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Aerosol-cloud interactions from combined observations with geostationary and polar-orbiting sensors

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Atmospheric aerosol particles are of great importance for cloud formation in the atmosphere because they are needed to act as cloud condensation nuclei (CCN) in liquid-water clouds and as ice nucleating particles (INP) in ice-containing clouds. Changes in aerosol concentration affect the albedo, development, phase, lifetime and rain rate of clouds. These aerosol-cloud interactions (ACI) and the resulting climate effects still cause the largest uncertainty in assessing climate change as they are understood only with medium confidence.

The PACIFIC project, which is embedded in the French-German Make Our Planet Great Again (MOPGA) initiative, aims to improve our understanding of ACI by enhancing the representation of those aerosols that are relevant for cloud processes and by quantifying temporal changes in cloud properties throughout the cloud life cycle. PACIFIC uses a three-fold approach for studying ACI based on spaceborne observations by (i) using spaceborne lidar data to obtain unprecedented insight in CCN and INP concentrations at cloud level opposed to using column-integrated parameters, (ii) characterizing the development of clouds by tracking them in time-resolved geostationary observations opposed to resorting to the snap-shot view of polar-orbiting sensors, and (iii) combining the detailed observations from polar-orbiting sensors with the time-resolved observations of geostationary sensors – for clouds observed by both – to study the effects of CCN and INP on the albedo, liquid and ice water content, droplet and crystal size, development, phase and rain rate of clouds within different regimes carefully accounting for the meteorological background.

This contribution will present the scope of the MOPGA-GRI project PACIFIC and illustrate the first findings.