Validation of the ocean products from the space-borne ATLAS, ALADIN and CALIOP and air-borne LNG lidars

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Remote sensing of ocean color has changed our vision of the distribution of phytoplankton and ocean carbon for the past forty years. These space-borne observations provide synoptic view of the concentrations of radiometric, bio-optical and biogeochemical parameters, continuously for the past twenty-+ years at high spatial (hundreds to thousand meters) and temporal (~2 days) resolutions. However, these observations are limited to clear-sky, day-light, over clouds, high Sun elevation angles and are exponentially weighted toward the ocean surface. Furthermore, they require a processing step to remove the contribution of the atmosphere and the air-sea interface.

Active remote sensing can overcome these limitations of passive space-borne ocean color observations. One of these techniques is. As an active remote sensing technique, it can overcome some of the above-mentioned limitations of passive observations. Despite several cases that demonstrated oceanic applications of ship-, air- and space-borne lidars, this tool has not received significant attention from the ocean color remote sensing community. Three space-borne lidars (CALIOP, ATLAS and ALADIN) are currently in space and several studies showed their interest in retrieval key oceanic optical parameters, i.e. the particulate back-scattering b_{bp} and the diffuse attenuation K_d coefficients. CALIOP and ATLAS are green lidars (532 nm) while ALADIN is a UV lidar (355nm) and using the High Spectral Resolution technique. While ocean processing algorithms were developed for CALIOP and ATLAS, there is no ocean products for ALADIN as it aims at estimating the atmospheric wind. Few validations have been made for the oceanic products from CALIOP and ATLAS.

During the CADDIWA campaign in Cabo Verde in September 2021, in-situ optical (remote sensing reflectance, profile of the diffuse attenuation coefficient), bio-optical (absorption and back-scattering coefficients) and biogeochemical (chlorophyll-a concentration and particulate organic carbon at different depths) parameters were collected during sixth one-day at sea. These in-situ measurements were coordinated with the overpasses of the CALIOP (one day), ATLAS (one day) and ALADIN (four days) and the French airborne lidar LNG (five days). Validation of

space-borne lidar oceanic products will be shown. Moreover, capabilities of the LNG to study the ocean will also be investigated and presented.