Making of a Portable and Cost-effective Particulate Matter Monitoring System. General Outlines of the *PRECEPT* Project

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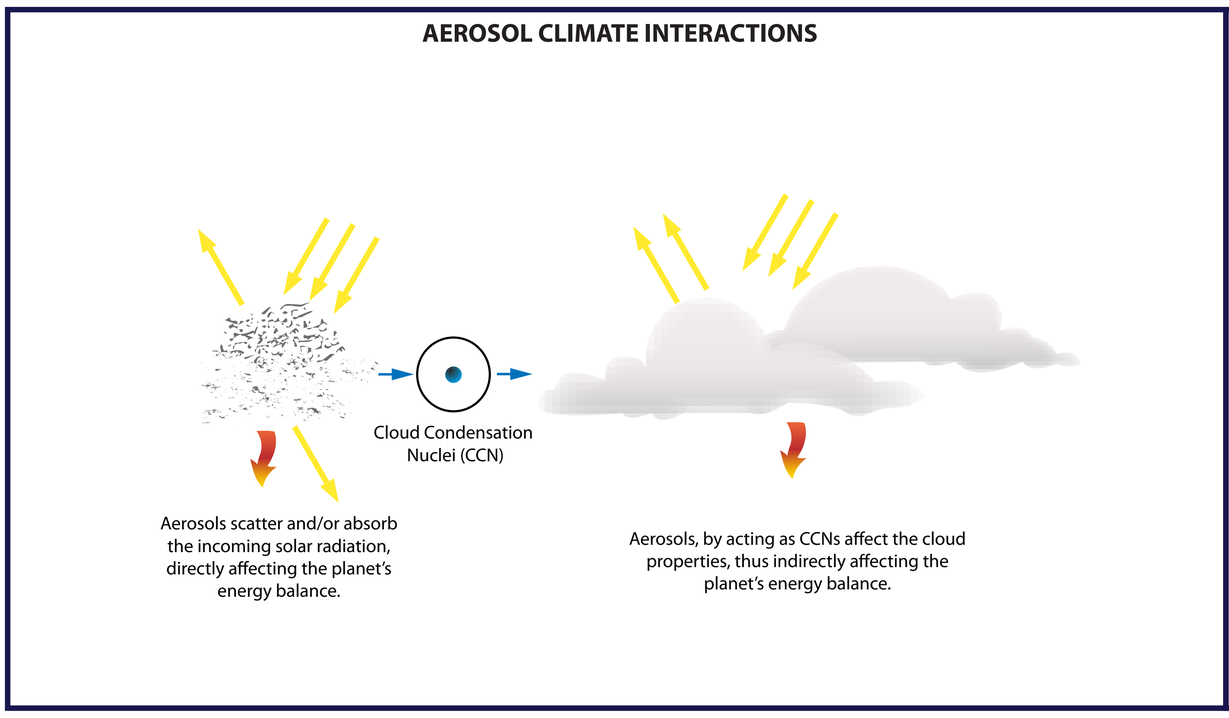
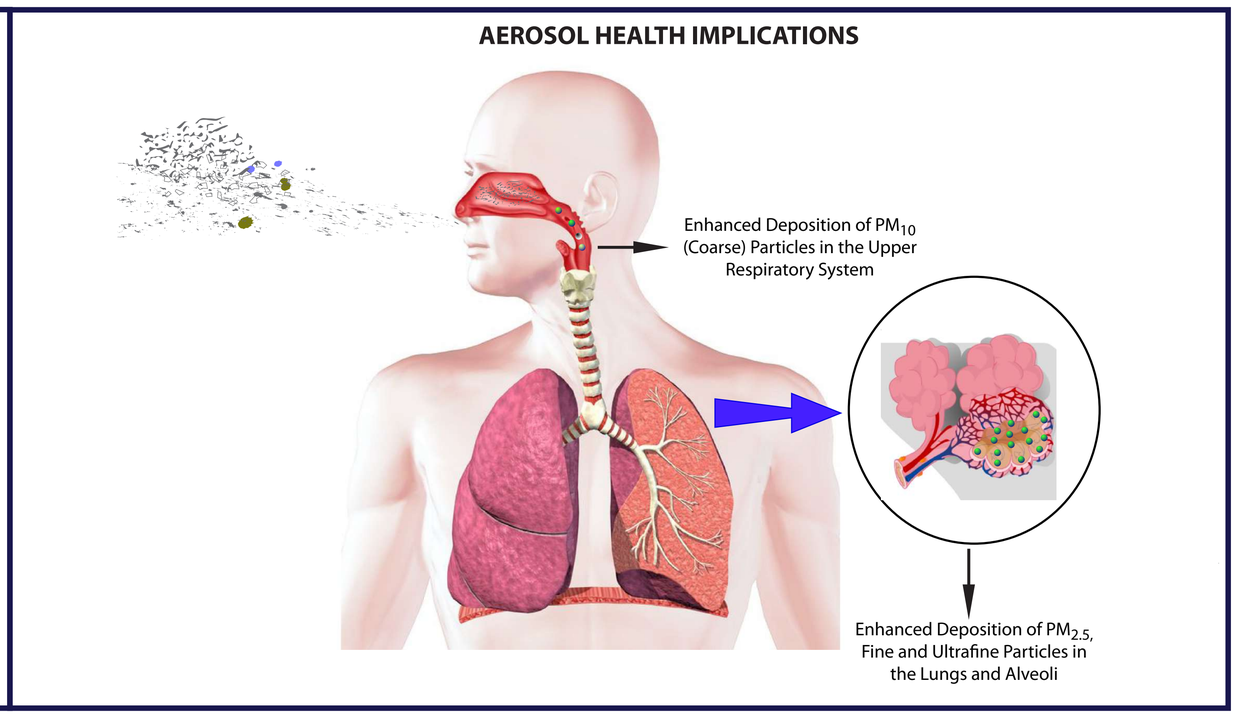
Intrduction

