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Cloud tracking in geostationary satellite data: Comparison of two Matching Methods

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Tracking clouds in satellite data has multiple applications. It is used for short-term weather forecasting as well as long-term weather and climate analyses. Our long-term goal is to investigate cloud lifecycles under different conditions, such as marine or continental areas, over deserts, or in areas with increased anthropogenic aerosols. This is a key element in understanding cloud radiation effects and the human influence on the cloud lifecycle.

To identify clouds and their trajectories, we are using Particle Image Velocimetry (PIV) which is well-known for measuring velocities in fluid dynamics. The algorithm works on the cloud mask from CLAAS2 (Cloud property dataset using SEVIRI v2) by EUMETSAT (2014 Stengel et al, "CLAAS: the CM SAF cloud property dataset using SEVIRI"). The mask is created with a multi-channel approach using satellite data from SEVIRI. However, the presented algorithm can be adapted to work on any geostationary satellite data set. It identifies clouds in the satellite data and computes a velocity field with the next timestep using cross correlation. This velocity field is interpolated onto the individual clouds and the virtual positions (old positions adjusted with velocity field) are then compared against the next timestep of clouds via a matching criterion. Previously only the distance of the centroids was used for this criterion. Now the overlapping area is used as well in sequence with the distance. This improves the capability to track large clouds immensely because they are more likely to have large shifts in their centroid due to a change in shape.

The presented results are twofold. Firstly, we will show a comparison of individual cloud trajectories between both methods to establish a deeper understanding of the methodology. Secondly, we will look at the distributions of the cloud sizes and trajectory lengths for both methods to see the overall improvement that can be gained from the updated matching criterion.