Geophysical Research Abstracts
Vol. 21, EGU2019-6490, 2019
EGU General Assembly 2019

Characteristics and management of the volcanic plumes associated with the Krakatau eruption, 2018-19

Andrew Tupper, Chris Lucas, Anjelica Chang, Jarrad Denman, Adele Crozier, Rajneel Prasad, and Meelis Zidikheri

Bureau of Meteorology, Australia (andrew.tupper@bom.gov.au)

Between 22 – 28 December 2018, the eruption associated with the partial collapse of Anak Krakatau, Indonesia, produced a sustained upper tropospheric / lower stratospheric volcanic plume to around 17-18 km, and likely higher. This is the longest sustained volcanic plume to these altitudes that we are aware of in the meteorological satellite era, which effectively dates from the 1970s. Further eruptions into January 2019 produced discrete, short lived clouds to similar altitudes, and were continuing at time of writing. The initial eruption plume was associated with phenomenal lightning activity observed on multiple lightning networks, consistently detected sulphur dioxide and ice, and relatively small amounts of detected ash. The proximity of the eruption to Jakarta posed significant aviation management challenges, somewhat mitigated by the low amounts of detected volcanic ash and the direction of upper level airflow. Indonesian and international operational agencies, particularly BMKG and CVGHM Indonesia (the Meteorological Watch Office and State Volcano Agency respectively) and the Bureau of Meteorology Australia (operating Volcanic Ash Advisory Centre Darwin), worked closely with aviation authorities and airlines to give operational scientific advice on the eruptions.

The height of the eruption plume and high ice content would certainly have been influenced by sea-water interactions. Moist entrainment of near-surface air into the eruption plume would also certainly have influenced the eruption height. Krakatau, like other volcanoes in the region such as Manam (Papua New Guinea), also lies in the Indo-Pacific Tropical Warm Pool, which consistently contains the warmest waters in the world, has very high precipitable water during the 'wet' seasons, and where ordinary atmospheric convection also reaches 17-18 km on a regular basis. In terms of having both sea-water interaction and entrainment of moist tropical air, Krakatau's plume may be similar to the 1994 eruption of Rabaul (Papua New Guinea), which also produced an ice rich, high altitude plume. Some of the January events may also reasonably be assessed as being 'volcanic cb' – thunderstorm type convection potentially containing volcanic ash and triggered by the volcano, but without strong eruptive input. For these reasons, caution should be used when assessing mass eruption rate for the Krakatau events using a height criterion.

In addition to the unique eruption length for a high-altitude plume, the volcanic lightning, and the management issues of ice-rich, ash-poor eruption clouds near major airports, the Krakatau eruption will deserve close examination for the potential for operational volcanic eruption warnings to contribute to global tsunami warning systems. Many marine volcanoes and most submarine volcanoes have little to no seismic instrumental monitoring, so the atmospheric observation of an eruption may be the first indicator of the potential for a volcanic tsunami. In the case of Krakatau, a high-level eruption was visible on satellite prior to the tsunami hitting nearby land.