Measuring the size and concentration of Particulate Matter (PM) is highly required to understand its impacts on human health and on the environment (McMurry, 2000). In particular, particles affect the energy balance of the planet directly by absorbing or scattering incoming solar radiation and indirectly by acting as cloud condensation nuclei, thus affecting the cloud properties, while in addition their deposition efficiency at diffrent parts of the human respiratory system depends on their size. In addition, PM measurements of high spatial and temporal resolution can be employed for recognizing air polution "hot spots". Various state of the art techniques/instruments are employed for measuring the size and concentration of PM on a real time resolution, mainly based on either optical methods (e.g., optical particle counter; OPC) or electrical mobility classification techniques (e.g., Scanning Mobility Particle Sizer; SMPS). While being very accurate, these instruments are associated with increased costs and in some cases (e.g., for the SMPS systems) low portability. Latest advances in the field of aerosol instrumentation allow for more cost effective and lightweight instruments (e.g., Barmpounis et al., 2016, Bezantakos et al., 2018), thus facilitating the tasks of increasing the spatial/temporal resolution of PM measurements. Portable and Cost-effective Particulate Matter Monitoring System (***PRECEPT***) is a project for promoting Research, Technological Development and Innovation, financed by the Research Promotion Foundation of Cyprus, under the pillar Sustainable RTDI System. This innovative 3-year project aims to develop a portable and cost-effective monitoring system from determining the properties of atmospheric aerosols (i.e the concentration, size and mass), in order to determine their influence on air quality, and thus in assessing their potential health and climate effects.





Methods

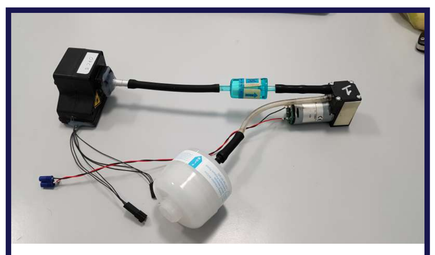
In order to fulfil the project main goals, the latest technological advances in the fields of aerosol instrumentation, electronics, and wireless communication networks will be combined. The 3-year project's articulated strategy involves:

i) The evaluation of currently available and/or newly developed technologies.

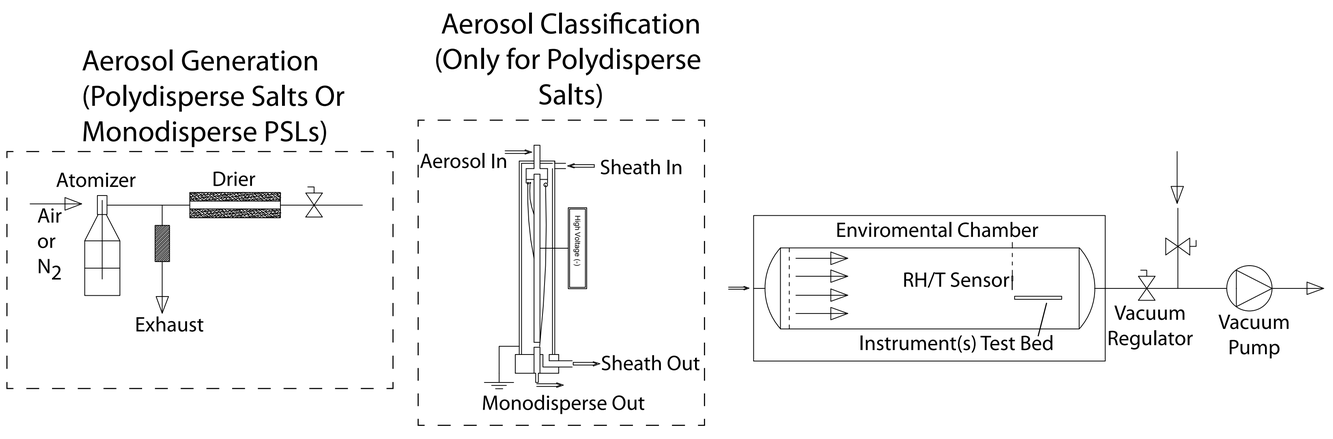
ii) Design and construction of a prototype, using modern techniques.

