Aerosols over the Mediterranean

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Aerosols are among the most effective drivers for regional climate change. Fine and coarse particles larger than 250 nm directly affect the earth's radiation balance in the shortwave as well as in the longwave spectral window by scattering and absorption. These direct effects reduce the radiation reaching the ground and affect the vertical stability of the atmosphere. Also the energy available for the initiation of convection is affected and energy input into elevated altitude levels further stabilizes the atmospheric boundary layer. Indirectly fine and coarse particles may also affect cloud properties and thus the temporal and spatial distribution of rainfall. Probably most effective for the atmospheric water cycle are smaller and invisible particles in the size ranges from 40 to 250 nm. These particles, mainly originating from forest fires and anthropogenic activities, do not interact directly with shortwave or longwave radiation but can be very effective as cloud condensation nuclei (CCN). As such they control the cloud droplet size distribution, the time required to generate raindrops and finally cloud albedo and lifetime. Enhanced number concentrations of these aerosols may even lead to a total suppression of rainfall from certain cloud types and a shift from frequent low rainfall intensity towards longer drought periods terminated by torrential rainfall.

The currently observed regional climate change in the eastern and western basins of the Mediterranean might be affected by changes and trends in the different major contributions to the aerosol budget such as dust, biomass burning or anthropogenic ultrafine aerosols. Although well known within the Mediterranean as major air pollution or dust, reducing visibility and solar radiation, dust and forest fire aerosol budgets and possible trends are still difficult to derive. The ultrafine aerosol fraction allows a more detailed investigation as well known anthropogenic sources contribute the majority of aerosols in this size range. Airborne measurements in the western basin over the islands of Lampedusa, Corsica, Malta and Southern France between 1998 and 2013 will be presented and compared to a few measurements available from early studies in the seventies of the ultrafine particle abundance over the Mediterranean.