

2024 DOCTORAL INPhINIT FELLOWSHIPS PROGRAMME – INCOMING

Atmospheric deposition of anthropogenic particles: impact on the resilience of coastal marine systems

Area of Knowledge: PHYSICAL SCIENCES, MATHEMATICS AND ENGINEERING

Group of disciplines: Geology, Earth Sciences, **Environmental and Atmosphere Sciences**, Mines, Geological Engineering, Oceanography, Hydrology

Research project

Coastal waters receive a wide range of atmospheric particles, covering different chemical forms and amounts of organic and inorganic constituents, including toxic trace metals (TM). Together, these atmospheric multi-stressors impact the marine dissolved organic matter (DOM) pump in poorly understood ways, with consequences on the biogeochemical cycles in coastal waters. The extent to which organic aerosols (OA) component and marine DOM modify the solubility/bioavailability of atmospheric TM in coastal waters is also unknown due to practical difficulties in studying post-depositional processes. Yet, a joint perspective is required, focusing on the synergistic effects of these atmospheric stressors acting upon coastal marine systems. Based on the current state-of-the-art, this PhD project has three specific research and innovative objectives: (1) assess how different atmospheric OA and TM inputs impact the dynamics and fertilizing role of marine DOM at a coastal area of Southwestern Europe; (2) evaluate the ecotoxicity of atmospheric particles before and after photochemical transformation, to deduce the impact of the deposition of anthropogenic particles transported over long distances from the emission sources; and (3) investigate the likelihood of trophic transfer after exposure of marine organisms to anthropogenic atmospheric particles. The outcomes are relevant for scientists, but also citizens and policymakers through renewed air quality measures aiming at ensuring the sustainability of coastal areas.

This PhD project is aligned with CESAM's mission and the UN SDGs 14. This project will be developed in the Research Groups "Biogeochemical Processes & Pollutants" (BPP) and "Environmental Changes, Hazards & Conservation" (EHC) of the Centre for Environmental and Marine Studies (CESAM), joining a research team with expertise in the fields of environmental & analytical chemistry, air particles characterization, and ecotoxicology.

Job position description

This project will recruit 1 PhD Early-stage researcher of any nationality to carry out her/his PhD project in CESAM. The candidate will be responsible for the following six specific Tasks:

Task 1: Implementation of sampling campaigns to collect air particles and seawater samples at a coastal area of Southwestern Europe (i.e., Aveiro).

Task 2: Assess the content of the carbonaceous and inorganic (water-soluble ions and TM) fractions in the collected air particles, as well as the extraction of water-soluble organic matter (WSOM) from

the aerosol samples. Measure DOM and TM content in the collected seawater samples and isolation of the DOM.

Task 3: Structural characterization of the isolated aerosol WSOM and marine DOM samples (from Task 2) using advanced analytical techniques available at the University of Aveiro.

Task 4: Aerosol seeding experiments in lab-made microcosms, with and without the presence of typical estuarine organisms, mimicking the deposition of freshly emitted and aged air particles onto surface seawater. Assess DOM and TM content/evolution and changes in the composition of settled air particles.

Task 5: Evaluate the ecotoxicological effects of atmospheric air particles and their organic and TM constituents in the marine organisms over time and assess the trophic transfer across the marine food web (Task 4).

Task 6: Data integration, analysis, and dissemination, including writing manuscripts for submission to peer-reviewed scientific journals, and presentations of the main findings in conferences/workshops.

This work program is based on an ongoing collaboration between the research groups BPP & ECHC of CESAM. The researcher will be proficient in techniques in the field of environmental & analytical chemistry and environmental toxicology, but also environmental proteomics. A high level of motivation, teamwork and communication skills are required. It is also expected for the researcher to attend complementary training workshops.

Supervisor team

Dr. [Regina Maria Brandão de Oliveira Duarte](#); Dr. [Roberto Carlos Domingues Martins](#)

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Research Groups descriptions

Website with the main research objectives and activities of the research group Biogeochemical Processes & Pollutants of CESAM: <https://www.cesam-la.pt/sobre/grupos-de-investigacao/bpp/>

Website with the main research objectives and activities of the research group Environmental Changes, Hazards & Conservation of CESAM: <https://www.cesam-la.pt/sobre/grupos-de-investigacao/echc/>

Additional information

Website of CESAM: www.cesam-la.pt

Website of the University of Aveiro, Portugal: <https://www.ua.pt/en/>

Website with the description of the main activities, results, and outputs of the ongoing collaboration between the research groups BPP & ECHC of CESAM within the framework of AMBIEnCE project: <https://projectambience.wordpress.com/>