

The Staring Observations of the Atmosphere (SOBA) Mission Concept

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Abstract

The Staring Observations of the Atmosphere (SOBA) Mission is a concept that was developed and matured under the guidance of the NASA Ames Project EXcellence (APEX) program. If funded, it will provide an unprecedented opportunity to improve ash transport forecasts and climate model simulations associated with volcanic eruptions. NASA and National science objectives require a better understanding of volcanic aerosol and trace gas emissions, transport, chemical transformation, and deposition, since they impact Earth's climate and atmospheric composition, human health, and aviation safety. Natural hazards such as the 2010 eruption of the Eyjafjallajökull volcano in Iceland demonstrated how existing remote-sensing assets were inadequate for individual volcanic event monitoring. During this eruption, available instruments were unable to provide data necessary to initialize volcanic plume transport models so that they could accurately predict the quantity and location of volcanic ash. As a result, thousands of flights around the world were grounded unnecessarily, at great expense. Volcanoes can also play a large role in regulation of the Earth's climate, so SOBA observations will also be used to evaluate and improve volcanic aerosol and trace gas simulation in chemical transport models (CTMs) and global climate models (GCMs). We propose the development of an airborne remote sensing concept and field campaign that will respond to an eruption and provide near real time observations of a volcanic plume, specifically ash injection height, transport, aerosol microphysical physical properties, and the location and concentration of sulfur dioxide (SO₂) (sulfate (SO₄²⁻) aerosol precursor). This airborne system will utilize a depolarization sensitive, downward looking Light Detection And Ranging (lidar) instrument and an ultraviolet (UV) imaging spectrometer, and will provide data to be ingested by volcanic ash advisory models. Furthermore, the lessons learned in the development of this system could eventually guide regular deployment of similar systems by NASA or other government agencies.