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AIR-BIO: THE ATMOSPHERIC ECOSYSTEM OVER ANTARCTICA

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ABSTRACT

The atmosphere is the Earth's largest potential habitat, yet the least understood. Microscopic organisms (microbes) are transported between land and water through the atmosphere in a process that shapes global biodiversity and influences disease transmission. Yet little is known about the nature and extent of the atmospheric microbiome, including the rates of airborne input, and the structure and function of resident microbial communities. This project will assess whether Antarctic atmospheric communities are structured and adapted to the atmosphere, and investigate the relationship of airborne communities to adjacent terrestrial, marine and cryospheric habitats. Antarctica is the most important location to study the dynamics and function of microbial communities in the atmosphere. Antarctica is the most remote continent on Earth (and therefore isolated from human modified ecosystems and background contamination), and its ecosystems share many of the same characteristics as the atmosphere - including freezing temperatures, extreme aridity, low energy and nutrient availability, and high UV irradiance. We will perform a survey of atmospheric microbial communities onboard leg CC131222 (or CC291122), to understand the community composition, physiological capabilities, and ecological controls of Antarctic atmosphere-dwelling microbial communities. We will also compare the atmospheric communities to underlying and adjacent terrestrial (soil, snow, ice) and marine ecosystems. We will sample atmospheric microbes using portable cyclonic air samplers on the ship deck during vessel stops, as well as on-shore during shore-based landings. We will also sample adjacent habitats during shore landings, including soil, snow and ice. Samples will be filtered and stored frozen onboard, and returned to home laboratories for further analyses. This will yield genomic data that we will use to tackle our main hypothesis - that atmospheric microbial communities are strongly structured due to selection for metabolic traits and resistance to atmospheric stressors. If the atmosphere is found to be ecologically structured, it would result in the discovery of the largest biosphere on Earth, and could broaden how (and where) we may search for life on other planets. Guests onboard will have the opportunity to participate in the project by assisting with the collection of water samples, snow, ice and soil sampling, be trained in sterile microbiology techniques, and conduct the measurement of physicochemical parameters including temperature, pH, conductivity. Onboard, the project team will host workshops, lectures and informal discussion sessions with guests.