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# Autonomous Assessment of Source Area Distributions for Sections in Lagrangian Particle Release Experiments

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Lagrangian experiments for particle tracing in atmosphere or ocean models and their analysis are a cornerstone of earth-system studies. They cover diverse study objectives such as the identification of pathways or source regions. Data for Lagrangian studies are generated by releasing virtual particles in one or in multiple locations of interest and simulating their advective-diffusive behavior backwards or forwards in time. Identifying main pathways connecting two regions of interest is often done by counting the trajectories that reach both regions. Here, the exact source and target region must be defined manually by a researcher. Manually defining the importance and exact location of these regions introduces a highly subjective perspective into the analysis. Additionally, to investigate all major target regions, all of them must be defined manually and the data must be analyzed accordingly. This human element slows down and complicates large scale analyses with many different sections and possible source areas.

We propose to significantly reduce the manual aspect by automatizing this process. To this end, we combine methods from different areas of machine learning and pattern mining into a sequence of steps. First, unsupervised methods, i.e., clustering, identify possible source areas on a randomized subset of the data. In a successive second step, supervised learning, i.e., classification, labels the positions along the trajectories according to their most probable source area using the previously automatically identified clusters as labels. The results of this approach can then be compared quantitatively to the results of analyses with manual definition of source areas and border-hitting-based labeling of the trajectories. Preliminary findings suggest that this approach could indeed help greatly to objectify and fasten the analysis process for Lagrangian Particle Release Experiments.