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FORMATION TECHNOLOGY IN THE CLOUDCT MISSION TO USE COMPUTED TOMOGRAPHY
FOR CHARACTERIZING THE INTERIOR OF CLOUDS TO ACHIEVE IMPROVED CLIMATE
PREDICTION**Abstract**

In climate predictions models clouds are one of the most significant uncertainty factors, due to their impact on Earth's albedo and on water transport through the atmosphere. While typical satellite observations address the dynamics by imaging the cloud surface, in the CloudCT-mission the backscattered Sun light is collected from different perspectives by a formation of distributed and networked small satellites. Here technology implementation of related formation technologies at the limitations of a 3U-CubeSat will be addressed. Technology challenges relate to coordination of 10 small satellites for joint observations of backscattered Sun light, suitable for subsequent processing by computed tomography methods.

Relevant satellite control information is exchanged via inter-satellite links to form the basis for self-organization of orbit positions and attitudes. Relative distances and relative orientations of all cooperating satellites are to be acquired for the implemented networked control approach for formation control. These technologies have been developed and tested by hardware-in-the-loop tests on ground using turntables providing high precision and high dynamics capabilities.

In 2023 launch is planned for the precursor mission TOM (Telematics earth Observer Mission), composed of three 3U-CubeSats to practice implementation of joint observation and sensor data fusion strategies. Its main focus is on 3D-imaging of ash clouds ejected from volcano eruptions and subsequent photogrammetric data processing of data acquired from different perspectives. An additional fourth satellite evaluates in orbit the performance of the selected CloudCT camera. Related computed tomography data processing principles have already been tested by aircraft campaigns. Thus most relevant technology aspects will be prepared before the planned launch in 2024 of the satellite formation CloudCT, composed of 10 self-organizing CubeSats.