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Characterising the surface temperatures and the deformations of a civil engineering structure by drone : application to a harbor dock

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Platforms are artificial plane surfaces allowing the building of harbors and industrial areas on the ocean. Internal water flows removing fine materials because of sealing defaults may lead to cavity formation and/or decompressed areas inside the platforms at depth, as well as surface deformations. Such events may then produce an important weakening of the structures.
This work presents visible (5 mm resolution) and thermal infrared (40 cm resolution) observations at two different seasons obtained with a drone on two harbor docks, where internal water flows occur. These data are georeferenced using 27 ground control points (GNSS-RTK method).
Our observations reveal the presence of thermal anomalies at the surface of the docks, with temperature contrasts reaching up to 4˚C with their surrounding environment. Using numerical modeling, we show that these observations can not be explained neither by thermal conductivity differences, nor by optical parameters spatial variations (albedo and emissivity).
Nevertheless, the observed thermal anomalies are clearly correlated to circular surface deformations obtained using the photogrammetric method. Different hypotheses may be invoqued to explain these surface temperatures : 1) water infiltration within the micro-fracturing associated to the surface deformations and/or 2) a preferential evaporation process occuring within the fractures and removing energy from the soil. Our work shows the potentiality of the combination of the thermal infrared and photogrammetric methods for the indirect detection of cavities/decompressed soils on civil engineering structures.