

Statistics of aerosol and clouds interactions from satellite measurements

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The goal of the ESA project “Statistics of AeRosol and CLOUDs INteractions from satellite” (STARCLINT) is to obtain a quantitative assessment of the interactions between suspended aerosol particles and clouds. Such interactions are thought to vastly determine the settings of our climate system and, therefore, to shape human activities and well-being. The long-term observational record provided by satellites enables the assessment of robust statistical relationships between atmospheric particulate and clouds, despite the superimposed modulation of regional-to-continental and mesoscale meteorology. Making use of the data sets generated within the ESA Aerosol, Cloud and Sea Surface Temperature (SST) Climate Change Initiative (CCI) activities, together with supplementary informations of complementary ground-based and spaceborne records, suitable local regimes of cloud and aerosol properties are identified, that are considered natural laboratories in which the meteorology is singled out. Following this observational-based approach, three questions are addressed: (1) to what extent the satellite records, generated with different techniques, are representative of the properties of the same cloud parts? (2) What corrections are needed for merging time series of columnar vs vertically resolved properties? (3) How to identify cloud and ice condensation nuclei (CCN/IN)? The outcome of STARCLINT is the identification of observational spatio-temporal constraints as well as of ranges of confidence in the satellite data sets enabling a geophysical assessment of local interactions in specific regional environmental conditions, as quantified by in-situ networks. Devising this established logical framework, the full length and geographical coverage of satellite records can be exploited, making a step toward an improved knowledge of the hydrological cycle.