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Tomographic iterative reconstruction of a passive scalar in a 3D turbulent flow

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Turbulence in the planetary boundary layer controls the exchange fluxes of passive and active tracers between the Earth's surface and the atmosphere. In climate and meteorological models, such effects of turbulence need to be parameterized, ultimately based on experimental data. A novel modeling/experimental approach is being developed within the COMTESSA project in order to study turbulence statistics at high resolution. Using controlled tracer releases, high-resolution camera images and estimates of the background radiation, different tomographic algorithms can be applied in order to obtain time series of 3D representations of the scalar dispersion. In a preliminary work we used using synthetic data to investigate different reconstruction algorithms with emphasis on algebraic iterative methods. We study the dependence of the reconstruction quality on the discretization resolution and the geometry of the experimental device in both 2 and 3-D cases. We assess the computational aspects of the iterative algorithms focusing of the phenomenon of semi-convergence applying a variety of stopping rules. We discuss the applicability of the methodology to the data collected during the 2017 measurement campaign and its associated numerical simulations.