SSIRC: STRATOSPHERIC SULFUR & ITS ROLE ON CLIMATE. LIDAR DATA RESCUE AND GLOSSAC IMPROVEMENTS

Juan Carlos Antuña-Marrero[1,2], Eduardo Landulfo[3]

[1] *Ephyslab, Departamento de Física Aplicada, Universidade de Vigo, Ourense, Spain*

[2] *Group of Atmospheric Optics (GOA-UVa), Universidad de Valladolid, Valladolid, Spain*

[3] *Laser Environmental Application Laboratory (LEAL), Instituto de Pesquisas Energéticas e Nucleares, University of Sao Paulo, Sao Paulo, Brazil*

Contact: jcam45@gmail.com

Abstract

SSiRC (Stratospheric Sulphur Processes and their role in Climate) is an established APARC (Atmospheric Processes And their Role in Climate) a core project of the WMO-WCRP (World Climate Research Programme). SSiRC goal is to foster collaboration across observational and modelling communities allowing a better understanding of the stratospheric aerosol layer and the processes governing its observed variations, in particular the ones from intense explosive volcanic eruptions The SSiRC Data Rescue Activity is aimed to recover, re-digitize and re-calibrate historic stratospheric aerosol data sets currently not publicly available, and invite scientists to contribute to this activity and to provide advice and expertise on how best to recover other incomplete long term observations of stratospheric composition. The focus so far has been oriented to lidar and searchlight datasets an important complement of space-borne measurements. So far, a total of five datasets, four from lidars and one from a searchlight, have been rescued digitized and stored at PANGAEA, a public data repository. The presentation briefly lists and describes the rescued datasets. Also are provided details of the cases when a re-calibration was conducted explaining the procedure conducted and the validation of the results. For all the rescued lidar/searchlight datasets estimates of the errors in the rescued/recalibrated aerosol extinction profiles are provided. Another current SSiRC activity is pursuing the GloSSaC (Global Space-based Stratospheric Aerosol Climatology) improvement. GloSSAC was created to support the WCRP Coupled Model Intercomparison Project Phase 6 (CMIP6). The importance of filling the gap in the SAGE II satellite aerosol extinction in the tropical stratosphere during approximated 6 months after Pinatubo is one of the focus. The existence of the gap and its temporal extension is shown using the available lidar profiles. The capabilities to fill the gap using lidar stratospheric aerosol profiles is discussed, showing the improvements that will be incorporated in GloSSaC for that period. The limitations and obstacles to conduct the proposed gap filling are discussed and the potential solutions are also shown and discussed. Incomplete long term observations of stratospheric composition. The focus so far has been oriented to lidar and searchlight datasets an important complement of space-borne measurements. So far, a total of five datasets, four from lidars and one from a searchlight, have been rescued digitized and stored at PANGAEA, a public data repository. The presentation briefly lists and describes the rescued datasets. Also are provided details of the cases when a re-calibration was conducted explaining the procedure conducted and the validation of the results. For all the rescued lidar/searchlight datasets estimates of the errors in the rescued/recalibrated aerosol extinction profiles are provided. Anther current SSiRC activity is pursuing the GloSSaC (Global Space-based Stratospheric Aerosol Climatology) improvement. GloSSAC was created to support the WCRP Coupled Model Intercomparison Project Phase 6 (CMIP6). The importance of filling the gap in the SAGE II satellite aerosol extinction in the tropical stratosphere during approximated 6 months after Pinatubo is one of the focus. The existence of the gap and its temporal extension is shown using the available lidar profiles. The capabilities to fill the gap using lidar stratospheric aerosol profiles is discussed, showing the improvements that will be incorporated in GloSSaC for that period. The limitations and

obstacles to conduct the proposed gap filling are discussed and the potential solutions are also shown and discussed.

Keywords: Stratospheric Aerosol; Remote sensing; Lidar; Searchlight.

XII WLMLA Topic: Remote sensing of Stratospheric Aerosols

ID: Oral OP-RSSA-06

OBSERVATIONS OF DUST PLUMES LEFT BY THE ERUPTION OF THE HUNGA TONGA-HUNGA HÁ'APAI VOLCANO OVER SÃO JOSÉ DOS CAMPOS, BY CBJLSW NA-K LIDAR

M. P. P. Martins[1], P. L. R. Maia[1], V.F. Andrioli[1,2,3], P. P. Batista[1], A. A. Pimenta[1], A. M. Santos[1,2,3], G. Yang[2,3], C. Wang[3], Z. Liu[2,3]

[1] National Institute for Space Research (INPE), São José dos Campos, SP, Brazil
[2] China-Brazil Joint Laboratory for Space Weather (CBJLSW), NSSC/INPE, São José dos Campos, SP, Brazil
[3] State Key Laboratory for Space Weather, National Space Science Center (NSSC), Chinese Academy of Sciences, Beijing,
Contact: iveselov@hotmail.com

Abstract

On January 15th, 2022, a volcanic eruption occurred on the island of Hunga Tonga-Hunga Ha apai, in the South Pacific. The base of the island is part of the earthquake-prone Tonga-Kermadec arc, formed by a chain of underwater volcanoes. The volcano is submerged a few tens to hundreds of meters below sea level, but this depth did not suppress the full force of the explosion, but allowed conditions to make this eruption different, ocean water reached high altitudes.

According to NASA researchers, based on data from Geostationary satellites, GOES-17 and Himawari-8, the Hunga Tonga-Hunga Ha apai volcanic plume reached the highest altitude ever recorded for this type of phenomenon, reaching approximately 58 km. The highest previously recorded height was 35 km and belonged to the plume from the eruption of the Pinatubo volcano in the Philippines in 1991.

Soon after Tonga's eruption, researchers from around the world organized themselves to monitor the plumes it left behind. On January 17th, 2022, the Na-K LIDAR of China-Brazil Joint Laboratory for Space Weather (CBJLSW) was in full operation in São José dos Campos, measuring the mesosphere region and Tonga's plumes was not observed at this day. Unfortunalety after that the laser had some technical problems and return to operate on February 16th, showing two huge peaks at 24.5 and 26 km height. The group decided to introduce an iris in the optical path to lower the laser intensity and after that was possible to observe strong scatterings around 25 km height without signal saturation. The evolution of Tonga's plumes was monitored from March 2022 until August 2023 and the results are in good agreement with satellite data.

Keywords: Tonga plumes; Aerosols; Lidar scattering.

XII WLMLA Topic: Remote sensing of Stratospheric Aerosols

ID: Oral OP-RSSA-07