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The NOAA Stratospheric Aerosol processes, Budget and Radiative Effects (SABRE) Project

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Stratospheric aerosols are an important component of Earth's albedo, and therefore energy balance, and provide surface area for heterogeneous chemistry, which can lead to stratospheric ozone loss. Acquiring a comprehensive database of stratospheric aerosol, trace gas and dynamical observations to establish the baseline state and background variability of the stratosphere is essential to (1) developing a complete understanding of stratospheric dynamical and chemical processes that determine aerosol microphysics, radiative properties and heterogeneous chemistry, (2) evaluating the stratospheric response to natural and anthropogenic perturbations including climate change, volcanic eruptions, and potential climate intervention activities, and (3) strengthening the scientific foundation to inform policy decisions related to regulating global emissions that impact the stratosphere.

The NOAA Stratospheric Aerosol processes, Budget and Radiative Effects (SABRE) project is a multi-year, multi-deployment UTLS airborne science measurement program to study the microphysics, transport, chemistry and radiative properties of aerosols in the upper troposphere and lower stratosphere (UTLS). The SABRE instrument payload and flight campaigns are designed to provide extensive, detailed measurements of aerosol size distributions, composition and radiative properties along with relevant trace gas species in different regions and seasons, which are critical for improving the ability of global models to accurately simulate the radiative, dynamical and chemical impacts of changes in stratospheric aerosol loading.

The first deployment of the SABRE project took place in February 2022, consisting of six flights from Ellington Field, Houston, TX. The flights provided an opportunity to field test several newly developed instruments that will be important for addressing SABRE science questions in subsequent deployments and sampled both the subtropical tropopause layer and midlatitude upper troposphere and lower stratosphere. The Realtime Air Quality Modeling System (RAQMS) was used for flight planning to target atmospheric dynamical features and species gradients. Complex structure was observed in trace gases and aerosol in the midlatitude UTLS, indicating significant stratosphere-troposphere exchange. Highlights from the deployment will be presented.

Subsequent SABRE deployments will target aspects of the stratospheric aerosol budget including high latitude processes with a deployment to Alaska in February-March 2023 and to the tropics to

study Tropical Tropopause Layer (TTL) processes in 2024. Each deployment will also include flights from Houston, TX to investigate seasonal and interannual variability in the subtropical and midlatitude stratosphere.