is measured in MIP (13.2) conditions. Three-dimensional rendering of **c**) sagittal and **d**) axial sections.

The method described in the main text has been developed to limit such uncertainties and improve the measurement of the CT number in the core slices of interest. It is based on the measuring (in AIP conditions) of the whole axial layer after removing ROIs comprising denser volumes (shell valves) and less dense volumes (bubbles, burrows) that do not belong to the sediment matrix. In this method, using the AIP (rather than the MIP or the MinIP) is quite intuitive.

In Figure S5, a comparison is shown among the regressions obtained with MIP, AIP and MinIP settings with respect to water content (W_C), organic carbon (OC), fine particle content (<16 μm) and total nitrogen (TN). Using the AIP setting produces a higher degree of correlation than in the MinIP setting and is better than the MIP setting in three out of four cases.

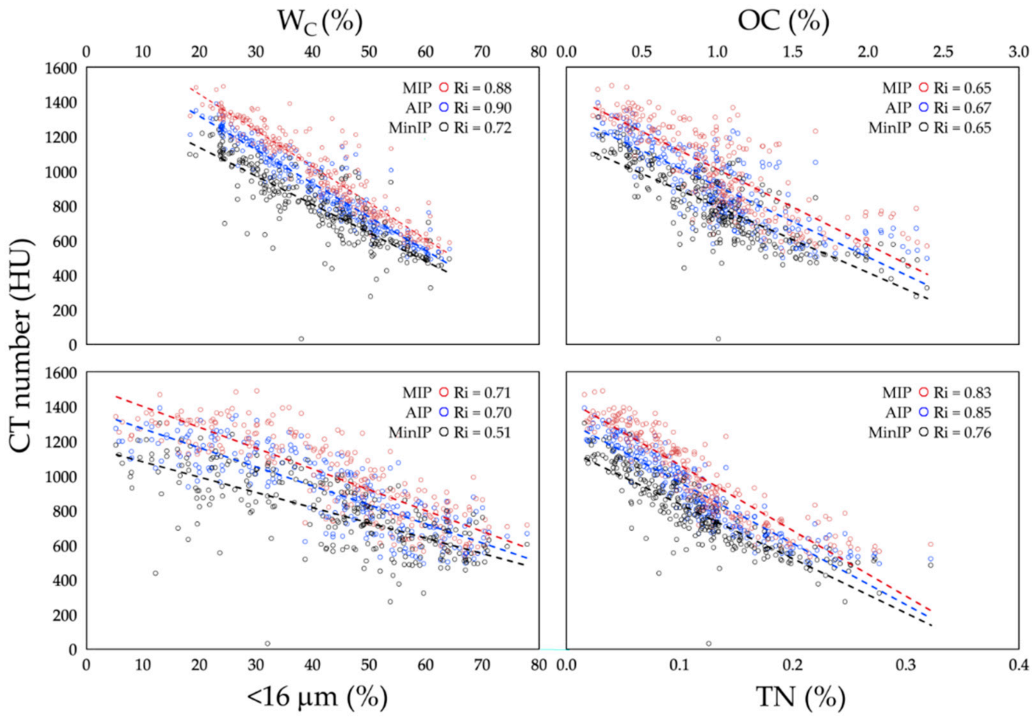

Figure S5. Regressions for CT number obtained with MIP, AIP and MinIP settings with respect to water content (W_C), organic carbon (OC), fine particle content (<16 μm) and total nitrogen (TN).