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STORMDUST:A SYSTEM FOR ANALYZING THE CHEMICAL AND MICROBIAL COMPOSITION OF THE STRATOSPHERE TO UNDERSTAND CLIMATE CHANGE

Abstract

The STORMDUST project, undertaken by students within the REXUS/BEXUS program, focuses on understanding the migration of chemical compounds and their effects on stratospheric microorganisms, which may lead to an expansion of knowledge about overall climate changes, including changes in greenhouse gas emissions.

Leveraging an array of ionizing radiation sensors and Solid Phase Extraction (SPE) columns controlled by an onboard computer, STORMDUST collects and analyzes air samples from the lower and middle stratosphere. The project's core aim is to examine the movement, concentration and impact of key volatile chemical compounds, including nitrogen dioxide (NO2), ozone (O3), oxygen (O2), hydrogen chloride (HCl), methane (CH4), and various volatile organic compounds (VOCs). The Solid Phase Extraction (SPE) columns, consisting of membrane and absorbent materials, facilitate the concentration analysis of these microorganisms and compounds, are helpful for understanding climate dynamics and exploring mitigation strategies for global climate challenges. SPE columns will be examined using gas chromatography and mass spectrometry. An achievement of the project was the first-time identification of phenol in the stratosphere during a prototype flight.

The experiment is engineered for easy replication, enabling conduction of comparable research across different global locations to construct a worldwide map of compounds, with its concentration, identified in the stratosphere. The onboard computer system, divided into two main components that communicate with each other, is responsible for managing tasks of data collection alongside steering the sensor array, monitoring the environment of collected samples and operating valves to enable air filtration using SPE columns. This setup allows the project to collect environmental data alongside chemical and biological material, facilitating the identification of correlations and enhancing our understanding of stratospheric processes including migration of conceivably detected toxins. Moreover, the experiment includes anti-contamination solutions to ensure the integrity of the samples taken for accurate analysis, thus preserving the natural conditions of the samples taken.

The STORMDUST experiment is scheduled to be launched aboard the BEXUS 34 stratospheric balloon mission from Esrange Space Center.