Australian Government
Bureau of Meteorology

The Centre for Australian Weather and Climate Research

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Improving Satellite Detection of Volcanic Ash Clouds at the Bureau of Meteorology

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Australia's Responsibility

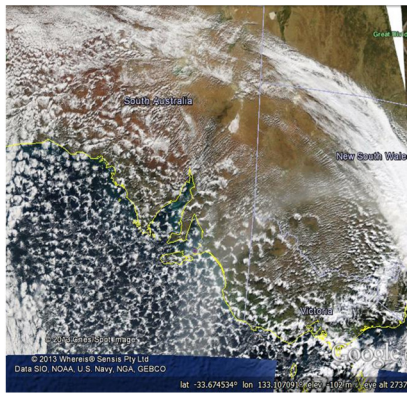
- While the Australian mainland has no active volcanoes, Australia is responsible for the operation of one of the nine global Volcanic Ash Advisory Centres (VAAC).
- Australia's VAAC is located in Darwin, NT and covers a broad area of responsibility, including the 127 active volcanoes in Indonesia.
- The region is continuously monitored, using volcanological reports, pilot reports of ash, satellite-based information (the workhorse) and whatever other reliable information can be found. Warnings (Ash advisories) are issued on an ad hoc basis shortly after detection, including predictions of future behaviour.

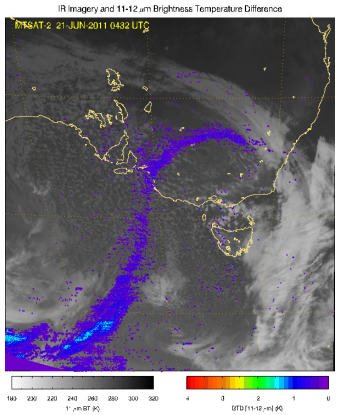
Areas of responsibility for the 9 global VAACs

Our project aims to improve the satellite detection of volcanic ash clouds of the Darwin VAAC's area of responsibility, in preparation for the increased capability of Himawari-8 expected in 2015.

Traditional Ash Detection

- Satellite volcanic ash detection is usually done by direct examination or via the 'split window' technique, a difference of the 11 and 12 micron IR brightness temperatures.

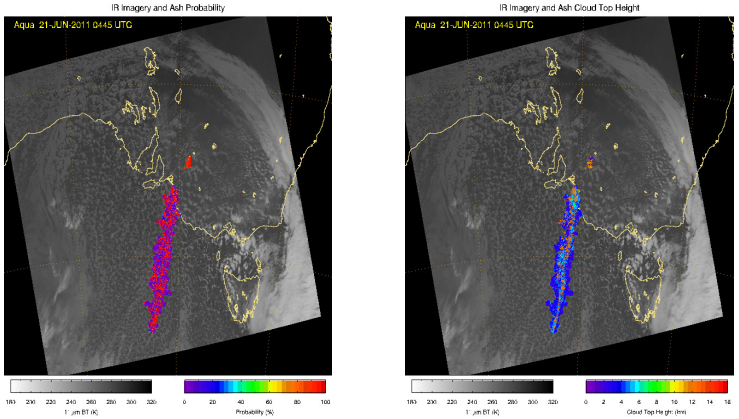




Views of the Cordon-Caulle ash cloud on 21 June 2011. left: Aqua MODIS true colour image (0445 UTC). Right: MTSAT-2 'split window' image (0432 UTC)

Automated Detection of Volcanic Ash

- Over the last ~10 years, techniques have been developed to improved detection methodology – more channels incorporated into more sophisticated algorithms.
- We are implementing and evaluating a software package (GEOCAT) from Mike Pavolonis of NOAA-NESDIS that uses several different ash detection algorithms for eventual operational use.
- These algorithms aim to retrieve physical properties of the ash clouds, including height, mass loading and particle size.



GEOCAT-based retrievals of the 21 June 2011 Cordon-Caulle ash clouds using the Aqua MODIS at 0445 UTC. Left: Ash probability (%). Right: Ash cloud top height (km)

Questions and future directions

- Work on this project is still at a relatively early stage. The software is installed and running correctly. Many questions remain.
- How well does the software work? What percentage of the time does it provide an accurate detection? What is the false alarm rate? What are its biases and shortcomings? How accurate are the retrieved properties?
- Given these uncertainties, how do we optimally use this software in an operational environment?
- We will address these questions by systematically examining case studies of past volcanic eruptions.
- Detecting volcanic ash is a tricky problem, and Indonesia presents a very challenging environment, particularly in the wet season. This project will allow for full exploitation of new satellite technologies and improve our ability to monitor this aviation hazard.