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Application of COSMO-SPECS for remote sensing observations of mixed-phase clouds during CyCare and DACAPO-PESO

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During the campaigns CyCyare (Limassol, Cyprus) and DACAPO-PESO (Punta Arenas, Chile), remote sensing methods were applied to study mixed-phase clouds. The two sites show contrasting aerosol loads with very clean, marine atmosphere over southern Chile and higher aerosol mass and number concentrations over Cyprus, which frequently are dust-laden. The observations suggest differing cloud properties. To further study the properties and evolution of the observed clouds as well as their relation to the ambient aerosol, the detailed coupled cloud microphysical model COSMO-SPECS is applied for selected real case studies.

The SPECtral bin cloud microphysicS model SPECS was developed to simulate cloud processes using fixed-bin size distributions of aerosol particles and of liquid and frozen hydrometeors. It was implemented in the numerical weather prediction model COSMO. COSMO-SPECS has been used for idealized case studies with horizontally periodic boundary conditions. Recently, the model system has been enhanced by considering lateral boundary conditions for the hydrometeor spectra allowing for high-resolution real case studies on nested domains. The simulations are carried out by first applying the meteorological driver COSMO using its standard two-moment microphysics scheme on multiple nests with increasing horizontal resolution. Finally, the COSMO-SPECS model system is applied on the innermost domain with a horizontal resolution of a few hundred meters using boundary data derived from the finest driving COSMO domain. For this purpose, the bulk hydrometeor fields of the driving model need to be translated into the corresponding hydrometeor mass and number distributions of SPECS' hydrometeor spectra.

In this work, we present first results for selected case-studies of mixed-phase clouds observed during CyCyare and DACAPO-PESO. The results of the model simulations are compared against the LIDAR and cloud radar observations at the two sites.