Shining a light on 1960s volcanism: MRes projects re: stratospheric aerosol data recovery.

There are two MRes projects available for science associated with a data recovery initiative (http://www.sparc-ssirc.org/data/datarescueactivity) within the international SSIRC activity on stratospheric aerosol. The SSIRC activity recently recovered the 1st ever multi-year lidar measurement dataset, profiling the Agung aerosol cloud from Massachusetts and Alaska from January 1964 to July 1965 (Antuna Marrero et al., 2020a). Ship-borne lidar measurements of the 1991 Pinatubo aerosol cloud have also been recovered (Antuna Marrero et al., 2020b), the datasets used at Leeds to evaluate volcanic aerosol model simulations (Dhomse et al., 2020; Shallcross, 2020).

1: Searchlight measurements of the volcanic aerosol cloud from 1963 Agung

Supervisors: Dr. Graham Mann and Dr. Alex Rap (University of Leeds, U.K.)
Collaborators: Dr Juan-Carlos Antuna Marrero (Valladolid Univ., Spain), Dr. John Barnes (NOAA)

The major eruption of Mt Agung (Bali, Indonesia) in March 1963 produced a global veil of volcanic aerosol (e.g. Dyer and Hicks, 1965) which cooled the tropical troposphere by around 0.5 degrees in the years after the event (e.g. Newell & Weare, 1976; Hansen et al., 1978)

Agung was the first major eruption to have its aerosol cloud observed via active remote sensing instruments, being measured both via searchlight from New Mexico (Elterman and Campbell, 1964) and from lidars in Jamaica (Clemesha et al., 1966), Massachusetts and Alaska (Grams and Fiocco, 1967).

This 1st project will re-digitize the searchlight measurements of the Agung cloud from New Mexico from an “Atlas of aerosol attenuation” report (Elterman, 1966), exploring the consistency of these measurements with the Massachusetts lidar, and compare to existing model simulations of the Agung aerosol cloud and the historical volcanic forcing datasets used in CMIP5 and CMIP6 climate models.

2: Balloon measurements of the solar near-infrared aerosol extinction after 1965 Taal and 1966 Awu

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In contrast to the unusually quiescent decades of the 1920s-1950s, the 1960s stratosphere had continued volcanic enhancement, with the major eruptions of 1963 Agung (e.g. Niemeier et al., 2019) and the subsequent VEI4 eruptions of Taal (Philippines, September 1965), Awu (Indonesia, August 1966) and Fernandina (Galapagos Islands, June 1968).

The existence of the stratospheric aerosol layer was confirmed by high-altitude balloon measurements in the late 1950s (Junge et al., 1961a; Junge et al., 1961b), with the first ever series of in-situ measurements of a major volcanic aerosol cloud made in 1963 and 1964. These “dust-sondes” were launched from Minneapolis (Rosen, 1964), and also Panama (Rosen, 1968) equipped with optical particle counters to measure the concentration of volcanic particles in the stratosphere.

In addition to the dust-sonde measurements of the Agung aerosol cloud, another series of balloon measurements were made in 1965-1968 from Minneapolis and Panama, with a rotating 4-telescope instrument to measure solar extinction at 4 wavelengths. The solar near-infra-red channel measured aerosol extinction directly, the data in the PhD thesis of Ted Pepin (Pepin, 1970), later one of the PIs for the Stratospheric Aerosol Measurements (SAM) satellite instrument (McCormick et al., 1979).

This 2nd project will re-digitize the near-infra-red (910nm) aerosol extinction profile measurements from the PhD thesis of Ted Pepin, comparing to model simulations of the Taal and Awu aerosol clouds.
References (for both projects)


