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Unmanned Aerial Systems as Part of a Multi-Component Assessment Strategy to Address Climate Change and Atmospheric Processes

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Unmanned Aerial Systems (UAS) have been established as versatile tools for different applications, providing data and observations for atmospheric and Earth-Systems research. They offer an urgently needed link between in-situ ground based measurements and satellite remote sensing observations and are distinguished by significant versatility, flexibility and moderate operational costs.

UAS have the proven potential to contribute to a multi-component assessment strategy that combines remote-sensing, numerical modelling and surface measurements in order to elucidate important atmospheric processes. This includes physical and chemical transformations related to ongoing climate change as well as issues linked to aerosol-cloud interactions and air quality.

The distinct advantages offered by UAS comprise, to name but a few: (i) their ability to operate from altitudes of a few meters to up to a few kilometers; (ii) their capability to perform autonomously controlled missions, which provides for repeat-measurements to be carried out at precisely defined locations; (iii) their relative ease of operation, which enables flexible employment at short-term notice and (iv) the employment of more than one platform in stacked formation, which allows for unique, quasi-3D-observations of atmospheric properties and processes.

These advantages are brought to bear in combining in-situ ground based observations and numerical modeling with UAS-based remote sensing in elucidating specific research questions that require both horizontally and vertically resolved measurements at high spatial and temporal resolutions. Employing numerical atmospheric modelling, UAS can provide survey information over spatially and temporally localized, focused areas of evolving atmospheric phenomena, as they become identified by the numerical models. Conversely, UAS observations offer urgently needed data for model verification and provide boundary conditions for numerical models.

In this presentation, we will briefly describe the current elements of our observational capabilities that enable the aforementioned multi-component assessment strategy by the Unmanned Systems Research Laboratory of the Cyprus Institute. This strategy is applied and utilized in the context of the EU-funded BACCHUS project, aside from other tasks. The ongoing and planned observations are particularly relevant as they are carried out in the Eastern Mediterranean and the Middle East, a region characterized by increasing anthropogenic pressures and ongoing and anticipated severe climatic changes and their impacts.