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**DOI**
10.5194/egusphere-egu24-8191

**Publication date**
2024

**Document Version**
Final published version

**Citation (APA)**
Diaz, V., van Oosterom, P., Meijers, M., Verbree, E., Ahmed, N., & van Lankveld, T. (2024). *Comparison of cloud-to-cloud distance calculation methods for change detection in spatio-temporal point clouds*. Abstract from EGU General Assembly 2024, Vienna, Austria. https://doi.org/10.5194/egusphere-egu24-8191

EGU24-8191, updated on 02 May 2024
https://doi.org/10.5194/egusphere-egu24-8191
EGU General Assembly 2024


# Comparison of cloud-to-cloud distance calculation methods for change detection in spatio-temporal point clouds

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The advantages of using point clouds for change detection analysis include comprehensive spatial and temporal representation, as well as high precision and accuracy in the calculations. These benefits make point clouds a powerful data type for spatio-temporal analysis. Nevertheless, most current change detection methods have been specifically designed and utilized for raster data. This research aims to identify the most suitable cloud-to-cloud (c2c) distance calculation algorithm for further implementation in change detection for spatio-temporal point clouds. Eight different methods, varying in complexity and execution time, are compared without converting the point cloud data into rasters. Hourly point cloud data from monitoring a beach-dune system's dynamics is used to carry out the comparison. The c2c distance methods are (1) the nearest neighbor, (2) least squares plane, (3) linear interpolation, (4) quadratic (height function), (5) 2.5D triangulation, (6) natural neighbor interpolation (NNI), (7) inverse distance weight (IDW) and (8) multiscale model to model cloud comparison (M3C2). We evaluate these algorithms, considering both the accuracy of the calculated distance and the execution time. The results can be valuable for analyzing and monitoring the (build) environment with spatio-temporal point cloud data.

**Key terms**: point cloud, spatio-temporal analysis, c2c distance, beach-dune system

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