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Tobac - a Lagrangian framework for object-based analysis of clouds

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A newly developed framework for tracking and analyzing individual clouds is presented. It consists of an open-source python package called “tobac” or “Tracking and Object-Based Analysis of Clouds”. The software package aims to handle very different types of input data, e.g. cloud-microphysical and dynamical properties from cloud-resolving model simulations or observational fields like geostationary satellite data. Tobac has been designed to flexibly use either two- or three-dimensional time-varying input. As core part of tobac, a Lagrangian analysis is performed in several subsequent steps: In the first step, selected cloud fields are transformed into a set of features using e.g. threshold-based segmentation techniques. In the second step, cloud features are tracked in time and based thereon connected graphs of various complexity are built. And finally, characteristics of the clouds are collected along the tracks and statistically analyzed. The work flow of the current tobac methodology is highlighted based on a few examples. Future development is planned as a collaborative effort between University of Oxford and TROPOS in Leipzig. It is aimed to incorporate a set of additional object identification and tracking methodologies, including multi-spectral techniques for identification of convective clouds in geostationary satellite data and an extension of overlap-based tracking approaches.