



H.F.R.I.
Hellenic Foundation for
Research & Innovation

Description of the funded research project
2nd Call for H.F.R.I. Research Projects
to Support Post-Doctoral Researchers

Title of the research project: Assessment of naTuraL and ANThropogenic Aerosols impact on climate (ATLANTAS)

Principal Investigator: Antonis Gkikas

Reader-friendly title: Interactions of natural and anthropogenic aerosols with radiation and associated impacts on climate

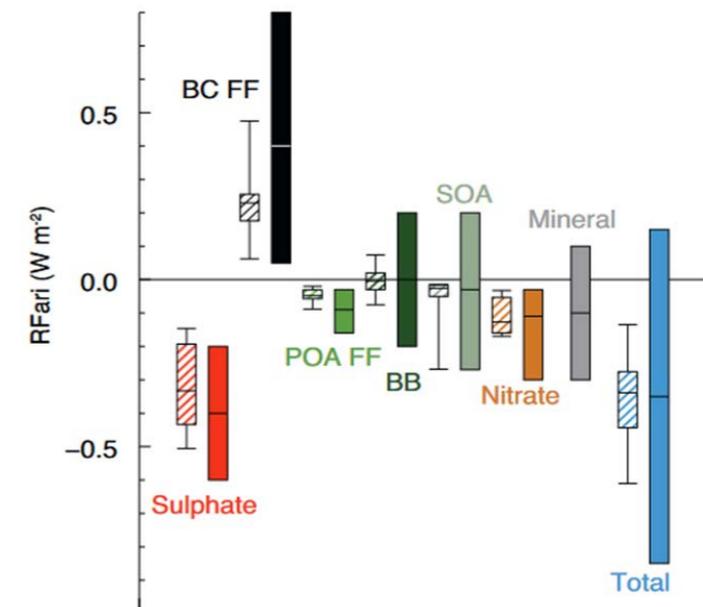
Scientific Area: Environment & Energy

Institution and Country: National Observatory of Athens (NOA) - Greece

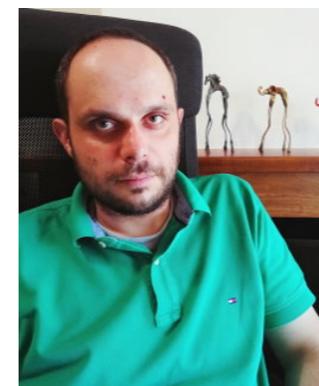
Host Institution: National Observatory of Athens (NOA)

Collaborating Institution(s): -

Project webpage
(if applicable): -



IPCC (2013)



Dr. Antonis Gkikas

Budget: 189,547.0 €

Duration: 36 months

Research Project Synopsis

Despite the considerable progress in climate modelling, current aerosol radiative forcing estimations are characterized by large uncertainties. This is attributed to the underrepresentation of natural and anthropogenic aerosols' properties, determining aerosol-radiation interactions and the subsequent impacts on climate. Therefore, it is imperative to constrain models with observations that can decompose the climate impact of anthropogenic and natural aerosols. ATLANTAS aims to fill the gaps in our understanding associated with the interaction of anthropogenic versus natural aerosols with climate. This frontier project will pioneer an attempt at achieving this decomposition by exploiting the great new insights coming from space with active remote sensing synergies. The scientific objectives of ATLANTAS include: (i) a discrimination and full characterization of different natural and anthropogenic aerosol types harnessing space-borne observations, (ii) a novel investigation of anthropogenic versus natural aerosol climatic effects and (iii) an investigation of potential co-variation of essential climate variables (e.g., near-surface temperature) and aerosol-induced radiative effects. This cutting-edge approach will take advantage of the dramatic improvement in vertically-resolved aerosol information provided by the CALIPSO satellite as well as ground-based lidar advances made in the EARLINET lidar network. The N. Africa, Middle East and Europe consists an ideal region for such a study as it is affected by diverse aerosol species. ATLANTAS will allow for the retrieval of climate-relevant aerosol parameters from space, decomposed into distinct aerosol types, enabling easy transference to the Earth Explorer missions of the European Space Agency.

Project originality

One of the innovative elements of ATLANTAS is the development of a 4-D database of anthropogenic and natural aerosols' properties by means of active remote sensing. Moreover, ATLANTAS envisions an effective decomposition of remote sensing information per aerosol type, based on sophisticated lidar parameterizations. This advancement will drastically improve observation-based anthropogenic and natural estimates of the shortwave direct radiative effects (SWDREs). To date, these estimates relying on passive satellite sensors reveal stronger radiative effects than those estimated by IPCC models. An ambitious component of the ATLANTAS project, will be the investigation of a potential response of the Essential Climate Variables (ECVs) to variations of the SWDREs induced by natural and anthropogenic aerosols. Such diagnostic analysis will provide an evidence of co-variation patterns, either temporal or spatial, between SWDREs and ECVs, thus highlighting the climatic role of atmospheric aerosols in the region of interest (N. Africa – Middle East – Europe).

Expected results & Research Project Impact

The scientific community has shown great interest in using CALIPSO active remote sensing retrievals in several applications related to: (i) the identification of aerosol air-masses of specific type; (ii) perform radiative transfer simulations; (iii) provide estimates of vertical atmospheric heating due to smoke absorption in the Mediterranean; (iv) perform assimilation experiments in regional and global aerosol transport models and (v) evaluate atmospheric models. However, even though the CALIPSO dataset is unique in many aspects, large uncertainties have already been reported for the current aerosol classification scheme that fails to realistically represent the type and properties of aerosol layers observed. These limitations may have a significant impact on the validity of the use of such data for the investigation of complex atmospheric processes, raising the immediate need for the optimization of CALIPSO, the core development foreseen within ATLANTAS. The optimized schemes and aerosol models developed by ATLANTAS can easily be applied in ongoing and forthcoming lidar satellite missions of Aeolus and EarthCARE managed by the European Space Agency (ESA). ATLANTAS will provide key input for the optimal exploitation of these European missions, strengthening the pioneering role that ESA anticipates to play in the global context. Moreover, the improved and more realistic optical and radiative properties of the different aerosol types in the region of interest, will provide a valuable dataset to constrain regional climate models, contributing significantly to their optimization and evaluation. Developments in the field of satellite data assimilation into models and the production of improved versions of blended products are also highly likely.

The importance of this funding

The received funding consists a unique opportunity for me to expand all the skills required to become an accomplished and multidisciplinary researcher. Throughout the ATLANTAS project, I will acquire new and advanced complementary competencies crucial for the mature stages of an independent researcher. At the end of the ATLANTAS project, I will have acquired strong competencies helping me to work as an independent scientist and to coordinate a research group performing multidisciplinary research. It is expected that the successful accomplishment of the ATLANTAS project will be a significant step-up on my career aiding me to: (i) upgrade my scientific knowledge and mentoring capacity, (ii) expand further my research networks and visibility and (iii) get the mandatory supplies in coordination and management. Hopefully, my improved skills will help me to achieve my appointment to reach an academic or research position in Greece.



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