iii) Testing of the prototype in laboratory conditions

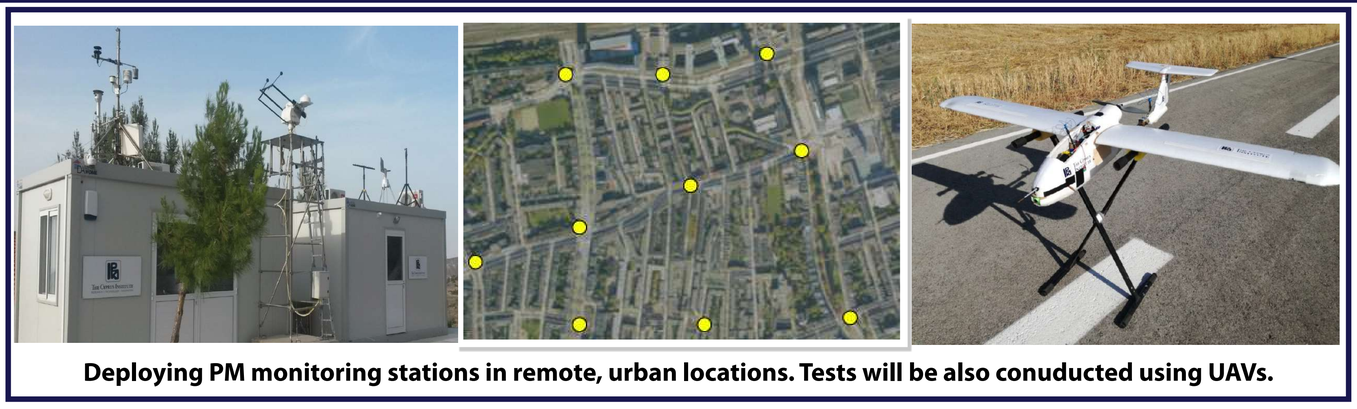
iv) Deployment of a few units for measureing at real-life, in-situ conditions and onboard UAVs.



Modification of a cost effective-lightweight OPC for further evaluation of its performance



Laboratory setup for testing the sizing and counting efficiency of modified instruments at various temperature and pressure conditions



Deploying PM monitoring stations in remote, urban locations. Tests will be also conuducted using UAVs.

Expected Outcomes

The holistic approach of the ***PRECEPT*** project is expected to result in developing of a **portable**, **cost-effective** PM monitoring station with integrated wireless **networking capabilities**, able for remote, urban, indoor and onboard Unmanned Arial Vehicle (UAV) deployment. Through the progress of the project, scientific results regarding the performance of the available/newly developed aerosol instrumentation and of the prototype at both laboratory and in-situ conditions will be disseminated. In addition, the main results of the project will be publically available through specific actions (e.g., open lectures, internet webpage, visits), increasing also the public awareness on air quality/environmental issues. Further exploitation of the project's results will involve (but not limited to) the economical benefits from the end product, enhancing the self-sustainability of research in the field of atmospheric sciences. The successful outcome of the ***PRECEPT*** project can result in: **a)** increase the spatial resolution of aerosol measurements (e.g., a network of these devices may be employed for assessing the air quality at different spots in cities), **b**) act as monitoring/warning system (e.g., in workplaces where increased particle concentrations pose a health risk), and **c**) help in better understanding of the contribution of atmospheric particles on climate by offering the ability of vertical measurements of their properties using lightweight Unmanned Aerial Vehicles (UAVs).

References

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Visit ***PRECEPT*** webpage for more information, news and updates on the activities of the project at : **http://preceptproject.info**

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