Geophysical Research Abstracts
Vol. 19, EGU2017-12966, 2017
EGU General Assembly 2017

Vertical profiles of fine and coarse aerosol particles over Cyprus: Comparison between in-situ drone measurements and remote sensing observations

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Vertical profiles of the aerosol mass concentration derived from light detection and ranging (lidar) measurements were compared to airborne dried optical particle counter (OPC MetOne; Model 212) measurements during the INUIT-BACCHUS-ACTRIS campaign. The campaign took place in April 2016 and its main focus was the study of aerosol dust particles. During the campaign the NOA Polly-XT Raman lidar located at Nicosia (35.08° N, 33.22° E) was providing round-the-clock vertical profiles of aerosol optical properties. In addition, an unmanned aerial vehicle (UAV) carrying an OPC flew on 7 days during the first morning hours. The flights were performed at Orounda (35.1018° N, 33.0944° E) reaching altitudes of 2.5 km a.s.l, which allows comparison with a good fraction of the recorded lidar data.
The polarization lidar photometer networking method (POLIPHON) was used for the estimation of the fine (non-dust) and coarse (dust) mode aerosol mass concentration profiles. This method uses as input the particle backscatter coefficient and the particle depolarization profiles of the lidar at 532 nm wavelength and derives the aerosol mass concentration. The first step in this approach makes use of the lidar observations to separate the backscatter and extinction contributions of the weakly depolarizing non-dust aerosol components from the contributions of the strongly depolarizing dust particles, under the assumption of an externally mixed two-component aerosol. In the second step, sun photometer retrievals of the fine and the coarse modes aerosol optical thickness (AOT) and volume concentration are used to calculate the associated concentrations from the extinction coefficients retrieved from the lidar. The estimated aerosol volume concentrations were converted into mass concentration with an assumption for the bulk aerosol density, and compared with the OPC measurements. The first results show agreement within the experimental uncertainty.
This project received funding from the European Union's Seventh Framework Programme (FP7) project BACCHUS under grant agreement no. 603445, and the European Union's Horizon 2020 research and innovation programme ACTRIS-2 under grant agreement No 654109.