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Unmanned Aerial Vehicles for the Joint Aeolus Tropical Atlantic Campaign

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During June 2022, the Cyprus Institute (CyI) took part in the ASKOS experiment in Mindelo, Cape Verde, with several of Unmanned Aerial Vehicles (UAVs), fitted with a number of in-situ aerosol instruments able to profile the Saharan Air Layer between the surface and an altitude of 5,300 m. In addition to ASKOS objectives, transnational access project Diurnal vAriation of the vertically resolved siZe distribution in the Saharan Air Layer (DAZSAL) was also carried out at the same time. The campaign aimed at validating the Aeolus L2A product in the presence of dust and marine aerosols, estimating the influence on Aeolus products of non-spherical particles, evaluating the impact of particle orientation, and study the diurnal cycle of the dust size-distribution at high altitude. In this presentation we will present and discuss the scientific objectives, the context, the Unmanned Aerial Systems (UASs) that we developed in-house, and the instruments used, together with their limitations, calibration methods, uncertainties, challenges and difficulties encountered. We will also discuss the logistical and planning challenges that such a campaign entails.

Operations took place from the Cesaria Evora International Airport. The instruments deployed on-board the UAVs permitted to evaluate the height-resolved particle size-distribution between 0.1 and 40 µm and detect cases of particle orientation, to complement the observations with ground-based remote sensing set out by NOA and TROPOS. Moreover, 24 high-altitude dust samples were collected on impactors, for further analysis by Scanning Electron Microscopy. In total, 25 scientific flights were performed on 12 flying days (almost half of which at night). Five flights were conducted during Aeolus overpasses. Weather has been a determining factor for both the ground-based remote sensing operations and the UAS operation, and airport traffic has been another

constraint that needed to be accounted for, in the UAS operation.